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Foreword

The scope of the conference is to strengthen the dissemination of important research results, representing achievements of different research groups especially from the Balkan countries. Presently, when the climate change is presently more and more causing irreversible affection upon the ecosystems, in terms of life standard, fauna and flora affections, air, soil and water pollution, the scientist have a personal duty and responsibility to turn their research conclusions in effective measures to keep the average temperature under an augmentation with more than 1.5 degrees, taken as basis the preindustrial epoch (as according to the Paris Conference, Article 2 United Nations FCCC,30/11/15). The society of knowledge must turn into the society for finding solution for the decarbonization of the economic activities. From words to facts is the future trend in all research work.

The EU vision for 2025 must take the Paris agreement in consideration; this implies driving Europe to progress in the achievement of clear objectives, and tracking it as a global leader for high value and low emissions energy, secure availability and protection of all ecosystems, in order to secure a sustainable development for the next years. Industry, Transport, Agriculture, Household, generally all manmade activities and sectors must turn into a decarbonized economy.
The connection of technologies for a clean world must take into consideration and ensure:

- Economic sustainability and growth of the energy sector
- Controlling and finally eliminating the largest CO2 emitters
- Reinforce the carbon price as signal for the decarbonization of Europe
- Clean electricity and lower bills for the consumers
- New markets for a mixture of energy resources, mainly renewable ones
- Remove market and policy barriers
- Correct valorization of innovative solutions
- Energy efficiency improvements
- Promoting innovation in household applications
- Switching from combustion engines' cars to hybrid and electrical ones
- Implement of Bio-energy
- District heating and cooling systems and insulation of buildings, turned into zero emission ones
- Storage systems coupled with energy generation systems
- Smart cities
- Trends in ecological administration of waste of different origins
- Water quality as main support for the development
- Sustainable development of fauna and flora, adapted to future trends
- and many, many other diverse actions and research developments concerning environmental protection.

Thus all papers followed these fields of interest and gave an answer, based on original research or data recherché to these major aspects of the world, concerning environmental protection.

The present Conference Proceedings are the result of the contributions of over 140 authors, and resume their articles presented, in oral or poster sessions, during the GLOREP 2018 conference, organized in Timisoara, Romania, by 15-17th November, 2018, under the auspices of the Balkan Environmental

Association (B.EN.A). This book offers an extra invitation and opportunity to those who appreciate the spiritual achievements of scientists everywhere, and especially in the Balkan area.

B.EN.A. was established on 1998 in Thessaloniki, Greece, from Alexander Technological Educational Institute of Thessaloniki, Greece (A.T.E.I.-Th) academic staff and from professors, researchers, experts and scientists of Balkan and EU countries. It is an International, nonprofit and nongovernmental scientific organization with the scope of preserving environment and cultures of Balkan countries. The association serves as a Balkan environmental thinking tank that goes beyond research to find scientific ways to protect Balkan region and to improve people's lives. B.EN.A.'s members study and analyze, interactions among environmental factors, economic and communities' trend and promote strategies and institutional change that may improve environmental, natural-resources decision making through objective and independent scientific research, studies and professional training and practice.

The GLOREP 2018 (http://glorep.upt.ro) congress was organized with great passion and work, with the hope of raising the increasingly competent level of spirituality, but its success depends exclusively on the involvement of the participants and the (agreement) of the general public, who is invited to be a part of this act of culture. The debates that will be developed and the free engagement of the auditor in interdisciplinary fields and actions will generate a special spirit during the congress.

As main host, the Politehnica University of Timisoara (UPT), offered all support for the organizing of the conference, and the fact that another three Romanian universities (West University of Timisoara (UVT), University of Agricultural Sciences and Veterinary Medicine of Banat 'King Mihai I of Romania' (USAMVBT), and University of Petrosani (UPET)) brought their support, is again a proof that there is a communion of the tendency and need of supporting the sustainable development further on. Not at least one has to mention the contribution of the Politehnica Foundation, which patronized the congress.

In my position as chair, I have to thank gratefully all members of the scientific and organizing staff of the conference, not at least the leadership of all involved universities and entities. A special acknowledge goes to the painter Mihai Teodor Olteanu, who gifted from his hart, non forgettable moments of colors and visions upon nature. Also the exhibition of the Banat Museum, during the conference, concerning Traian VUIA – the flying pioneer of Banat - is worth of mentioning. The atmosphere was generously sustained by an artistic program, especially during the opening ceremony, when the students of the Faculty of Music and Theatre of The West University of Timisoara delivered a special program.

My deep recognition goes to all persons that supported the planning and developing of the conference, on technical and organizing field. Not at least one mentioned that the quality of the conference is based on the quality and responsibilities of all authors and co-authors. All papers in this Conference Proceedings were accepted after a review made by the reviewers team, based on the declaration of authenticity and originality fulfilled by all authors. All contents are the direct responsibility of the authors.

We wish success to the work of the GLOREP international conference, dedicated it to the fulfillment of the Great Union. May the spirit of our ancestors illuminate our right path and inspire us with impetus and power for a future, as they have wished and cut, by deed and power of mind, to modern Romania.

Conference Chair Timisoara, 15.11.2018

Professor Dr Eng. habil Ioana IONEL

Iron Oxide Nano Particles doped Multiwall Carbon Nanotubes

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Abstract: Iron oxide nano doped multiwalled carbon nanotubes (MWCNTs) have been considered as ones of the best adsorbents for hydrocarbon removal from surface waters as compared to parent multiwalled carbon nanotube and singlewalled carbon nanotube. Carbon nanotubes attracted the attention of several researchers in nanoscience because of their high surface area and excellent sorption properties. Many works were done in this field and the authors focused on the hydrocarbon removal efficiency of the surface modified/functionalized MWCNTs and adsorption capacity of the MWCNTs. The functionalization of the MWCNTs has been studied by nano metal oxide deposition onto the surface of the MWCNTs. The surface features were correlated with the hydrocarbon removal efficiencies of the functionalized MWCNTs from surface waters. Iron doped MWCNTs have been tested to adsorb model hydrocarbons and kerosene cuts from waters in this work. XRD, BET techniques were applied for newly prepared adsorbents to characterize the morphological properties of the new preparations. XRF technique was used to identify the nano metal oxide particles on the surface of MWCNTs.

Keywords: Removal hydrocarbons, MWCNT, Nano, Metal Oxide, Adsorption.

III. INTRODUCTION

Hydrocarbons byproducts which throw into revers or oceans around the world from oil industries are a major cause of water pollution, these substances are toxic. Just speculating the amount of hydrocarbons materials presented each year is not easy. [1] The presence of these hydrocarbons negatively impacts water quality, which affects the life of organisms. This has led many researchers to find ways to remove

hydrocarbon contaminants from the surface of the water. These substances form a layer of water that prevents the exchange of oxygen with the atmosphere, causing oxygen deficiency contain in the water, which in turn affects the aquatic environment. Hydrocarbons affect water purification projects for drinking and industrial purposes, as well as leaving a smell, taste and other effect on sterilization units[2-5]. The increasing in the use of hydrocarbons fuel due to increase population of the world has a significant impact on the increase in oil transport and increase the probability of oil spill, due to accidents in oil lines leading to pollution of the oceans, causing the death of many organisms in the spell areas and usually there are toxic materials and heavy metals loading with oil and hydrocarbons. Spills of quantities of oil in aquatic environments are one of the biggest problems facing the sea environment and the oceans because of the increase in oil extraction, production and use of super tankers. Oil leakage resulting from transport and production processes, as well as natural leakage in the ocean floor, oil leaks into surrounding environments in various forms. [6-8]. The most important are oil tanker accidents caused by overload; in the carrier system, Such as the explosion and combustion; due to walk to the shallow water area. Incidents of offshore oil platforms and wells resulting from the unloading and loading of oil in special platforms, and the direct or indirect spillage of oil into the surrounding areas. Oil leakage when cleaning oil tankers deep in the sea, or near the shore and oil leakage due to faults in land or sea transport pipelines. Purification of the water surface from these oil spills and hydrocarbons is one of the most important ways to address the water pollution disaster in order to preserve the environment. Researchers in different parts of the world have been working in recent years to find feasible ways to be more efficient in removing the hydrocarbon substances from water [9-10]. The method of adsorption of hydrocarbons is one of the most effective and relatively inexpensive methods. This method helps to preserve the environment is not polluted and efficient way to remove hydrocarbons, removing hydrocarbons from water using activated carbon as an absorbent material has been studied [11]. The percentage of the adsorbed substance used to remove hydrocarbons from water and the time of adsorption has a significant impact [11-12]. Multi-wall carbon nanotube (MWCNTs) could be one of the most important materials which got the attention of researchers in nanotechnology

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recently due to the surface area very high and the best adsorbent material [13]. Several works are done in this field and they have recognized that flow rate and the temperature had a high impact on the removal efficiency and adsorption capacity. According to results, MWCNTs can be considered as the best adsorbent for hydrocarbons removal as compare to single wall carbon nanotubes and nano activated carbons. In this research, MWCNTs has been used to adsorb hydrocarbons from wastewater which is a by-product of petroleum industries. researchers seeking to modified some materials can be used in the removal of hydrocarbons from water so as to scope significant results in removing efficiency, and adsorption of MWCNT is one of the best materials is used for remove hydrocarbons removing. Modification of MWCNT with nano metal oxide could be increase the efficiency of MWCNT adsorption to hydrocarbons. Many researchers recently studied the preparing of metal oxides nano particles [14-16].

IV. FUTURE WORK

A. Analyzing Iron oxide nanoparticles which has been preparing by using XRD, SEM, TEM, and BET.

B. Fe_2O_3 Nano particles which have been preparing, will doped at MWCNT surface.

C. Modified MWCNT with iron oxide nanoparticles will analyze by using XRD, SEM, TEM, and BET.

D. Testing parent and modified MWCNT with Fe_2O_3 nanoparticles as adsorbent material to hydrocarbons and studying the significant of adsorption removal of hydrocarbons from water.

ACKNOWLEDGMENT

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Treatment of oily wastewater using electrocoagulation method with iron poles

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Abstract: The Chemical oxygen demand (COD) removal from oily wastewater has experimentally investigated employ electro coagulation EC operation to consideration the performance of the electrochemical techniques to handle oily wastewater with batch reactor. The oily effluent has been selected in this study because it includes hydrocarbon compounds, suspense solids, sulfides, ammonia, heavy metals, etc. In the EC of oily wastewater, the influences of primary pH, electrolysis time, current density was to be thoughtful. The electrolytic cell consumed 2L cylindrical glass reactor with magnetic stirrer. Iron is applied as anode and cathode . The actual area of the anode is 45 cm2. The batch experimental outcome revealed that COD in watery phase has been effectively removed with Iron as anode. The COD removal efficiencies approach to 86 % with the current density of 9 mA/cm2, electrolysis time of 60 min and pH 7.7.

Keywords: COD, Electrocoagulation, wastewater, efficiency

I.INTRODUCTION

Wastewater generated by the chemical industry is often characterized with high condensation of organic and inorganic pollutants, which generally have prejudicial and hurtful vestige on plant and aquatic life as well as roof and soil water sources [1,7]. The facilities of Wastewater in these plants was usually related with many expensive pre-treatment steps to decrease the condensation of these organic pollutants prior any ultimate biological purification step, this pre-treatment identity may include ultra-filtration, adsorption, coagulant and coagulant aides, and electrochemical fashion [2-4,]. The oily effluent has been selected in this study because it includes hydrocarbon compounds, suspense solids, sulfides, ammonia, heavy metals, etc. hold higher concentration of salts, and organic [2,5,6]. Only compared with other techniques in terms of cost, but in term of efficiency, and in some situations, may be an indispensable method for treating refractory pollutants [11-13]. Electrochemical technologies offer various handling processes, like electro oxidation, electro coagulation, electro flotation, and electro precipitation, the electro flotation and electrochemical technologies offer various handling processes, like electro oxidation, electro coagulation, electro flotation,and electro precipitation [8-10]. The electro flotation and electro deposition technologies will not be explained, as electro coagulation technologies are our central points. Electro coagulation is effective in tears out suspended solids as well as oil and greases. It also tears out metal, colloidal solids, particles, and soluble inorganic contaminates from aquatic media by introducing extremely charged polymeric metal hydroxide species. These types neutralize the electrostatic charges on suspended solids and oil droplets to facilitate agglomeration or coagulation. The thematic of the current research are to evaluate the electro coagulation for the handling of oily effluent under different operation like initial pH, current density, and electrolysis time, to remove the pollutants from oily wastewater, using batch reactor.

Table 1: Discharge limits for oily effluents

Chemical Constituent	Discharge Limits
pH units	6-9
TSS mg/L	15
BOD/5 mg/L	25
COD mg/L	150
Total Oil & Grease mg/L	5
Ammonia (as NH3) mg/L	1
Sulfide mg/L	0.2
Benzene mg/L	0.05
Cyanide (free) mg/L	0.05
Phenols mg/L	0.1

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II. Materials and Methods

A- Wastewater

There are professional automobile services depots and the samples were taken from it. Petroleum refining industry torrential is treat like one of the generality significant contamination root, it included poisonous core such the complex hydrocarbons, petrol and asphalt has elevation BOD and COD loads. This kind of stream derives from several roots for example water created from crude oil processes, petroleum refining, petrochemicals, metal dealings and car washing. The professional automobile services depot condense all serving like motor servicing, engine washing. Oily remnants water or waste from an automobile maintenance depot is breed by blending of automotive petrol, for example gliding petrol with wash and emulsifiers water. The premier characteristics of the oily effluent are as follows in Table 2:

Table2: Initial characteristics of the oily effluent

S. No.	Parameters	Values
1	pH	7.7
2	Oil and grease	630mg/L
3	Total solids	1910mg/L
4	Total dissolved solids	1830mg/L
5	Total suspended solids	120mg/L
6	Chemical oxygen demand (COD)	2000mg/L
7	Biochemical oxygen Demand	410mg/L

B- Electrochemical Reactor

The experiments have been done in batch electrochemical reactor for the treatment as the oily effluent is shown from Figure 1. The system consists mainly of a glass cylindrical reactor having a 2 L capacity. The volume of the sample taken is 1.8 L. irons used as an anode and cathode; area of the anode is 45cm2. For every 15 min sample is collected to check the % COD removal for different current densities. In the electro coagulation process iron alloys were used as the anode and cathode.

Fig (1). Batch electrochemical set-up

I. Results and Discussion

The treatment process aims to establish the technical feasibility of the electrochemical treatment for improving the physicochemical characteristics of the oily effluents. The results of the electrochemical process, and a discussion on the effect of the operating conditions on the performance of this process, are presented.

Figure 2 has been shown the diversity of the proportion of COD removal with electrolysis time at diverse current concentrations. The proportion of COD sweep increases with an excess in the electrolysis time for iron as the anode. That can be referred to the fact of applied current density; the anodic dissolution for iron begins. This in transition creates hydroxo-cationic conventions, performing in COD sweep. An growing in the gas bubble intensity with a reduction in their extent enhances the upward flux, resulting in higher pollutant degradation and sludge flotation. However, growing the current density behind 9 mA/cm2 did not offering any considerable amelioration in the proportion of COD sweep.

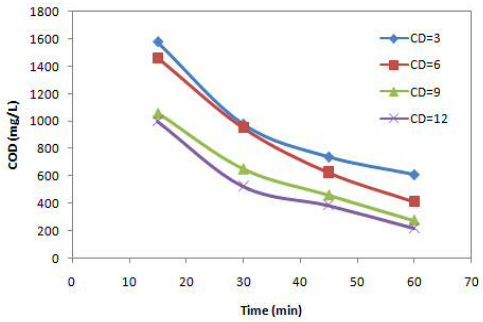
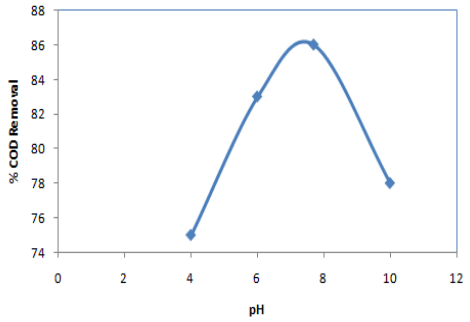


Fig (2).vesting of current density on COD with handling time at pH=7.7

Figure 3 shows the effect of pH on the variation of the proportion of COD sweep, after one hour of the reaction period, using Iron anode, at optimum current density. It can be noticed that the percentage of COD removal was low in the case of the alkaline and acidic media. The removal is higher when the pH varies from 6 to 8. For the basic pH 10 about 78% of COD removal, and for the acidic pH 4 about 75% of COD removal was achieved. The optimum proportion of COD removal was about 86% when the original pH value of the effluent was left unaltered for the Iron anode.



Fig(3).vesting of pH on COD sweep at handling time of60 min.

IV. Conclusion

Electrocoagulation processes were carried out for handling of oily contaminated wastewater, instate the traditional fashion. It is consumes more quantity of chemical compounds; it required more treatment time, and produce large amounts of sludge. The physicochemical characteristics of oily wastewater were emotional by the used current, type of anode, initial pH, and electrolysis period, during the EC treatment. Experiment tests were tote out in a batch reactor to handle oily wastewater by EC and utmost COD removal of 86% was noticed under experimental conditions of initial pH 7.7, current density 9 mA/cm2 and primary concentration of 2000 mg/L using iron as anode. The electro-chemical mechanization is applicable fashion for the handling of oil refining industry wastewater.

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Experimental research on recycled concrete aggregates (RCA)

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Abstract: Recycling is defined as the process that changes materials into new products for preventing the waste of potentially useful materials, reducing the consumption of fresh raw materials, the energy usage and the air and water pollution. Many of the large, existing buildings which don't have any historical importance, such as industrial type, office buildings or apartments, have a reinforced concrete structure. Recycled concrete is mainly used as coarse aggregate and filler in road construction industry; another usage of it could be adding it into new concrete mixtures. Present paper is devoted to the use of recycled concrete aggregates (RCA) obtained from concrete elements into new mixes as a replacement of the natural aggregates. An experimental program was developed in this purpose; the mechanical properties of the obtained concrete samples have been studied.

Keywords: recycling; recycled concrete aggregates; mechanical properties; new concrete mixtures.

INTRODUCTION

A, General information

Last years the recycling subject was treated with a higher importance, due to the increasing quantity of waste [1] The applications of recycled aggregate in construction have started since end of World War II by demolished concrete pavement as recycled aggregate in stabilizing the base course for road construction [2]. The advantages of using RCA at the fabrication of concrete are of economic values and environmental issues. The wastes from construction and demolition works are of large volume and are still increasing. To prevent this issue, sustainable concrete construction is one of the strategies to be considered by the construction industry. A solution for achieving these is to use recycled aggregates from these wastes of construction and demolition works (CDW) into the production of concrete. The reused of recycled concrete aggregate (RCA) is not common practice in the Romanian construction industry nowadays because there is no depletion of natural aggregates (NAT). The use of RCA in replacing the NAT in concrete construction has become a popular subject among researchers. The aim of their work is to compare the performance and characteristics of the two types of aggregates used in concrete production. Lots of researchers found that the performance of RCA used in concrete has low workability and compressive strength. The reasons for these quality depreciation are factors like smooth texture and rounder shape of RCA, higher percentage of fine particle sand high water absorption [2]. Some researchers found in their work that RCA has higher compressive strength. They claimed that RCA has more angular shape and rough surface texture compare to NAT. The angular shape and rough texture of RCA leads to better bond and higher strength in concrete structure. To increase the compressive strength, RCA should be oven dried condition that will create the interfacial bond between cement paste and aggregate particles [3]. According to the Romanian standard SR EN 12620/1993 the RCA belong to the recycled type of aggregates. According to BS 812: PART 112:1990 standard, the aggregates are subjected to 400 KN compression load in a steel cylindrical mold. The crushing value is defined by the percentage loss in mass on 2.36 mm size of test. Bigger percentage of aggregate crushing value means the aggregate is inferior in quality. According to BS 882:1992, aggregate with crushing value less than 25% can be used in heavy duty floor, crushing value for more than 30%, aggregate to be used in concrete for wearing surfaces and for more than 45% it can be used other concrete purposes.

B. Performance of RA Concrete

The physical property of concrete named workability is defined as properties of concrete alone without referring to the circumstances of a particular type of construction. Workability is the property of a fresh concrete and this is measured by using the slump test [4]. The workability of concrete using RCA is affected by some factors like the higher rate of water absorption. This will affect the workability of the concrete mix that uses the RCA.RCA exhibits water absorption higher than 15% is not acceptable in many countries [5]. According to BS882/1992, a maximum of 10% water absorption is accepted for many construction applications such as structural element, minor structural element and non-structural element. A preliminary research shows that the values of water absorption increases by the size of RCA, meanwhile the NAT stays better at this chapter. With a higher replacement of RCA in concrete, the workability of the concrete will decrease proportionally. A lower workability of concrete using RCA is due to the mortar

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coating of RCA, which led to higher water absorption[6]. Internal pores and absorption in the aggregate particles was mentioned in connection with the specific gravity of aggregate and indeed the characteristics of these pores are very important in the study of its properties [4]. Beside water, the texture and angular shape of RCA are also recognized asa factor for lower workability of the concrete using RCA[7];the irregularity of RCA surface contributed to lower workability of the concrete[8].

An important characteristic of hardened concrete is the compressive strength determined by using a compression machine. This property of the concrete is commonly considered the most valuable mechanical property, because it usually gives an overall picture of the quality of concrete which is directly related to the structure of the hydrated cement paste. Concrete using RCA at 3 days had a similar value of the compressive strength for all size of RCA[9]. At the age of 28 days, the results of concrete samples using RCA is within the same range of compressive strength value as the concrete samples using NAT, except in 20 mm sizes. Several researchers have made researches to determinate the compressive strength of concrete using RCA compared to the concrete using NAT. Factors such as smoother texture, rounder shape of RCA, and higher percentage of fine particles were the reasons for RCA had lower compressive strength than NAT[2]. Meanwhile, the more angular shape of RCA and its rougher surface texture are what contribute to a higher compressive strength in recycled aggregate concrete [7]. An angular shape and rough texture in RCA leads to better bonds and a higher strength value of concrete. Recycled aggregate concrete can also have a higher compressive strength when RCA is oven dried, due to the interfacial bond between cement paste and aggregate particles [3].

EXPERIMENTAL RESEARCH

A. Materials and compositions

The present experimental study is focused on developing new concrete recipes where the natural aggregates (NAT) are replaced with recycled concrete aggregates (RCA). The aim is to compare the two types of aggregate in concrete mixture and also the way that RCA influence the concrete properties. The materials used for the experimental program were the following: natural aggregates (NAT) from Timiș county Romania, washed and sieved; RCA obtained from a reinforced concrete beam demolition containing a C16/20 concrete, established by use of cylindrical samples, washed and sieved; Portland cement CEM I 42,5R supplied by Holcim company; water from the Timisoara city network; SikaPlast421 additive.

There was established a grain size distribution of the aggregates used for the concrete proposed recipes as following in Table I.

Table I. Particle size distribution for proposed concrete recipes

Sieve diameter [mm]	% passing aggregates
0,0-0,25	5
0,25-0,5	15
0,5-1,0	10
1,0-2,0	10
2,0-4,0	10
4,0-8,0	20
8,0-16,0	30

It has been established the crushing resistance for the cores aggregates and for the RCA, BS 812: PART 112:1990 standard and were obtain the following results presented in Table II.

Table II. Aggregates crushing resistance

Aggregate 8,0mm→16,0mm	NAT	RCA
Crushing resistance [%]	19	23

The RCA has a smaller crushing resistance than NAT with 18%, a normal decrease considering that RCA has higher or smaller percent of cement stone in the composition; from a C16/20 crushed concrete. It was proposed a specific workability for the concrete recipes and a resistance class. For the slump test was required a subsidence of 100 up to 150 mm. The experimental research proposed C16/20 concrete recipes it can be seen in Table III.

Table III. Proposed concrete composition

Concrete resistance class	Cement CEM I 42.5R [kg/m3]	Aggregates [kg/m3]	Admixture [kg/m3]	Water [kg/m3]	W/C
C16/20	292	1694	1,46	205	0,7

It was proposed eight recipes of concrete, with the same cement, aggregates and water quantities and a variable additive quantity. For the each recipe it was replaced a percent from the NAT with RCA as it can be seen in Table IV. It is well known that for the using of RCA, the concrete workability will decrease due to a higher water absorption compared to the NAT. From this reason, the higher water absorption was compensated with a higher quantity of additive.

Table IV. Proposed recipes for RCA concrete

Recipe	Diameter of replaced NAT with RCA [mm]	Percent of replacements [%]
M	-	**-**
R_1	0,0...16,0	**0**
R_2	0,5...16,0	**100**
R_3	0,5...1,0	**100**
R_4	1,0...2,0	**100**
R_5	2,0...4,0	**100**
R_6	4,0...8,0	**100**
R_7	8,0...16,0	**100**
R_8	0,0...16,0	**50**

B. *Preparation technology*

The proposed recipes were prepared using an electrical mixer with a 0,08m3 volume. For the workability of the concrete was performed the slump test, and for the recipes with a workability smaller than the proposed one, the percentage of additive was increased in order to obtain it.

For obtaining the same workability, after mixing the binder, for the recipes with a smaller workability it was increased the percent of additive. The cases when it was necessary a higher percentage of additive, was when it was used RCA instead of natural aggregate as it can be observed in Table V.

The mixing process was different for the recipes contain RCA, with 10% longer each mixing process compared with the M recipe; for the same mixing process, the recipes with RCA have failed.

Table V. Recipes additive

Recipe	Additive [kg/m^3]
M	1,46
R_1	5,84
R_2	2,19
R_3	1,825
R_4	1,46
R_5	1,46
R_6	1,46
R_7	1,46
R_8	1,825

The molded samples of concrete had the following dimensions:

- For compression test: 150 x 150 x 150 mm cubes and cylinders with diameter of 150mm and 300mm high;
- For bending test: 150 x 150 x 500 mm;

For each recipe have been molded 3 samples for each determination. The samples were de-molded after 24h and cured in water for 28 days at 20ºC.

C. *Mechanical properties*

The samples were tried after 28 days at bending tensile test and compression test.

Compressive and tensile strength for hardened concrete was determined by using compression machine. Fig.1 shows the results for compressive strength at 28 days determined on cylinders and on cubes for all proposed recipes. Strength of concrete is commonly considered its most valuable property in the mechanical properties because the strength usually gives

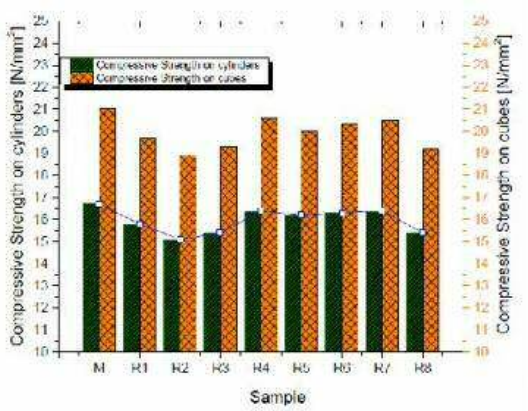

Fig. 1. Compression strength

an overall picture of the quality of concrete that is directly related to the structure of the hydrated cement paste.

It was determined also the bending tensile strength on 150 x 150 x 500 mm samples, at 28 days, and the results are

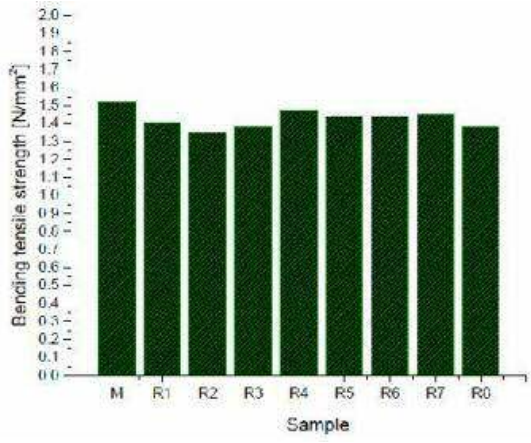

Fig. 2. Bending tensile strength

presented in Fig.2.

Results from the experimental determination of the compression resistance shows that the proposed concrete recipes are more or less a C16/20 concrete. Based on the results obtained from cylinders were between 15,03MPafor R2and 16,8 MPafor R4 . From cubes determination, the compressive resistance was between 19,06MPafor R2 and 21

MPafor R4. It can be said that the difference between the recipes are in the range of 10%. The decreasing of the compressive resistance is present in the cases of recipes with a higher quantity of additive. Even if the workability is the same due to additive adding, the resistance is not.

CONCLUSIONS

- RCA can be used in concrete recipes with notable results; lots of studies were performed in last years related to the RCA characteristics.
- The RCA used in our experimental research has a crushing resistance value of 23%, and according to BS 882:1992 can be used in heavy duty floor. This value is similar with the crushing resistance of NAT, with just 18% lower.
- Even if RCA have higher water absorption than NAT, it can be obtained the same workability for the concrete recipes with a higher additive percent used. The fresh concrete using RCA has different percent of additive; the highest was used in R1 recipe where the entire NAT was replaced with RCA.
- Compressive and tensile strength of the recipes using RCA are equal or smaller than the reference concrete, with a maximum decreasing of strength about 10% for the recipes R2 and R8.
- For the same workability obtained the recipes have different strength, the additional quantity of additive cannot improve the strength of concrete; R1 with the higher percent of additive has the lower strength.

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Estimation of the absolute cloud fraction from radiometric data

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Abstract: The morphological properties of an effective cloud field can be described in terms of the absolute cloud fraction and cloud aspect ratio. This study proposes a simple method for estimating the absolute cloud fraction from radiometric data. Basically, the method is routed on tracking the probability of a clear line of sight. Preliminary results on the relationship between cloud aspect ratio and cloud shade are discussed. The study is conducted with high resolution radiometric data recorded on the Solar Platform of the West University of Timisoara.

Keywords: renewable energy, solar irradiance, sunshine number, cloud fraction.

I. INTRODUCTION

The numerical models for describing a cloud field are used in many domains, such as climatology, meteorology or solar engineering. In spite of a huge effort paid in the last decades and the significant achievements (see the discussions from [1]), the representation of clouds remains a significant source of uncertainty in modeling the radiative transfer through the atmosphere. Usually a cloud field is modeled in terms of vertical and horizontal dimensions of the individual clouds, spatial distribution of clouds. Figure 1 presents the typical geometry of a 2D homogeneous effective cloud field. Associated to this geometry, two parameters are commonly used in modeling such a cloud field. The first one is the cloud aspect ratio β which is defined as the cloud height divided by the cloud diameter:

$$\beta = \frac{h}{d} \tag{1}$$

The second one is the cloud fraction N which is defined as the ratio of the total length occupied by the vertical projection of a cloud to the sum of this length and the space between clouds:

$$N = \frac{d}{d+s} \tag{2}$$

N is smaller than one and β can take any positive real value. It is worthy to note the difference between the definitions of cloud fraction in climate models and solar energy models.

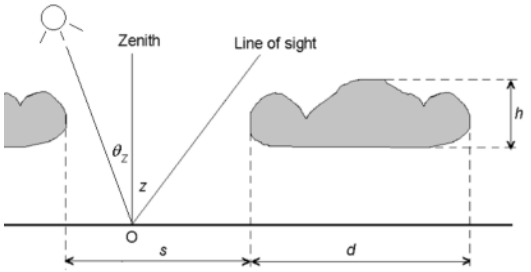

Fig. 1. Geometric parameters associated to a 2D cloud field. h – cloud thickness, d – length of the vertical projection of a cloud on a horizontal line, s – space between clouds). z is the zenithal angle of a certain point on the celestial vault and θ_z is the zenithal angle of the Sun.

In climate models the cloud fraction is defined as the fraction of the horizontal area covered by clouds and viewed from nadir, while in solar energy modeling this term is defined as the fraction of the hemispherical sky covered by clouds, commonly called point cloudiness. A study on the relationship between the two definitions can be read in Ref. [2].

This study is focused on the accuracy of extracting cloud fraction N from radiometric data. The methodology for N is based on our previous achievements [1, 3-4] in extracting the effective cloud field parameters from sunshine number measurements [5]. In principle, the probability of a clear-line-of-sight (*PCLOS*) is modeled in relation with the cloud field parameters. *PCLOS* is defined as the probability that a line-of-sight between observer and the Sun goes freely without intersecting a cloud. In this paper *PCLOS* is estimated by means of the 2D_Poisson_SemiEllipsoid model [6]:

$$PCLOS(z) = (1-N)^{\frac{1}{2}\left(\sqrt{1+4\beta^2\tan^2 z}+1\right)} \tag{4}$$

were z is the zenithal angle of a certain point on the vault. The accuracy of estimation cloud fraction for different values of cloud aspect ratio is assessed. For this, cloud shade *CS* is estimated in relation with the estimated values of point cloudiness *PC*. *PC* is computed as the weighted average of 1-*PCLOS*(z) over the entire celestial vault [7]:

$$PC = \int_{\gamma=0}^{2\pi}\int_{z=0}^{\pi/2}\left(1-PCLOS(z)\right)\sin z\, dz d\gamma \Big/ \int_{\gamma=0}^{2\pi}\int_{z=0}^{\pi/2}\sin z\, dz d\gamma \tag{5}$$

where γ is the azimuth angle of a line-of-sight.

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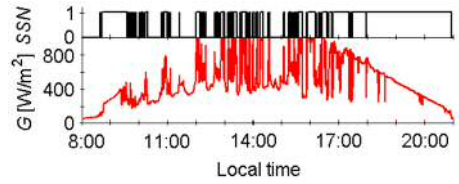

Fig. 2. Global solar irradiance G and sunshine number SSN in 22/05/2018.

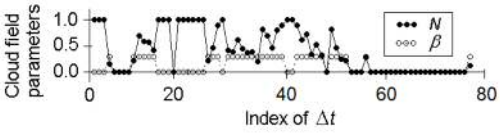

Fig. 3. The estimated cloud field parameters on day 22/05/2018. The index of Δt denotes the disjointed time intervals of 10 min from sunrise to sunset.

II. Results and Discussions

a. Data

This study was conducted with radiometric data recorded on the Solar Platform of the West University of Timisoara, Romania (http://solar.physics.uvt.ro/srms). The database consists 3087 values of global G and diffuse G_d horizontal solar irradiances, measured using Kipp & Zonen SMP10 pyranometers at high temporal resolution (15 seconds) in 22/05/2018. During this day the solar radiative regime was very unstable (Fig. 2). Sunshine number SSN [5], a time dependent random binary variable showing whether the Sun shining or not, was calculated on basis of the measured data using the WMO criterion: at a given moment the Sun shines if the direct-normal solar irradiance exceeds 120 W/m^2. All the measurements for a Sun elevation angle smaller than 10° were removed from database.

b. Estimation of cloud shade

The iterative procedure from Ref. [1] was applied to compute $PCLOS$. The daylight was divided into 77 disjointed intervals Δt = 10 min. On each time interval, $PCLOS$ was estimated assuming different values for the cloud aspect ratio β. For all sunny intervals Δt, β was forced to zero. Then, $\overline{PC}$, the average value of PC over each interval Δt, was computed using Eq. (5). Finally, the dependence of cloud shade on the estimated $\overline{PC}$ was compared with the typical curve $CS = 0.582\left[\exp\left(\overline{PC}\right)-1\right]$ [8]. Table 1 summarizes the results in terms of the statistical indicators of accuracy. Visual inspection, the accuracy of modeling the effective cloud field increases with the increasing of β, it reaches a maximum and, then, decreases with the increasing of β. The best results are obtained for $\beta = 0.3$: $nRMSE$ = 6.4% and $nMBE$ = 0.2%. The estimated values of N for this case are displayed in Fig. 3. The values of $nMBE$ from Table 1 shows that for small values of β, the estimated CS overestimates the typical relation while for large value of β, the estimated CS underestimates the typical relation. This means that as β increases, CS migrates from the popular assumption $CS = \overline{PC}$ beyond the typical curve. The typical curve is reached at $\beta = 0.3$ with $R^2 = 0.996$.

Table 1. Statistical comparison of the estimated cloud shade $1-\overline{PC}$ with the typical curve for Timisoara for different values of β. The determination coefficient R^2, the normalized root mean square error $nRMSE$ and the mean bias error $nMBE$ are displayed.

β	R^2	$nRMSE$	$nMBE$
0.0	0.970	0.180	0.107
0.1	0.989	0.107	0.057
0.2	0.995	0.069	0.023
0.3	0.996	0.064	0.002
0.4	0.993	0.078	-0.015
0.5	0.990	0.096	-0.027
0.6	0.986	0.112	-0.037
0.7	0.982	0.126	-0.045
0.8	0.978	0.138	-0.052
0.9	0.975	0.147	-0.057
1.0	0.971	0.156	-0.061

III. Conclusion

In order to simplify the methodology of estimation $PCLOS$, a cloud aspect ratio about 0.3 represents a reasonable assumption. This means that an individual cloud from an effective cloud field is about three times larger horizontally than vertically. The preliminary results presented in this paper show that at this value the typical relationship between cloud shade and point cloudiness is traced with a high accuracy. Further researches are necessary for better understanding the influence of different local factors, such as the solar irradiance variability or seasonal changes in cloud field properties.

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Green aircraft minimum fuel consumption methodologies

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Abstract: In this abstract, two sub-projects will be presented in the area of morphing wing for green aircraft technologies development. In both projects, a different morphing wing was designed and manufactured with the aim to reduce drag and to delay the flow transition, therefore the fuel consumption; the morphing wing was equipped in both sub-projects with piezoelectric pressure sensors. The morphing wing shapes were changed using different types of actuation systems, as detailed for each sub-project: 1) classical wing-box equipped with smart material actuators, and 2) regional jet wing-tip equipped with in-house electrical actuators. The multidisciplinary (aerodynamics, structural and controls) research methodologies and results will be presented. Comparison of results obtained on both sub-projects will be compared. The advantages and disadvantages of both projects results will be highlighted. Both sub-projects are realized in collaboration with Canadian partners such as Bombardier, Thales, and Ecole Polytechnique teams, while one of them, is international, being realized also in collaboration also with Italian partners from University of Naples and CIRA.

Keywords: Morphing Wing, Aerodynamics, Structural Dynamics, Aircraft Controls

I.PRESENTATION OF THE PROJECTS

In both morphing wing projects, three phases took place during three years; design, manufacture and wind tunnel tests. Three main groups worked on these projects in their corresponding disciplines: aerodynamics, structures and controls. There was the need of permanent interaction between teams and their corresponding disciplines.

These projects were mainly realized at the ÉTS in collaboration with Bombardier and Thales, two aerospace Canadian companies, and also in collaboration with the research institute called IAR-NRC. The second project was realized had also Italian collaborators from CIRA, Alenia and Naples University.

The wing analyzed for its morphing capabilities in the first project had its dimensions of 0.5 m x 0.9 m, and its reference airfoil was chosen to be that of a laminar Wing Trailing Edge Airfoil (WTEA).

The wing analyzed for its morphing capabilities in the second project was in reality a wing-tip (no winglet was studied) that had its span of 1.5 m and the root chord of 1.5 m, the and trailing edge angles of 8^0 and the taper ratio of 0.72.

Both models scales were chosen according the subsonic IAR-NRC wind tunnel dimensions and capabilities.

During the first year period or phase of both projects [1], the optimized aero-structural models of the morphing wing and of the morphing wing-tip were realized through collaboration between aerodynamic and structural teams. In fact, these models were optimized with the aim to reduce drag and, therefore to delay the flow transition to the trailing edge. 2D aerodynamic studies were performed in both projects; however, 3D aerodynamic studies were performed also in the second project. Comparison in the second project was performed for results obtained using 2D ([2], [3]) and 3D aerodynamic analyses [4].

Following optimization of these models, the optimized shapes of the wing and wing-tip were obtained in the subsonic regime for different flow conditions expressed in terms of angles of attack, Mach numbers, Reynolds numbers, and aileron angles. The optimization was led with the aim to find the best shapes in two actuation points. Novel genetic algorithms were used to find the displacements of the actuators needed to optimize the shapes for the best flow transition location. 2D XFoil software and 3D Ansys Fluent software were used to find the corresponding aerodynamic coefficients for these displacements. Therefore, aerodynamic performances were calculated for the optimized airfoils. In parallel, Hypermesh and Nastran software were used to optimize the composite structure of the models, and finally the aerodynamic and structures teams worked together to obtain the best aero-structural models of the wing (in the first project) and of the wing-tip (in the second project).

In both projects, the actuators were manufactured in-house at the ÉTS. In the first project, the nickel titanium shape memory alloys actuators were installed at 25.3% and 47.6% of the chord with respect to the leading edge of the airfoil, and they had a displacement range between $\pm$ 8 mm. In the second project, four electrical actuators were installed at 32% and 48% of the local wing chord, and at 37% and 75% of the wing span, and they had a displacement range between $\pm$ 3.5 mm.

These electrical actuators were fixed to the ribs and to the composite skin located on the upper surface of the morphing wing-tip model.

Piezoelectric sensors were used in both projects to measure the pressures and the flow transition on the wing, and on the wing-tip models. In the wing model considered in the first project, 16 piezoelectric sensors were installed on the composite upper surface, while in the wing-tip model considered in the second project, 32 piezoelectric sensors were installed.

From experimental point of view, various tests were considered. The most important tests were the bench tests and the wind tunnel tests. During the bench tests, the models were controlled, therefore the controller design, as well as the optimized shapes design were verified and validated. These shapes were scanned to compare their numerical values with the experimental values. Another type of bench tests was the 1 g loads tests for testing the behavior of the wing under static conditions, and it was successful.

In Figure 1, the bench tests is represented – where from left to right, one can see the bench test laser scanner, the laptop equipped with Matlab Simulink Control, and the power supply and data acquisition.

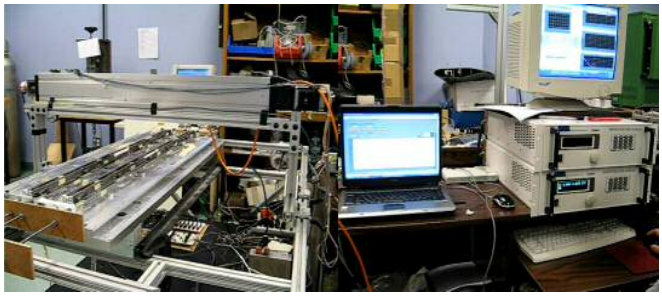

Figure 1. Bench tests representation

The final aim of the project was to change (thus, to optimize) the shapes of the shapes of the wing and wing–tip models in the wind tunnel for different flight conditions using the controller in open and closed loops. Various methodologies were used in both projects.

In the first project, the methodologies were developed based on Adaptive Neuro-Fuzzy Inference System ANFIS, Hybrid Fuzzy Logic Proportional Integral Derivative and Conventional On-Off Controller, On-Off and Proportional-Integral Controller, and Real Time Optimization ([5],[6]).

In the second project, Proportional Integral Derivative (PID), Fuzzy-Logic and Neural Network control algorithms were developed. The main controller (part of the integrated communication and control system) was developed as a PID controller, and the controllers were integrated on the National Instruments (NI) system [7].

The controllers have used the piezoelectric pressure measurements for detecting the flow transition. The Root Mean Square (RMS) method is based on the pressure fluctuations of sensors increase in turbulent flow, and therefore, the flow transition is visualized by a spike in the RMS plot of these sensors. Another method to measure the flow transition used infrared measurements that quantified the flow transition by a change in colors. Therefore, calculated pressures were compared and validated with measured pressures in the wind tunnel.

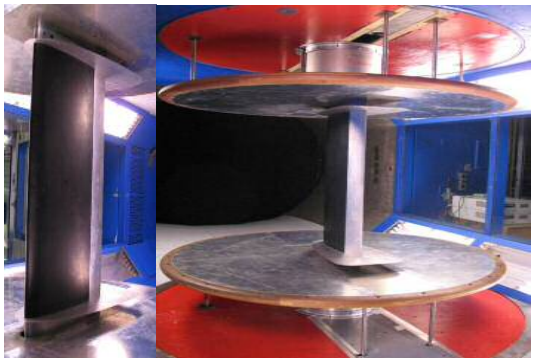

Figure 2. Visualisation of the Morphing Wing in the Wind Tunnel at the IAR-NRC

In the first project, the transition position moved closer to the trailing edge by 40% of the chord. This transition delay would conduct in drag, and thus, in fuel consumption reduction.

In the second project, the wing-tip model had more structural constraints than the wing model in project 1 (as it was a modified model from an existing aircraft) – and for this reason the transition position displacement was much smaller than the one found for the first model. In both projects, the flow transition delay will conduct to fuel consumption reduction [8].

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Dynamic Measurement Procedure of Road Lighting applied to Street Lighting in the Municipality of Resita, Romania

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Abstract:This research paper presents a method of measuring road lighting in a dynamic regime using a data acquisition system. The measurements made were the subject of a pilot project initiated by the City Hall of Resita with the support of the URBIO LED Company of Iasi, Romania. The light sources analyzed are two types of luminaires from different manufacturers and are equipped with environmentally friendly and energy-efficient LEDs. Some of the LED lighting units analyzed are equipped with a telemanagement system that represents the City of Resita one of the smart city components. Graphical representations of the variation of the illumination in the dynamic regime were obtained, namely the car's performance, and a comparative analysis of the results obtained with the results of the design with the DiaLux specialized software, respectively with the provisions of the international standard for road lighting and adopted in Romania SR EN 13201: 2016, for the lighting class in which the street on which the illumination measurements were made. The maximum values obtained are above the values calculated with the DIALux program, and with a good correlation between the static and the dynamic (automotive) measurements.

Keywords: dynamic, LED, lighting, measurement,.

I. INTRODUCTION

In 2014, under a pilot project, measurements of dynamic lighting were made in street public lighting, on the boulevard of the Republic of Resita, Caraş-Severin County, Romania.

II.DESCRIPTION OF THE METHOD OF MEASUREMENT

The measured size is the level of horizontal illumination. An acquisition system piloted by a Raspberry Pi SBC (Single-Board Computer) and TSL2561 show in Figure 3.1, [11], with omni-directional correction for incidence angle and GIS data recording with MN5515 HS GPS receiver integrated into the MCE Kit GPS system .

Fig. 3.1 TSL 2561 LIGHT-TO-DIGITAL CONVERTER

Sampling speed worked: 10 fps at a travel speed of approx. 30 km/h, resulting in at least one measurement per linear meter. The total number of measured values was 440,000. Processing in EXCEL and indexing readings with GPS coordinates required additional processing in EXCEL leaving a limit to 65,000 values. Additionally, there is an unacceptable gap between the GPS coordinates collected and the GOOGLE MAPS coordinates and the aero-photogrammetric coordinates, which has also been offset by checks with the on-site notes. The outside temperature was 10^0 C. Measuring the luminance has the advantage of being able to evaluate the light sensation, but measuring the level of illumination has the advantage of repeatability of the measurements, regardless of the state of the road (precipitation in the form of rain or snow, snow, wear, deposits, etc.). Measurement of the level of illumination is also indicated in accordance with the European standard EN 13201-4:2015, subchapter 4.4 [10]: Measurements taken from a moving vehicle, specifying the advantage of the dynamic measurements, respectively the large number of measured points, but also the consequence of the impossibility of locating the observer or the grid measures required to measure luminance:

"The light performance of an installation can be measured from a moving vehicle. The main differences between dynamic and static measurements are:

- the number of measurement points is greater in the case of dynamic measurements;

- the requirements in EN 13201-3 for observer position and location of grid points may be more difficult or impossible to meet in the case of dynamic measurements" [9].

Identifying the number of poles allows repeating measurements at any time as well as accurately identifying the type of light sources in operation.

3. ILLUMINANCE MEASUREMENTS

For the two analyzed technical solutions (URBIO LED and EnergoBit Schréder Lighting), the cross-sectional illumination profiles (YF-1065 type) were shown in Figure 3.2. This device was used as a working sensor for the system sensor data acquisition.

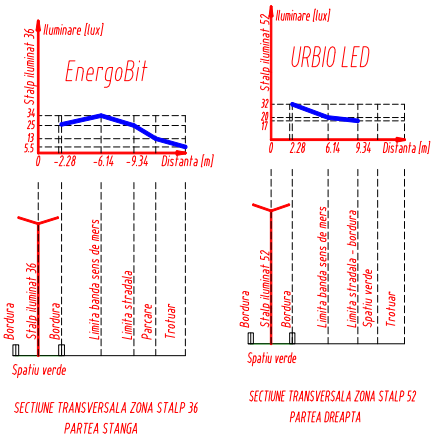

Fig. 3.2 Measurement of transverse lighting profiles

Observation: The maximum values obtained with the two luminaires are virtually equal, but for the URBIO-LED solution, it is necessary to change the angle of displacement to move the maximum location to the center of the track. The inclination angle of URBIO LEDs is to be optimized.

The dynamic measurements made with the data acquisition system reflect this aspect, with the measured band excluding the maximum levels of illumination measured at the poles.

4. RESULTS

Set I. Republic Boulevard - lighting pillars 64-53 (equipped with HPS - GE) shown in Figure 4.1.

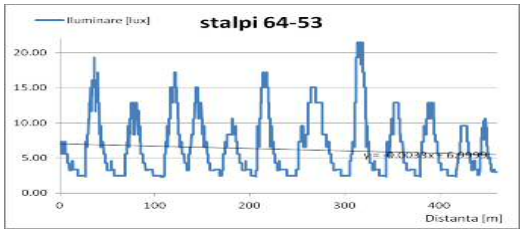

Fig. 4.1 Graphic representation of illumination variation on the pillar section 64-53

The weighted average value is 7 lx.

Set II. Republic Boulevard - lighting pillars 52-47 (equipped with URBIO LED) shown in Figure 4.2.

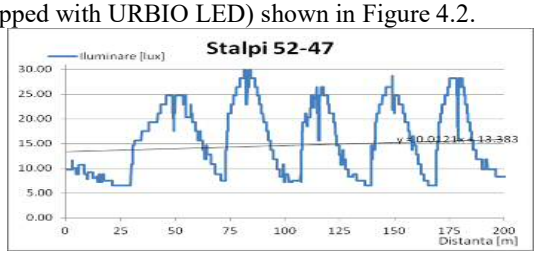

Fig. 4.2 Illustration of illumination variation on pole 52-47

Weighted average value 13.4 lx. The acquisition was made on the gangway near the center of the boulevard.

Republic Boulevard - lighting pillars 47-52 (equipped with URBIO LED) shown in Figure 4.3.

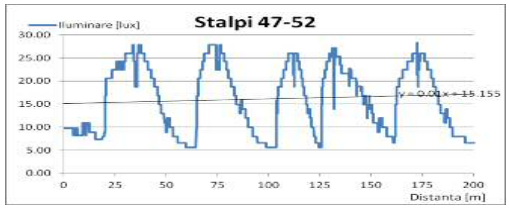

Fig. 4.3 Graphic representation of illumination variation on the pillar section 47-52

Weighted average value 15.2 lx. The acquisition was made on the gangway near the center of the boulevard.

Republic Boulevard - lighting pillars 52-47 (equipped with URBIO LED) shown in Figure 4.4.

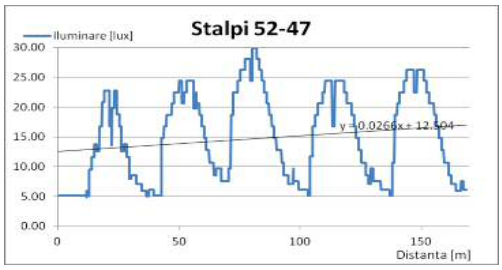

Fig. 4.4 Graphic representation of illumination variation on the pillar section 52-47

Weighted average value 12.5 lx. The acquisition was made on the walkway near the sidewalk

Republic Boulevard - lighting pillars 32-36 (equipped with EnergoBit Schréder Lighting) shown in Figure 4.5.

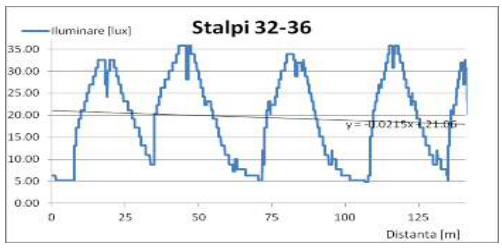

Fig. 4.5 The graphical representation of the illumination variation on the 32-36 poles

Weighted average value 21 lx. The acquisition was made on the gangway near the center of the boulevard.

Republic Boulevard - lighting pillars 36-32 (equipped with EnergoBit Schréder Lighting) shown in Figure 4.6.

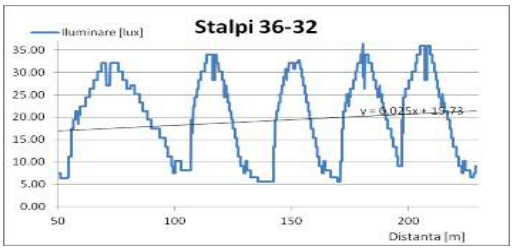

Fig. 4.6 The graphical representation of the illumination variation on the 32-36 poles

Weighted average value 15.7 lx. The acquisition was made on the walkway near the sidewalk.

The Dynamic Data Acquisition System provides a large amount of data that can also be used in the future to track the evolution of the lighting system.

For a vehicle running at 30 km/h, the entire lighting system can be monitored.

To this end, the URBIO LED team works to optimize routines to process the volume of collected data as quickly as possible.

For the pilot project under review, the quantitative and qualitative results obtained are considered positive, corresponding to the lighting class M3 [8].

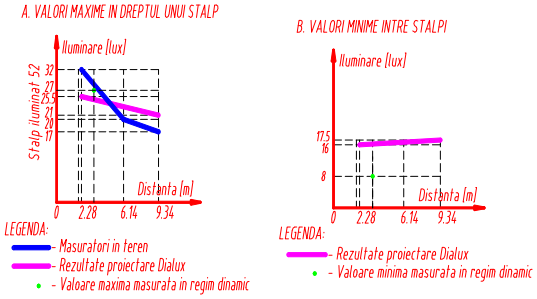

Fig. 5.1 Comparison of the illuminance values measured in the field and in the project (DIALux)

On the graph illustrated in Figure 5.1, the measured values on the field are measured in blue, with the luxmeter, and with the green color the corresponding value obtained by the dynamic measurements. Fuchsia pinc color represents the values obtained in DIALux. Variant A corresponds to the maximum values under column, and variant B shows the minimum values between the pillars.

The maximum values obtained are above the values calculated with the DIALux program, and with a good correlation between the static and the dynamic measurements (from the car).

At the minimum value there is an important difference, the dynamic measurements indicate a minimum value of about 8 lx, compared to 16 lx in DIALux. Analyzing the measurement procedure, we conclude that it is a systematic error of the method used, explained by the shading of the sensor by the vehicle's hood, for angles of high incidence relative to normal (between poles). On the ground these minimums are not highlighted, therefore, these values have not been measured in static mode.

Since the verifiable field situation does not highlight visible minimum illuminating areas, it has not been considered useful to carry out additional measurements.

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Comparative Study of Luminances in Street Lighting Luminaires equipped with High Pressure Sodium (HPS) and LED lamps

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Abstract: This research paper presents a comparative study of the results obtained by measurements of luminances made on the Republic Street, which is the most important traffic road in the city of Resita, Caras-Severin County, Romania. The measurements made were the subject of a pilot project initiated by the City Hall of Resita with the support of the "Eftimie Murgu" University of Resita, Faculty of Engineering and Management. Lighting measurements have been carried out in accordance with the provisions of the international standard adopted in Romania SR EN 13201-4: 2016, both for lighting units equipped with HPS and LED lamps. Lighting fixtures equipped with HPS lamps have been the subject of a modernization project built in 2006, and those equipped with LED lamps were installed in 2013 as part of a pilot project to implement intelligent lighting as a component of the smart city. Also, at the initiation of the pilot project, both energy efficiency and pollution reduction were taken in account and in accordance with the current European Union directives. In the study, the results obtained by the luminance measurements were compared with the performance requirements presented in the standard SR EN 13201-2: 2016 for the class of lighting in which the street is located. In conclusion, street-lighting luminaires equipped with LED lamps are much better compared to those equipped with HPS lamps, both in terms of measured luminances.

Keywords: dynamic, LED, lighting, measurement

1. THE PILOT PROJECT

The experiment was carried out at the public lighting on the Republic Boulevard of Resita, Caras-Severin County, Romania (Fig.1), where on the network section of five public lighting poles were replaced the ten luminaires GE Lighting, type Eurostreet ET 25G HPS 150W equipped with HPS lamps [10], with ten Schréder, type TECEO 2 LED, 139W luminaires [11].

Fig.1 The Republic boulevard of Resita

The luminaires equipped with replaced HPS lamps have 171 W absorbed electrical power, and the LED equipped luminaires used in the experiment absorbed electrical power of 139 W. Figures 2 and 3 show replaced HPS, and new LED lighting fixtures.

Fig.2 GE Lighting, type Eurostreet ET 25G HPS 150W

Fig.3 Schréder, type TECEO 2 LED, 139W

The LED lighting fixtures are equipped with dimmable drivers controlled by a Schréder Owlet Nightshift tele-management system (Fig.4) which monitors, controls, measures and manages outdoor lighting. Based on open technologies, it saves energy, reduces greenhouse gas emissions, improves outdoor lighting reliability and lowers the maintenance cost. Each individual light point can be switched off/on or dimmed at any time. Operating state, energy consumption and failures are reported and stored in a database with exact timestamp and geographical location. Owlet helps public lighting managers to assure the right lighting level on streets while improving reliability of outdoor lighting and reducing operating costs. Due to its open architecture Owlet makes the public lighting network part of the internet, enabling to do anything whatever possible with modern web based applications [11].

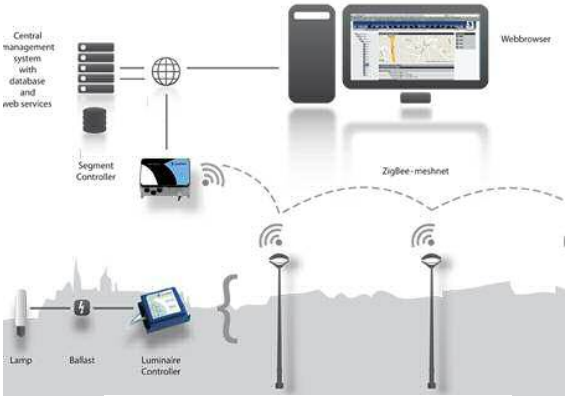

Fig.4 Schréder Owlet Nightshift interoperable network

2. LIGHT-TECHNICAL MEASUREMENTS AND EXPERIMENTAL RESULTS

Measurements have been made to determine the luminance level [8].

The technical characteristics of the analytical area, presented in Fig.5 are:
- Awning arranged with grass and flowers;
- Paved road with light gray bitumen;
- Car parking space, the same texture as the roadway;
- Pavement paved with gray bitumen.

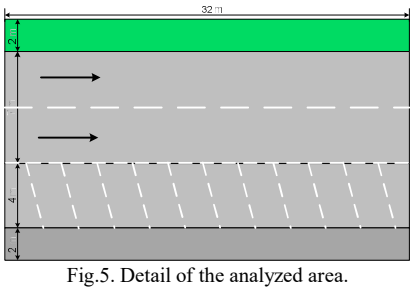

Fig.5. Detail of the analyzed area.

For measurements, the following devices were used:
- Laser-based measuring instrument Professional DLE 50, manufactured by Bosch, built according to EN 60-825-1: 2003, with a maximum power of 1 mW, operating on the 635 nm wavelength, designed to measure the accuracy of the distances;
- LS-100 luminance meter, manufactured by KONIKA MINOLTA SENSING INC., calibrated in the laboratories of the Japanese Ministry of International Trade and Industries, equipped with an internal and external display device for measuring values.

The technical and location characteristics of the pillars on which the luminaires are located namely:
- the distance between two consecutive pillars: 32 m;
- the height of the pillar: 11.5 m;
- arm length: 2.5 m;
- angle of inclination: 5 º.

The area under consideration is in the M3 class of the lighting system. According to EN 13201-2:2015 (Road lighting - Part 2: Performance requirements) [8], standard for this class of lighting system, the following conditions must be met:
- The average luminance on the calculation area must be at least L = 1 cd/m2;
- The overall uniformity of luminance must be at least U_0 = 0.4 cd/m^2;
- The longitudinal uniformity of the luminance must be at least U_l = 0.6 cd/m^2.

Luminance levels for the illuminated surface with type TECEO 2 LED, 139W luminaires are shown in Table 1

Table 1

R/C	1	2	3	4	5	6	7	8	9
1	1,72	1,67	1,26	1,13	0,94	1,08	1,41	1,55	1,67
2	1,41	1,37	1,06	0,92	0,77	0,93	1,13	1,34	1,31
3	1,24	1,15	0,95	0,85	0,72	0,84	0,96	1,12	1,19
4	1,12	0,92	0,73	0,68	0,64	0,58	0,69	0,87	0,89
5	1,02	0,83	0,67	0,54	0,48	0,58	0,56	0,66	0,82

Following the calculations, the results were obtained:
- Medium luminance on the road L = 1 cd/m2;
- The general uniformity of luminance U_0 = 0.48;
- The longitudinal uniformity of luminance U_l = 0.58.

The measured values of the luminances represented in table 1 correspond to the 50% dimension of the nominal luminous flux (light dimming control).

Luminance levels for the illuminated surface with type Eurostreet ET 25G HPS 150W are shown in Table 2.

Table 2

R/C	1	2	3	4	5	6	7	8	9
1	1,75	1,5	0,89	0,65	0,53	0,8	1,05	1,78	2,02
2	1,41	1,19	0,8	0,6	0,51	0,57	0,84	1,51	1,66
3	1,17	1,08	0,73	0,52	0,49	0,52	0,71	1,21	1,31
4	0,94	0,88	0,64	0,48	0,46	0,47	0,64	1,13	1,23
5	0,88	0,81	0,55	0,46	0,44	0,45	0,62	1,05	1,17

Following the calculations, the results were obtained:
- Medium luminance on the road L = 0.91 cd/m2;
- The general uniformity of luminance U_0 = 0.48;
- The longitudinal uniformity of luminance U_l = 0.37.

3. ENERGETIC EFFICIENCY

With the help of the Schréder Owlet Nightshift telemanagement system [11], three dimming steps of light output from the luminaires were programmed at 100%, 66% and 50% of the rated luminous flux value. The system also allows manual light control from a notebook or cellular phone through a web interface.

From the comparative analysis of reports obtained through the web interface, regarding the energy consumption of LED lighting units, with the energy consumption recorded on the HPS lamps, a 42% energy efficiency was achieved corresponding to an operating period of three months.

Analyzing the results from Tables 1 and 2 of the luminance measurements, it is noted that the performance of the luminaires equipped with LED modules are superior to those equipped with HPS lamps. It is also noted that lighting fixtures equipped with HPS lamps do not fall within the luminance values specified in standard EN13201-2: 2015, Table 1 - M lighting classes [8]. This is due both to the large length of the lighting pillars and to the mounting height of these HPS lamps.

At the rated luminous flux (100%), for luminaires equipped with LED modules, values higher than those specified in the EN 13201-2: 2015, Table 1 - M lighting classes standard are achieved, as this is also noticeable by the human observer, because luminance is the only parameter of perceptible light in the human eye.

The application made in April 2013 of pilot project is functional and is currently reliable and it is desirable to extend it to Municipality of Resita, if possible for non-reimbursable financing from European Union funds.

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Study on the proper destination for the char (fixed carbon) from waste tyre pyrolysis

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Abstract: **There has been great interest on alternative treatment processes for waste tyres, amongst which is the use of pyrolysis technology. Pyrolysis is the thermal degradation of organic components of tyres, at typical pyrolysis temperatures of 500°C to produce oil, gas and char as the main co-product. A solid char consists of carbon black filler and also the char produced during the pyrolysis of rubber. It may be used as a solid fuel, as a carbon black or upgraded component to produce an activated carbon. In this paper it is presented the characterization of a solid carbonaceous fraction. Characteristics such as: total moisture, particle size distribution, ash content, volatile matter, fixed carbon, total sulphur and the net calorific value have been studied. The resulted for the calorific value indicates that this pyrolytic carbon is suitable as an alternative for solid fuel. Moreover, in addition the treatment method has been evaluated to transform it into active carbon due to the fact that actually the most references in the literature show that the most immediate uses of pyrolitic carbon is the production of activated carbon. Other applications can also be for instance the filler in pavement/sidewalk, the printing pigment or the reinforcing filler for low-value rubber goods. Besides the high amount of carbon (> 60%) pyrolytic carbon continues being a very heterogeneous material regarding the ash content, particle size, etc. This is because due to the complexity of the pyrolysis process which modify the initial characteristic of the pyrolytic carbon.**

Keywords: renewable energy sources, waste tyre pyrolysis, char (fixed carbon).

INTRODUCTION

Recycling material appears to be one of the most significant future routes for sustainable development in tyre industries.

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Recycling is not a new concept. Prior to World War II, recycling was a relatively common industrial practice for a variety of materials and products-including tyres [1]. More than a half century later, recycling is again becoming an accepted industrial activity. However, as it is interpreted today, the concept of recycling is inextricably linked to waste production and management and to its prevention and minimization. Recycling has evolved into one of the four pillars which support improved resource management through waste prevention and reuse. Recycling and recovery of the waste occur in order to achieve sustainable development goals. [1].

World production of natural and synthetic rubber is estimated to be approximately 20,000,000 tons per year. About 20% or approximately 4,000,000 tones are consumed in European Union each year. Indications are that an additional of 1,000,000 tones are imported annually from outside the EU as finished good, including tyres. Once a tyre of any category is permanently removed from a vehicle without the possibility of being re-mounted for continuous on-road-use, it is defined as waste. It is generally accepted that for each tyre sold, whether newly manufactured, retreaded or part-worm, that tyre has become a waste. In the 15 Member Stated of the EU alone, post-consumer tyres amounted to more than 2,600,000 tons of waste in 2003 [2]. Projections of 2004 indicate that the expanded union of 25 states will account for annual arising of approximately 2,850,000 tones.

Pyrolysis uses pre-treated car or truck tyre chips as the principal feedstock. It is a two-phase treatment which uses thermal decomposition to heat rubber in the absence of oxygen to break it into its constituent parts, e.g., oil, gas and carbon. Cracking take place as the material is heated to 450-500°C and above. De-polymerization and oil and gas production take place progressively. A clean oil free char can be produced. [2].

Like material recycling, energy recovery is inextricably linked to the prevention and minimization of waste. It is one of the two principal means of valorizing the waste, thus reducing its environmental and economic impacts. Both material recycling and energy recovery offer alternative and complementary means of gaining the greatest sustainable benefit from natural resources and their wastes and thereby reducing the consumption of virgin resources. The cement industry is using whole tyres as well as shred and chips.

These measures provide; significant savings in raw materials, electricity and non-renewable fossil fuels, a reduction in CO_2 emission and an effective solution to the problems posed by incinerating and dumping waste products. In pyrolysis, the main products are: a solid fraction, usually rubber and focused mainly on the identification of products and by-products produced at different temperatures [3, 4-7]. During the pyrolysis of vulcanized rubber, the yield of different fractions varied with temperature and evaporation rate of different compounds. Low temperatures, in the range of 300–400°C, have been associated with an increase of heavy oil fractions (i.e., tar) and, therefore, higher temperatures have been preferred for the process, making it energy intensive. Studies involving the pyrolysis of synthetic rubber with a range of temperature between 400 and 600°C have shown that increasing temperature favored the production of gas fractions. However, the effect of temperature in the liquid yield varied within studies, indicating that other factors such as reactor configuration, amount of feed materials and atmosphere played an important role [8].

Generally speaking, pyrolysis offers the possibility to convert organic matter into carbon-rich solid (char). In the case of tyres, this solid carbonaceous fraction, also named pyrolytic carbon CB, corresponds to the initial CB as well as the inorganics used in the tyre manufacture such as Zn, Ca and Si.

The char compositions depend on the pyrolysis conditions and the tyre composition and its/their quality and yield greatly influence the waste tyre pyrolysis economic feasibility besides the liquid fraction [9].

In this paper it is presented the characterization of the solid carbonaceous fraction. These characteristics such as: total moisture, particle size distribution, ash content, volatile matter, fixed carbon, total sulphur and the net calorific value have been studied.

MATERIALS AND METHODS

Pyrolysis is considered one of the most promising methods for waste tire recycling and energy recovery and was considered several times.

The pyrolysis technology involves a rotary kiln as a pyrolysis reactor (volume 35 m^3), a separator condesate, and distillation columns, as is shown in the fig. 1. Pyrolysis takes place at 450-500°C. The process treats 8 tons/batch of raw material.

The experiments on this research are conducted on char samples; the total moisture (ISO 589:2008, ash (ISO 589:2008), volatile matter (ISO 1171:2010), fixed carbon (ISO 17246:2010), total sulphur (XRF) and net calorific value (ISO 1928:2009), the particle size distributions (sieve method and sedimentation method).

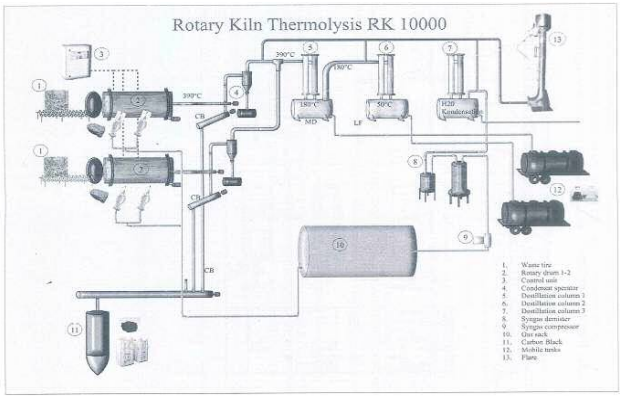

Fig. 1. Flow diagram of tyre pyrolysis process

III. RESULTS AND DISCUSSION

The results from the experiments are presented in the following table.

Table I. The parameter for char (pyrolytic carbon) produced by waste tyre pyrolytic

Parameter	Value	Unit
Total Moisture	1.7	%
Ash	19	%
Volatile matter	18.2	%
Fixed carbon	62.8	%
Total sulphur	2.7	%
Net calorific value	6545	Kcal/kg

Temperatures at which a good conversion grade of the tyre is usually (500°C), pyrolytic carbon represents approximately 35-40 wt% of (fixed carbon plus ash content) [10]. In the studied sample the fixed carbon is 62.85% much more than 40%. To understand the large amount of fixed carbon we need to study the tyre composition. Also, the sample can contain extra carbonaceous material as a consequence of repolymerisation reactions among the polymer-derivates depending on the process severity and complexity. Depending on the process conditions of pyrolysis and the tyre compositions the pyrolytic carbon may have 80% for a large char yield (%). The Mitrovica plant has a char yield (8 ton/batch) in batchreactor**.**

Pyrolytic carbon can present a calorific value of 25 and 34 MJ/kg. In our sample there is a value of 27.4 MJ/kg that makes it very attractive as a solid fuel, table I. The sulphur content in the studied sample is 2.7%. In various literatures the amount of sulphur in pyrolytic carbon varies 2.2- 3.5% S.

Ash content was 19 wt% and the total moisture was 1.7 %.

Sieve (um)	Weight passing (gr)	Percent passing
200	65.1	42.8
160	19.7	12.95
125	6.6	4.3
71	30	19.7
65	25.3	16.6
<65	5.4	

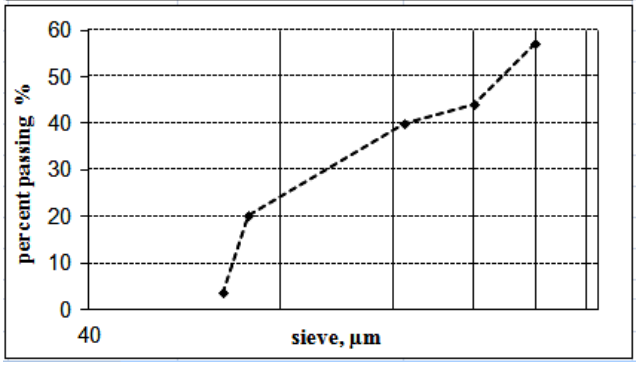

Fig. 2. Particle size distributions of the tested char

Fig. 2 shows the particle size distribution curve for the tested char. Regarding the particle size of the char sample, 42.8% remain above the 200 *um* and 53.55 % appears smaller than 200 *um*. The specific gravity of the char sample was 646.66 kg/m^3.

Also for granular carbon fraction is performed particle size analysis by the sedimentation method. From the results of the experiment, differential and integral distribution was established to determine the average diameter of pyrolytic carbon, fig.3, 4. The integral distribution expresses the part of the material from 0 to D (diameter in μm), while the differential distribution represents the size fraction part in the interval (D, dD).

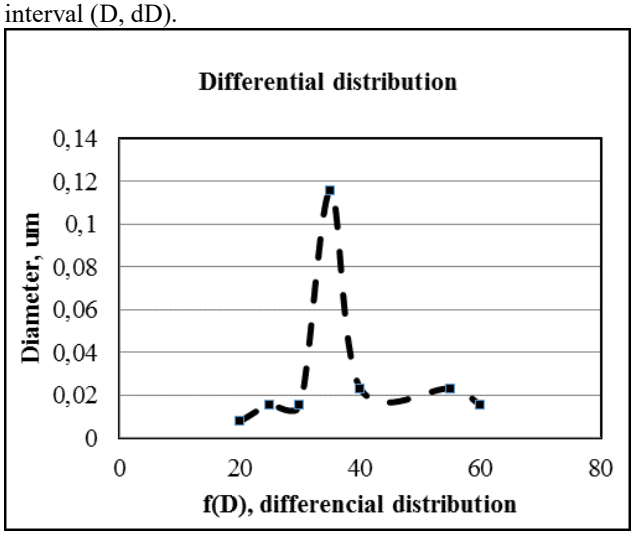

Fig. 4. Differential distribution of the tested char (pyrolytic carbon)

As is shown in the fig.3, 4 the moda number (which represents the diameter value for which distribution has a maximum) is 35 μm, while the median number (which represents the diameter value for which 50% of the material mass has a diameter below the average value) is 43 μm.

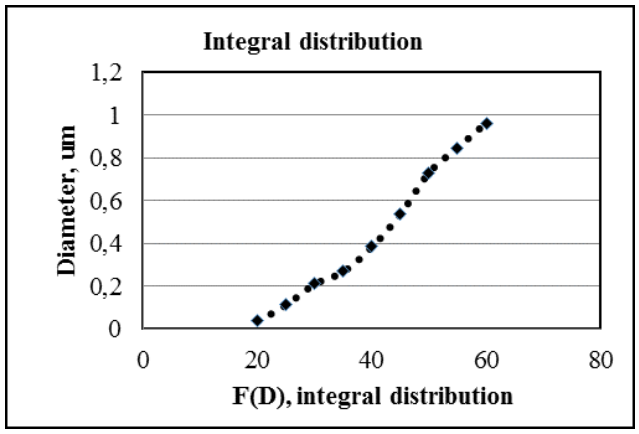

Fig. 3. Integral distribution of the tested char (pyrolytic carbon)

Also, we evaluated the treatment method to transform the pyrolytic carbon into active carbon due to the fact that the most of the actual references in the literature show that the most immediate uses of the pyrolytic carbon is the production of activated carbon. Activated carbons have a high adsorption capacity and large surface area. These carbons could be considered as excellent adsorbent in order to remove dyes, heavy metals and different types of pollutants from surface chemistry of materials.

In this study we have begun to treat the activated carbon production methods; physical method and chemical method [11].

Physical method: the source material is developed into activated carbons using hot gases. Air is then introduced to burn out gasses, creating a graded, screened and de-dusted form of activated carbon. This is generally done using a combination of the following processes:

Carbonization: Material with carbon content is pyrolyzed at temperatures in the range 600-900°C, usually in inert atmosphere with gases like argon or nitrogen.

Activation/Oxidation: Raw material or carbonized material in exposed to oxidizing atmosphere (oxygen or steam) at temperatures above 250°C, usually in the temperature range of 600-1200°C.

Chemical method: Prior to carbonization, raw material is impregnated with certain chemicals. The chemical is typically an acid, strong base or a salt (phosphoric acid, potassium hydroxide, sodium hydroxide, calcium chloride, and zinc chloride 25%). Then, the raw material is carbonized at lower temperatures (450-900°C). It is believed that the carbonization/activation step proceeds simultaneously with the chemical activation. Chemical activation is preferred over physical activation owing to the lower temperatures and shorter time needed for the activating material.

We are studying both methods to analyze the influence of different parameters, such as pyrolysis temperature, holding time, the carbon yield and the surface characteristics.

CONCLUSION

In the studied sample the fixed carbon is 62.85% much more than 40 % (which is the common value). To understand the large amount of fixed carbon the tyre composition needs to be examined, observed. Also, the sample can contain extra carbonaceous material as a consequence of repolymerisation reactions among the polymer-derivates depending on the process severity and complexity.

Pyrolytic carbon can present a calorific value of 25 and 34 MJ/kg. In our sample there is a value of 27.4 MJ/kg that makes it very attractive as a solid fuel. The sulphur content in the studied sample is 2.7%. In various literatures the amount of sulphur in pyrolytic carbon varies 2.2- 3.5% S. Ash content was 19 wt% and the total moisture was 1.7 %.

Besides the high amount of carbon (> 60%) the pyrolytic carbon continues being a very heterogeneous material regarding the ash content, particle size, etc. This is because the complexity of the pyrolysis process which modifies the initial characteristic of the pyrolytic carbon.

By all means, anyhow, the production of activated carbon from waste tyre pyrolysis remains one of our future challenges.

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Aerosol influence on PV performance in Romania

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*corresponding author

Abstract: The paper is focused on aerosol influence on the photovoltaic (PV) performance in Romania. An aerosol loaded atmosphere has an impact on reducing the amount of solar radiation. The study is based on the aerosol data (aerosol optical depth, Angstrom exponent, size distribution, single scattering albedo, asymmetry factor) from ground-based remote sensing aerosol networks, taken from AERosol Robotic NETwork (AERONET) and satellite measurements provided by MODIS (Moderate Resolution Imaging Spectroradiometer). By taking data for photovoltaic energy production from Transelectrica website, several days are analyzed when the aerosol is present in the atmosphere. Also, by running the HYSPLIT model (Hybrid Single Particle Lagrangian Integrated Trajectory), the source of aerosol origin is discovered.

Keywords: aerosol, solar radiation, renewable energy, photovoltaic

INTRODUCTION

Atmosphere loaded with aerosol has become a serious problem in recent decades. The aerosol is a suspension of solid particles or liquid droplets in air, with diameters between 0.01 μm and 100 μm. Examples of natural aerosols are dust, marine aerosol/sea salt, aerosol from forest fires, fog, ash and gases volcanic, pollen, etc. The presence of aerosols in the earth's atmosphere can influence its climate, as well as human health, and visibility.

Aerosol can directly contribute and affect the atmospheric budget through scattering or absorption of the solar radiation [1], and they also indirectly affect the radiation, by changing cloud's microphysical properties [2], [3].

Aerosol parameters can be measured in situ (mostly by standardized methods) [4] or by remote sensing (e.g. sun photometer) from ground [5], [6], aircraft, or satellite [7].

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The AERONET program [6] includes more than one thousand instruments at ground, covering the entire globe and provides a long-term and public accessible database of aerosol optical, microphysical and radiative properties [7]. Another example is MODIS (Moderate Resolution Imaging Spectroradiometer) program, a key instrument aboard the Terra and Aqua satellites, which provides a wide range of information about atmospheric properties [8].

An atmosphere loaded with aerosols partially blocks sunlight from reaching the ground, and consequently affects the electric power generation of solar photovoltaic (PV) system. Aerosol pollution can lead to a significant loss of collectable solar energy, of over 20% [9]. Such very high values of losses are irregular in time and difficult to anticipate due to the aerosol dynamics.

Fig. 1 shows that 3.67% (meaning 264.12 MW) from the total energy (meaning 7190.53 MW) resulted from photovoltaics (PV) [10].

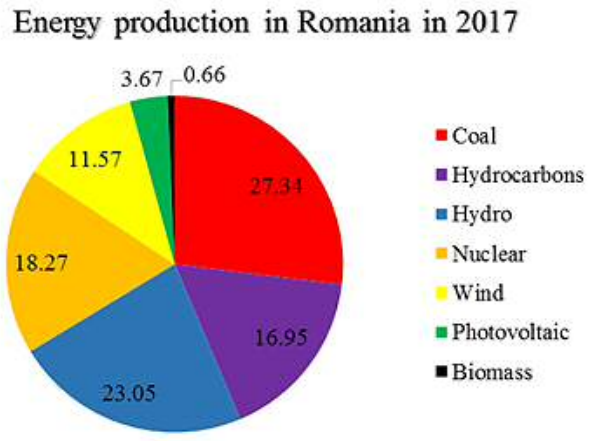

Fig.1. Energy production in Romania in 2017, according to Transelectrica website [10]

DATABASE

Two type of data was used for this study: information about the atmospheric column content and energy production.

The following data related to aerosol properties were retrieved from the AERONET network: aerosol optical depth (AOD), Ångström exponent (α), size distribution, Ångström turbidity coefficient (β), single scattering albedo (SSA). The aerosol type can be determined from the properties analysis. Data were collected from AERONET version 3, level 2, which assures high quality (pre- and post-field calibration, automatically cloud cleared and manually inspected).

Aerosol data was taken from sun photometer CE318 measurements. The sun photometer is located on the roof of the Mechanical Engineering Faculty at Politehnica University Timisoara (45.74 N, 21.22 E, and 122 m) and occupies the 645 position in the AERONET network. The sun photometer (see details on [5], [6]) is an automatic sun and sky radiometer, equipped with nine spectral channels covering the spectral range of 340–1640 nm. It performs two basic measurements, either sun or sky, both within several preprogrammed sequences. AOD is calculated from the direct sun measurements at equal time intervals of 15 min using eight interference filters. Measurements starting at an air mass of 7 in the morning and ending at an air mass of 7 in the evening. Size distribution results from the sky measurements. The two sequences of sky scanning are the principal plan and almucantar measurement procedure [6] that are regularly used in the AERONET sun photometer schedule. The sky measurements are performed daily at four values of the atmospheric mass: 1.7, 2, 3 and 4, both in the morning and afternoon using four interferences filters.

However, for a good interpretation of the aerosol type, satellite images from MODIS were used. In addition, for determination of the aerosol origin the HYSPLIT model was applied. Data from energy production (coal, hydrocarbons, hydro, nuclear wind, photovoltaic and biomass) in Romania was taken from Transelectrica website. Also, Navy Aerosol Analysis and Prediction System - NAAPS was used. NAAPS combines the current and expected satellite data with other available data and the global aerosol simulation and prediction developing one of the most complete suites of aerosol retrieval products in the world.

RESULTS AND DISCUSSION

The aerosol parameters analyzed in this study are:

a) Aerosol optical depth takes values in the range of 0-2 and is dimensionless (0 for an atmosphere without aerosol).

b) Ångström exponent takes values between 0 and 2, and if value is: (i) $\alpha < 1$ - denote large particles in the atmosphere - coarse particles, eg.: dust ($\alpha \leq 0.6$ and $0.3 \leq AOD \leq 0.6$); and (ii) $\alpha > 1$ - denote small particles in the atmosphere - fine particles, eg. urban - industrial pollution (α is between 1.2 and 1.4) and aerosols originate from biomass burning (α is between 1.6 and 2, and $0.2 \leq AOD \leq 0.6$).

c) Size distribution is denoted by $dV(r)/d\ln r$, where r is the particle radius, and V is the volume of particle. The volume particle size distribution is retrieved for 22 logarithmically equidistant discrete points in the range of sizes $0.05\ \mu m \leq r \leq 15\ \mu m$. By size, the aerosol particles are divided into three categories called modes: Aitken mode (particles with diameter between 0.01 and $0.1\mu m$), accumulation mode (particles with diameter between 0.1 and $1\mu m$) and coarse mode (diameter particles has greater than $1\mu m$).

d) Single scattering albedo (SSA) which takes values between 0 and 1 (1 is for scattering and 0 for a perfect absorber).

e) Ångström turbidity coefficient (β) with values from 0 (clear atmosphere) to 0.5 (high aerosol load). Value 0.2 is for polluted atmosphere.

In fig. 2, after 10 AM GMT, the AOD values are increasing during the day. The coarse particles of aerosols are usually characterized by: - a single scattering albedo increasing with wavelength, SSA for 440 nm at 14:46 pm is 0.95 and the values increase with the wavelength; - small values of the Ångström exponent (13 o'clock α is lower than 0.6); - high values of AOD at 440 nm wavelength (daily average is 0.166); - a coarse mode size distribution (the presence of dust).

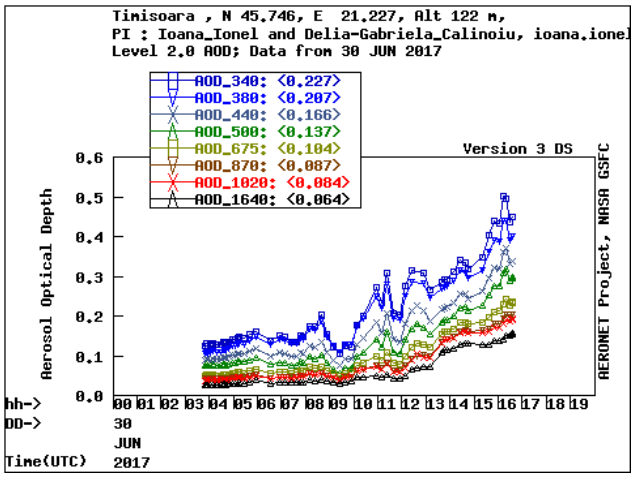

Fig. 2. Aerosol Optical Depth in Timisoara, 30.06.2017 [6]

In Fig. 3 shows the variation of the Ångström exponent during the day, but also the sudden decrease after afternoon, the value reaching 1.

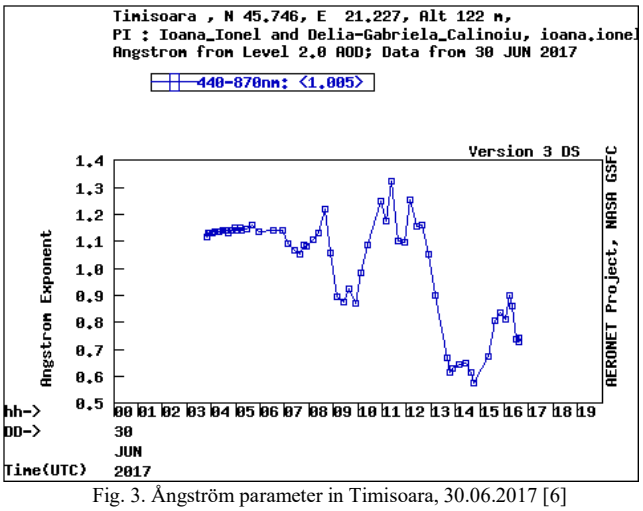

Fig. 3. Ångström parameter in Timisoara, 30.06.2017 [6]

Looking at the aerosol size distribution (Fig. 4) we find an almost bimodal distribution of primarily coarse particulate matter, with diameters between 1 and 10 µm, mixed with finer aerosols. At 15:21 o'clock, the volume concentration of the coarse aerosols is high and the predominant are both the accumulation and coarse mode, that means in the atmosphere is present a mixt aerosol.

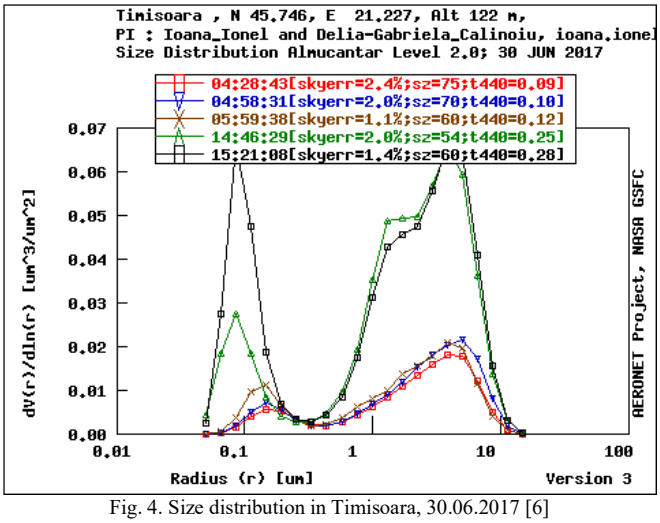

Fig. 4. Size distribution in Timisoara, 30.06.2017 [6]

For a good interpretation of the aerosol type, HYSPLIT model [11], NAAPS Model [12] and Global Fire Maps from MODIS are used [8].

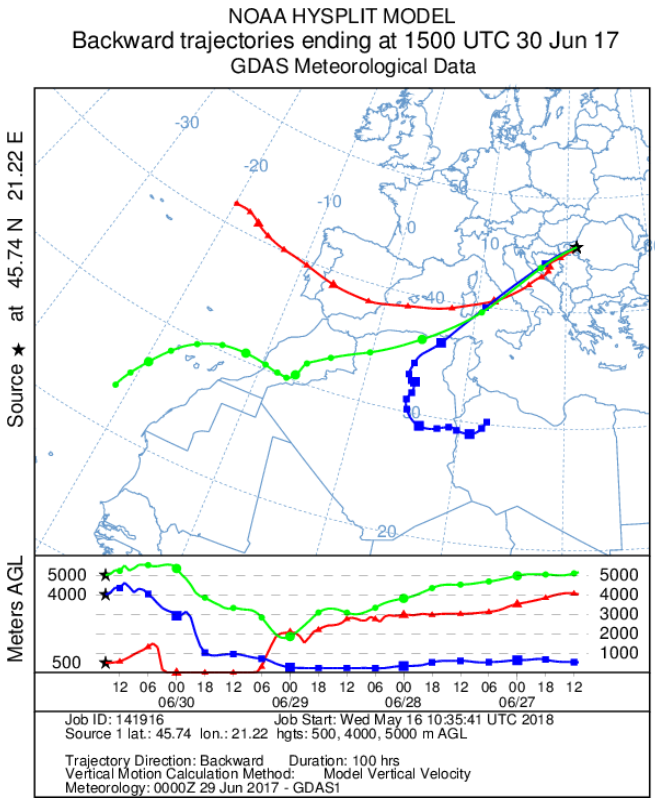

Fig.5. NOOA HYSPLIT model for 30.06.2017 [11]

The origin of the air masses transporting the aerosol was investigated by running HYSPLIT model. The air masses backward trajectories were found to be oriented from northern Africa towards the South of Europe (Fig. 5). They enter in Romania through the west and southwest.

In satellite image taken from MODIS, centered on Timisoara (blue circle), the biomass fires are represented by red dots (Fig. 6). Biomass fires are outside the country in the west and southwest. The air masses trajectories from HYSPLIT model pass over the biomass fire.

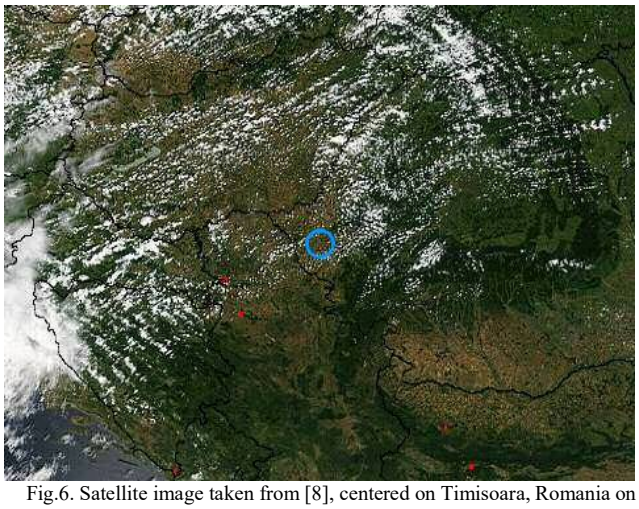

Fig.6. Satellite image taken from [8], centered on Timisoara, Romania on 30.06.2017, hour 09:58 GMT. The red dots represent the locations of ongoing wildfires.

In Fig. 7, from the NAAPS model results the intrusion of desert dust (top left image) with concertation in the range 20 and 40 $\mu g/m^3$ (bottom left image). Also, in Romania, in June 30, sulfate is present with surface concentration between 2 and 4 $\mu g/m^3$ (top right image).

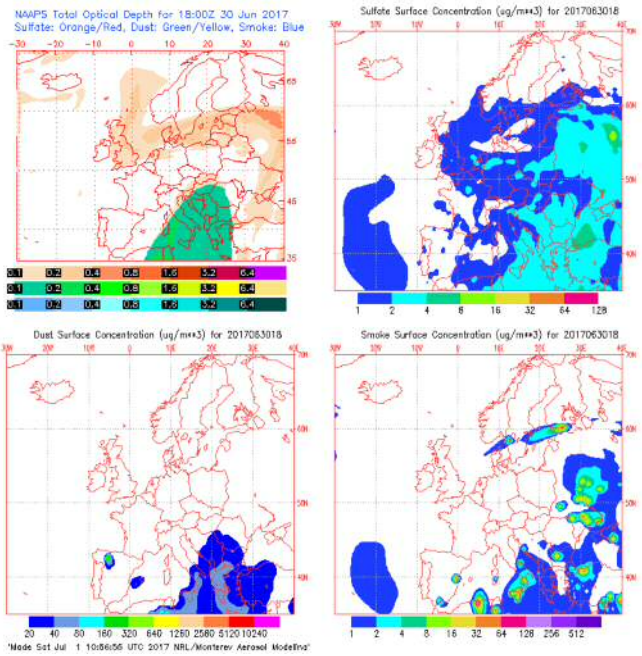

Fig. 7. NAAPS Model for 30.06.2017 [12]

As expected, in the pollution episode with aerosol, the amount of energy from photovoltaic plants is lower compared to other days of the same period when the aerosol is not present (Fig. 8).

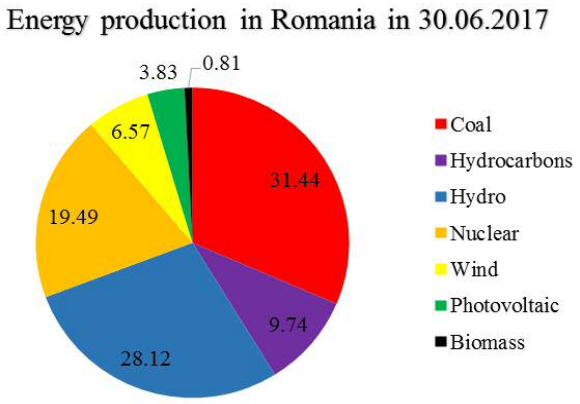

Fig. 8. Energy production in Romania in 30 June 2017 (3.83 % is PV) [10]

The variation of the PV energy production is presented in Fig. 9 for period June 24 and 30. Also, in 27 and 29 the values for PV power capacity are smaller comparted to 28. In 29 the atmosphere is loaded with desert dust from Northern Africa, and in 27 fine aerosols are present in the atmosphere from biomass fires outside the border.

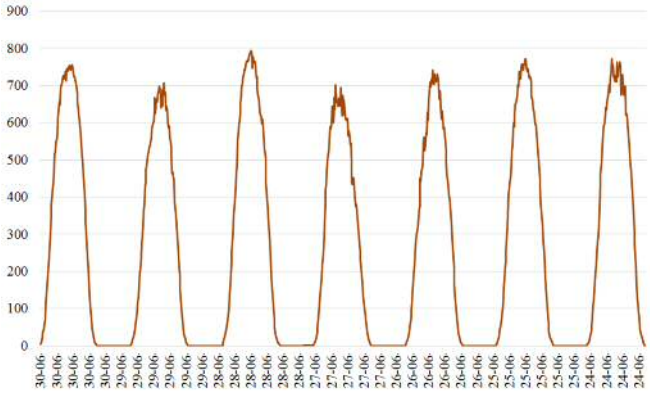

Fig. 9. PV power capacity, in MW, in period 24-30.06.2017 [10]

In this study, the June 30 was chosen because of complete and continuous all day measurements.

CONCLUSION

From the analysis of the all aerosol parameters (such as: aerosol optical depth, size distribution, Angstrom exponent, single scattering albedo), concluded that the atmosphere is loaded with dust originating from Sahara and small amount from biomass fire for selected day.

In this case the amount of solar radiation reaching the surface of PV panels is smaller, and thus the efficiency is lower (~31 % lower energy production from PV).

ACKNOWLEDGMENT

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Aspects Regarding Industrial Platform Timişoara Solvent

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**corresponding author*

Abstract: The research took place in February 2018. It is noted that there are no facilities on the site as defined in HG no. 804/2007. The Solventu industrial platform is currently full, loaded with debris, construction waste, vegetable wastes, household waste, rubber wastes, glass wastes, waste from the septic tank et.a. We have identifie 1. soil misalignments resulting from chaotic excavations on site in search of underground facilities. From the histori 2. building, (1868) there is a single wall in brick waste, th 3. broken tile, and so on. There are damp areas c 4. precipitation water accumulated between building debris, where aquatic ecosystems develop with aquatic biocenosis (aquatic vegetation, frog silk, frogs, etc.); As far as hazardous substances are concerned, they do not exist in the installations, as the installations no longer exist being demolished and dismantled. But on the platform, on the ground, on the ground, some areas could be observed where there was glass wool resulted from the dismantling of the pipelines, installations, and on the location of the store were identified large degraded bags filled with something "silica". Then, at the former plasticizing stations, oil films, hydrocarbons floating over meteoric water accumulated over time could be observed. Approximately 70 % of the platform's surface is predominantly invasive vegetation - shrubs, but also nuts, various trees and perennial vegetation. It is recommended to remove, remove the debris, concrete bodies, etc. and ecological rehabilitation of the area.

Keywords: environmental pollution, historic building, construction waste, ecological rehabilitation

I. INTRODUCTION

The Solventu industrial platform is located in the north-west of the city of Timisoara, between the railway and the river Bega. The former "Solvent Petrochemical Combined" has been certified since 1868 as an alcohol factory. In 1976, the Timisoara Petrochemicals Complex and the Solvent Chemical Complex merged and formed the Solvent Petrochemicals Complex for the PJP and OXO installations. In 1968, Solvent merged with the Margina Factory (where esters, acetic acid, etc.) were produced. The crate consists of four lots (Figure no.1):

1. The main platform-392000 m^2
2. Waste water treatment plant - 46400 m^2 containing:
   - Rainwater pumping station - 2400 m^2 and
   - Water catchment plant - 713 m^2. [3]

II. RESEARCHES, RESULTS AND DISCUSSIONS

A ground water bed analysis is needed to obtain sufficient information on the possible remediation of groundwater. Inventory and disposal of waste on site, including waste water from the wastewater treatment plant and tanks.

The data provided by *Report technical expertise*, Timis Court, March 2018 and by the Environmental Protection Agency Timis and the auxiliary documents used have led to [3]:

- inventory - fixed assets-buildings SC Valkiria Invest SRL, working place Timisoara, 31.12.2010;
- minutes of 25.11.2011, between SC Valkiria Invest SRL working place Timişoara - S.C. Inter Industries Managemant SRL Constanta teaching to receive the buildings to be demolished, respecting the legality in demolition;
- minutes from 25.11.2011, between SC Valkiria Invest SRL working place Timişoara - S.C. Inter Industries Managemant SRL Constanta teaching to receive the buildings to be demolished, respecting the legality in demolition;
- table from May 10, 2011, with the buildings taught by SC Valkiria Invest SRL, working point Timisoara towards demolition to S.C. Inter Industries Managemant SRL;
- address no. 48198 / 08.04.2011 ISU Banat to APM Timis;
- notification No. 3082 / 28.02.2011 SC Valkiria Invest SRL, working place Timişoara to APM Timiş, GNMC Timiş, ISU Banat, S.C. INTER INDUSTRIES MANAGEMANT SRL Constanta;
- notification 1124 / 24.09.2008 S.C. Inter Industries Managemant SRL Constanta announces the transfer of responsibilities to SC SETCAR SA Braila;

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Fig. 1. Solventu Industrial Platform-1968, [3]

- address no. 3167 / 06.06.2011 SC Valkiria Invest SRL, working place Timisoara to Risk Secretariat, APM Timiş, GNMC Timiş, ISU Banat

- notice of observation National Environmental Guard no. RUC 26 /24.05.2011 10. Address S.C. Intercom Perst SRL no. 7 / 20.06.2008.

- drawings of sewerage networks and pipelines, installations, pipelines, buildings, structures, etc.

- general layout - Timişoara Solvent (41 ha) and description of each area [3]:

A. Chemical Section - Ethyl Alcohol, Lactic Acid, Carbonate, CTC Laboratory, Plasticizers I,
B. Chemical Plasticizing Section II.
C. Chemical Plasticizer Section III.
D. Chemical Plasticizing Section IV.
E. Chemical Section V.
F. Plasticizers Synthetic oil plant,
G. Phthalic anhydride plant,
H. Water-oxygen section,
I. Low pressure polyethylene section,
J. OXO alcohol department,
K. Energy, mechanical, automation,
L. Thermal sector,
M. Sector hydro,
N. Transport sector,
O. Deposit sector,
P. Sector CTC,
R. Administrative sector,
S1. Water catchment area water,
S2. District hydro-station of meteoric waters,
T. Hydro-treatment plant sector,
U. Parc old fuel oil tanks,
V. Magazine synthetic oils,
Z. Other areas.

- outline of the General Layout - The Timisoara Solvent Main Platform (39.2 ha) together with the table centralizing the buildings;

- general layout - Waste water treatment plant platform Timişoara Solvent (4,6 ha) (Underground pipelines - zone 1, zone 2, zone 3, zone 4, zone 5 - sewage treatment plant, pipeline network underground - water station and water pumping station);

- drawings on underground and overground infrastructure (iron cables, pipes, etc.);

- drawings / plans for dismantling all facilities, including all attachments and all connections, removal of connecting pipes, cables and other connections, etc. demolition of buildings, structures. Drawings for all works during the execution of the works.

- technical projects for the dismantling of installations, for demolition works and for the disposal of hazardous waste and wastes.

- diagram of papers reflecting the Work Program and main activities. Planning / detailed worksheet. Monthly progress reports on work progress.

- schedule / work program approved with a brief description of the main activities, specifying the order of procedures and the deadline for completion of the Works.

- full Health and Safety Plan for Works.

- full Health and Safety Plan for Works.

- action Plan on Safety Management in the event of incidents and accidents.

- authorizations, approvals and licenses required for the execution of the Works.

- inventory / Register of Waste and Hazardous Substances of 26.11.2008 and 10.03.2016 respectively

- analysis of the transport of the contents of tanks and containers, the transport of dismantled materials and residues from demolition to destinations.

- proof of disposal of substances (reception report signed with the specialized company specifying the type of substances delivered, quantity, date and means of transport used).

- water analysis bulletins from groundwater.

- pictures during the dismantling, demolition, removal and disposal of hazardous substances, waste, etc. to the former Solvent, Str. Garii, no. 25, Timisoara, Timis county.

- service contract - Greening and Disposal of Hazardous Wastes, no. E-001 / 22.09.2008 S.C. Intercom Perst S.R.L. (at present SC INTER Industries Management S.R.L. Constanta) and S.C. SETCAR S.A. Braila.

- the technical project for the removal of hazardous wastes and wastes from the former Timişoara Solvent, Str. Garii, no. 25, Timisoara, Timis county.
- the authorizations, approvals and licenses required for the execution of the Works for the taking / disposal of dangerous substances, respectively of the waste.
- inventory / Register of Wastes and Dangerous Substances from the former Solvent Timisoara, Str. Garii, no. 25, Timisoara, Timis county.
- analysis of the transport of the contents of tanks and containers, transport of dismantled materials and residues from demolition to destinations.
- proof of disposal of substances (reception report signed with the specialized company specifying the type of substances delivered, the quantity, date and means of transport used). [3]

III. IN SUMMARY, ON THE FORMER SOLVENTU TIMISOARA INDUSTRIAL PLATFORM

In summary, on the former Solventu Timisoara industrial platform, there are no installations as defined in HG No. 804/2007, respectively dangerous substances in the respective installations [1], [2]. But in February 2018, we have identified [3]:

Construction waste (Figure no. 2);

Fig. 2. Construction waste [3]

Vegetable waste (Figure no. 3);

Fig. 3. Vegetable waste [3]

Household waste;
Rubber wastes;
Framed glass fragments;
Wastes with / from chemical substances, (quantitative hundreds of kilograms in many degraded bags); ✓
Wetlands with precipitation water accumulated between the buildings' debris, where aquatic ecosystems with aquatic biocenosis (aquatic vegetation, frog silk, frogs, etc.) develop; (Figure no. ✓
Wastes from the treatment plant, sewage sludge; [4] ✓
Deposits from septic tanks;

Fig. 4. Precipitation water accumulated [3]

Concrete blocks, concrete structures;
Concrete;
Caramel, bolts, broken tile from demolitions;
- Rubber / plastic sleeves made of cables;
- Building administrative building in paragliding;
- Concrete blocks with concrete;
- Blasts, wetlands with meteoric water; (Figure no. 5

Fig. 5. Blasts, wetlands with meteoric water [3]

- Land degradation resulting from chaotic excavations on site in search of underground facilities;
- Heads from broken pipes;
- Piles, debris mountains from demolitions - building materials, related wastes; ✓
- Oils, hydrocarbons floating in a significant layer of meteoric water accumulated; (Figure no. 6) at the four former plasticizing stations ✓

Fig. 6. Oils, hydrocarbons floating in a significant layer of meteoric water accumulated [3]

- Land with pronounced bumps;
- Artificial snow on the ground and floating on water mirrors;
- Crushed slabs of asbestos;
- Soil mixed with building debris, asbestos;
- A wall of the former historic building from 1868;

- ✓ - Areas with concrete platforms, concrete vents, concrete roads;
- ✓ - concrete slabs with concrete;
- ✓ - Concrete blocks (cca. - thousands of tons);
- ✓ - Mixture of pitch, pitch of insulation from the upper platforms of buildings;
- ✓ - Glass wool;

- Traces of fuel oil, at the corresponding tanks, practically below the zero level of the land;
- Rubber sleeves;
- Rubber straps;
- but also flora and fauna: invasive vegetation, perennial vegetation, walnut specimens, witch-willow, more shrubs, predominantly marsh and mace, was seen a rabbit, a pheasant.

Fig. 7. Solventu Industrial Platform, 2018 [3]

IV. CONCLUSION

Behold, in 2018 after Christ and the year of the Centenary for our beautiful Romania, we want, we do not want, whether we want it or not, we face a negative pressure on the environment, unprecedented climate changes and unfavorable effects on the human factor on this wonderful being - man. Nowadays, the renowned Father Arsenie Boca, the Holy Transylvanian, said: "Maybe we do not pull ourselves out of the monkey, but we are moving fast towards that." Why did he say this word?! if not ... we humans, by our actions we get below the level of the beasts.

Vertical and horizontal cylindrical screeds, storage facilities, decanter basins and sewerage network are decommissioned and demolished.

The facilities are decommissioned and demolished.

SC Valkiria Invest SRL - working place Timisoara did not elaborate and did not make available to the Risk Service of APM Timiş, a document that complies with the principles set out in Annex no. 3 of HG no. 804/2007.

We believe that procedural flaws have also arisen from the confusion created by the sale-purchase of facilities, buildings, infrastructure to SC Inter Industries Management S.R.L. Constanţa (former S.C. Intercom Perst S.R.L.), respectively hazardous substances, and waste to S.C. SETCAR S.A. Braila.

On the Valkiria land, located at the address no. 25, Timişoara, Timiş County, there are no other facilities, as they are defined in HG no. 804/2007.

There are no more hazardous substances in installations on the Valkiria field, located at the address of Garii str., No. 25, Timişoara, Timiş County, because there are no facilities, as they are defined in HG no. 804/2007.

In the field, through expertise in the field of ecology and environmental protection, it was found that SC Inter Industries Management S.R.L. Constanţa (formerly S.C. Intercom Perst S.R.L.) and S.C. SETCAR S.A. Brăila did not fully fulfill the assumed responsibilities for the industrial platform - the former Solventu, SC Valkiria Invest SRL, working place Timişoara Gării Street.

It is advisable, as a matter of urgency, to dispose of the site in question and the whole area (approximately 44 ha) to be ecologized in accordance with the legislation in force.

I believe that all of this must be studied and applied to save as much as we can from our habitat before we overcome the "monkey" through our overnight enrichment, excess food, and clothing, luxury that led and led to waste over waste in the environment or exploitation over exploitation and poor poverty over our seed!

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Use of different sources of phosphorus in agriculture

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Abstract: At present, the major source of phosphorus used in fertilizers is phosphate, which we use in large quantities, more than can be replaced by the very slow geological cycle and nearly all phosphate fertilizers are manufactured from naturally occurring phosphorus containing minerals. The actual use of phosphorus is inefficient in several stages of the life cycle, causing water pollution and the wasting of a wide range of associated resources. It was estimated that only 15% to 20% of P in fertilizer is actually taken up by crops because fertilizers are applied far in excess of plant demand and dynamics of phosphate in soil. In Romania, the largest quantities of fertilizers used are those based on nitrogen (nitrogenous) and those based on phosphorus (phosphate) represent only 28% of total nitrogenous, phosphates and potash fertilizers. This is due to a low supply of phosphorus-containing fertilizers and high marketing prices. In the scientific environment there are researches for finding non-polluting alternative sources to satisfy the need for phosphorus in plants and soil. Hydroxyapatite (HA) has multiple uses in agriculture, being used as a source of phosphorus, to obtain slow-release fertilizers as well as for removing and / or immobilizing heavy metals. The use of synthesis hydroxyapatite offers the advantage of using a source free of elements can lead to soil, water and plant pollution. Therefore, in recent years extensive research has been achieved for obtaining and characterization of nano-hydroxyapatite complex subsequently processed by the various processes of addition / substitution with various cations or molecules. The products thus obtained have found their usefulness in various fields such as medicine, industry, environmental remediation. Thus, agriculture benefits from the results of top research that can be adapted to improve soil fertility and increase agricultural yield.

Keywords: fertilizers, phosphorite, hydroxyapatite, phosphorus fertilizers.

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I.INTRODUCTION

As the population grows and meat consumption intensifies, demand for phosphorus fertilizers is expected to increase over the medium and long term. [1]. At the present time, nearly all phosphate fertilizers are manufactured from naturally occurring phosphorus containing minerals. Some natural phosphorus sources represented by Bone meal, guano are found in very small quantities and are preferred for using in organic farming [2], [3]. The major source of phosphorus used in fertilizer is phosphate rock, which we mine in vast quantities, more than can be replaced by the slow geological cycle [4].

In a report about mineral commodity it is estimated that World mine production capacity for phosphate rock production, (excluding China), was projected to increase to 168 million tons in 2021 from 147 million tons in 2017, according to industry analysts [5]. Some data suggest that phosphate rock has the potential to represent a source for rare earth elements, particularly heavy used in high-tech industries [6] and shows excellent ion-exchange properties for zinc [7], silver [8], lead [9].

Furthermore, from a scientific point of view, the reactive surface functional groups on the HA NPs offer rich opportunities for surface modification through immobilization of strategic chemicals for creation of nanohybrids with multifunctional properties [10].

On average, about 2.0 kg P were removed from soil per ton of crop production each year between 1961 and 2013, showing a linear correlation between global P demands and crop production [11].

For the efficient use of phosphorus-containing fertilizers, the following aspects should be considered [12]:

- fertilizer selection to optimize the bioavailability of phosphorus;
- fertilizer use to maximize plant root's opportunity to take up the phosphorus;
- crop selection to maximize plants ability to access more soil phosphorus or yield more crop per phosphorus accessed;
- soil management to (a) ensure soil phosphorus is in

solution and hence readily available to plant roots when they need it and (b) to minimize permanent loss of soil phosphorus via wind and water erosion.

The amount of phosphorus released is higher as the amount of decomposed organic matter is greater. Organic phosphorus is found in humus, mostly and in organic matter not decomposed or decomposing. Various products resulting from the activity of soil microorganisms contain a certain amount of organic phosphorus. Humus contains between 0.17 and 1.09% P, depending on the soil type [13].

Application of phosphorus fertilizers to acidic soils (pH <4.5) or alkaline (pH> 8) results in the passage of soluble phosphates into insoluble forms, a process known as phosphorus immobilization. On acidic soils, aluminum or iron phosphates are forming, and on alkaline soils, superior calcium phosphates are forming, they are insoluble compounds hardly accessible to plants. Generally, insoluble phosphorus fertilizers (phosphorites, bone meal) or lightly mobilized forms (Thomas slag, activated phosphorite) are applied to acidic and weak acid soils and soluble phosphorus is applied to neutral and alkaline soils (simple superphosphate, triple superphosphate, ammonium phosphates) [14].

An assessment of the agricultural production system is needed for more efficient use of phosphorus resources to increase the efficiency of its use and to reduce the effects of pollution [15]. One of the necessary measures, for the efficient use of phosphorus in agriculture, is the evaluation of the amount of phosphorus from the soil available to the plants, and the dosing of phosphorus fertilizers according to the needs of each plant [16], [17], [18], [19].

In Romania, according to the National Rural Development Program for the period 2014 - 2020, as a result of agricultural practices for the use of agro-chemical inputs, between 2005-2008 a surplus in the nitrogen balance (as a diffuse source of pollution) of 6.8 kg / ha was recorded, while phosphorus in the soil was deficient 1.3 kg / ha reaching this deficit in 2013 by 2 kg / ha.

Therefore, in the Midterm Agro Food Development Strategy for 2020-2030, one of the specific measures for agricultural soils, aims to restore the phosphorus reserve, and farmers are encouraged to adopt innovative methods and practices, that can improve soil fertility and yields.

II.MATERIAL AND METHODS

According to the Regulation (EC) No 2003/2003 relating to fertilizers, the main types of fertilizers based on phosphorus that can be used in agriculture, are:

- Basic slag: Thomas phosphates and Thomas slag; product obtained in iron-smelting by treatment of the phosphorus melts and containing calcium silicophosphates as its essential ingredients (12 % P_2O_5)
- Single superphosphate; product obtained by reaction of ground mineral phosphate with sulphuric acid and containing monocalcium phosphate as an essential ingredient as well as calcium sulphate (16 % P_2O_5)
- Concentrated superphosphate; Product obtained by reaction of ground mineral phosphate with sulphuric acid and phosphoric acid and containing monocalcium phosphate as an essential ingredient as well as calcium sulphate (25 % P_2O_5)
- Triple superphosphate; product obtained by reaction of ground mineral phosphate with phosphoric acid and containing monocalcium phosphate as its essential ingredient (38 % P_2O_5)
- Partially solubilised rock phosphate; product obtained by partial solubilisation of ground rock phosphate with sulphuric acid or phosphoric acid and containing as essential ingredients monocalcium phosphate, tricalcium phosphate and calcium sulphate (20 % P_2O_5)
- Soft ground rock phosphate; product obtained by grinding soft mineral phosphates and containing tricalcium phosphate and calcium carbonate as essential ingredients (25 % P_2O_5)

Hydroxyapatite (HA) is a inorganic component of the animal endo- and exo-skeletons, and have the stoichiometric formula $Ca_{10}(PO_4)_6(OH)_2$ for a Ca/P molar ratio of 1.67 [20], [21].

III.RESULTS AND DISCUSSIONS

For the evaluation of the agrochemical efficiency of the synthesis hydroxyapatite, an experiment was conducted in vegetation vessels using three phosphorus-based fertilizers with high phosphorus content,

Phosphorus fertilizers and hydroxyapatite were applied by incorporation into the soil prior to planting. Synthesis Hydroxyapatite was tested compared to phosphorus fertilizers Superphosphate, Triple superphosphate, and Activated Phosphate Rock. Fertilizers were characterized for total phosphorus content and soluble phosphorus in neutral ammonium citrate using standardized methods and the obtained results are shown in Table 1.

Table I. The content of total phosphorus and soluble phosphorus in neutral ammonium citrate from the used fertilizers

No.	Variants of fertilization	P_2O_5 total (%)	P_2O_5 soluble phosphorus in neutral ammonium citrate (%)
1	Superphosphate	20,68	18,71
2	Triple superphosphate	48,52	46,03
3	Activated Phosphate Rock	30,79	22,53
4	Hydroxyapatite	38,34	7,61

The content of total phosphorus and soluble phosphorus in

neutral ammonium citrate from the used fertilizers in agrochemical experiments carried out in vegetation vessels, is shown in the Table I.

From the obtained analysis, HA contains the lowest amount of phosphorus soluble in neutral ammonium citrate (7.61%), although it has a higher phosphorus content than the activated phosphate and superphosphate.

The experiments were organized in the laboratory in vegetation vessels in 4 rehearsals for each fertilized variant and for the non-fertilized control. The soil used was stagnant albumin luvosol, pH 5.28, 24.8% clay and 1.71% organic matter, using Lolium perenne.

The amount of fertilizer used for each fertilized variant was equivalent to 80 mg of total P_2O_5 applied to each pot of vegetation. After 35 days, harvesting and weighing of the plants was performed, and the average for four determinations, obtained for each variant is shown in Table II.

Table II. Matter content for variants of fertilization

No.	Variants of fertilization	Average (g/vessel)	Yield (%)	Difference (g/vessel)	Meaning
1	Non fertilized control	0,90	100,00	-	-
2	Superphosphate	1,31	145,15	0,41	***
3	Triple superphosphate	1,44	159,28	0,54	***
4	Activated Phosphate Rock	1,17	129,36	0,27	***
5	Hydroxyapatite	0,97	107,76	0,07	*

DL 5% = 0.11 g/vessel, DL 1% = 0.08 g/vessel, DL 0.1% = 0.05 g/vessel

The effects of the treatments were studied by analysis of variance (Fischer method) and Fisher's Least Signiant Difference (LSD) test. All data are relative values as compared with the control (treated only with water) considered equal 100%.

The results were considered significant and were noted for the following circumstances: *significant ($0.01<p\leq0.05$), **very significant ($0.001<p\leq0.01$), ***highly significant ($p\leq0.001$).

It is noted that although HA application, has led to a significantly higher production, than the non-fertilized control, this production is significantly lower than any of the three phosphorus-based fertilizers. The phosphate activated rock, although having a superior content of phosphorus soluble in neutral ammonium citrate compared to superphosphate, has led to a significantly lower production increase. This can be explained by the availability in a shorter amount of phosphate

ions needed for the nutrition of plants in the structure of the superphosphate.

The highest increase rate was obtained from the fertilized variant with Triple superphosphate; this product contains the highest total phosphorus quantum (48.52%) and the highest amount of phosphorus soluble in neutral ammonium citrate (46.03%).

Due to a relatively low solubility compared to other phosphorus sources, HA can also be used as a fertilizer with controlled release along with products who have high solubility, to avoid solubilization and leaching of the nutrient components. Phosphorus is absorbed by the plants only in the form of orthophosphoric acid, the most accessible for plants being monophosphate, which is also the most common in soil. In soil, the amount of soluble (mobile) phosphorus is 2-8 mg P_2O_5 /100g soil and as it forms is absorbed by the plants. [22], [23].

IV. Conclusion

Hydroxyapatite nanoparticles have been proposed as a novel phosphorus (P) fertilizer that could potentially provide increased efficiency through controlled release which depends on the pH value of the soil.

For the correct assessment of the effect of HA on the production and amount of phosphorus in the soil, experiments should be organized on different soil types for both autumn and spring culture for a longer period to evaluate its remanent effect.

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Heat Transfer by Conductivity and Climate Changes in Norrbotten, Sweden

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Abstract: The changing climate of our planet is more and more remarkable. Scientists have projected temperature increases taking into account many scenarios, but the fact is, that we do not know exactly what is happening. The present paper refers mainly to the study of the soil temperature evolution in Abisko National Park, in the context of subarctic climate changes. These processes are occurring more intensive on high latitudes and can influence directly the adjacent regions. The researches have implied the usage and processing of data which were monitored in Abisko Research Station since 1982, and also the 'on-land' explorations, in order to find new answers for the global climate modifications. Using the conductive heat transfer theory, the geological and physical properties of the soil in the article there are established some relations between the evolution of the soil temperature at the surface and at different depth and the evolution of the air temperature. After visits and expeditions in the subarctic area Norrbotten, Sweden, at Abisko Research Station, between 2006 and 2016, there were obtained more than 540,240 data about the air temperature, air humidity, wind speed and direction, solar radiation, soil temperature. The future objective of the researches is to establish a model for the heat transfer in the soil and for the heat exchanges between the soil and the atmosphere. The conclusion of the article is only the beginning for new researches regarding aspects of the heat transfer in the subarctic area in the complex system soil – atmosphere.

Keywords: CCh&RA, climate changes, model, north.

I. Introduction. Location and sample collection

Abisko Natural Reservation is situated in Kiruna Municipality, at 220km in North of the Arctic Circle (figure 1). Despite its remoteness from most of the world's population, its name is known around the world and visitors which like to study the north come every year to enjoy for a preferred period this area [1]. Using the conductive heat transfer theory and the geological and physical properties of the soil, there are established some relations between the evolution of the soil temperature at the surface and at different depth and the evolution of the air temperature [2]. Therefore, soil samples and rocks from the shore of the Tornetrask Lake, Trollsjo Lake and the geological reservation, were collected and analyzed. We have used data from Abisko Research Station, for the monitoring of soil temperature starting with 1982, on different depth. The main soil types from the area are the frozen soils, especially the permafrost [3].

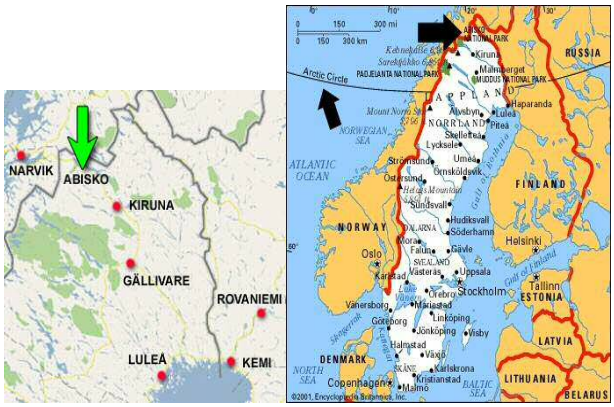

Fig.1: The localization of the Abisko National Park and Abisko Research Station in Norrbotten, Scandinavia

In the figure 2 are presented some points for the soil and water analysis in the area of Abisko Natural Reservation.

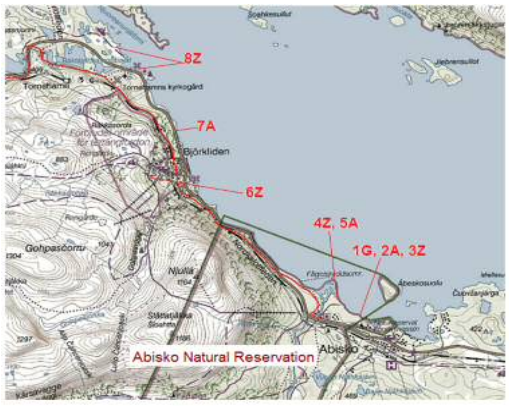

Fig.2: Some points of the soil samples collection in the ANR area (June 2016)

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II.A POSSIBLE MODEL OF HEAT TRANSFER

Many facets of the climate system are not well understood, and thus the uncertainties in modeling atmospheric, cryospheric, and oceanic interactions are large [2]. In evaluating the differences among models, attention must be focused on atmospheric processes, because these uncertainties must be understood before others can be addressed. On the other hand, there are not too many models to take in consideration the interaction between the earth and the atmosphere.

In order to analyze the heat transfer in soil, the following cases can be considered:

- supposing there is an inhomogeneous plan system, composed of three uniform layers with thickness of δ_1, δ_2 ,δ_3, and constant thermal conductivity λ_1, λ_2 ,λ_3. An inhomogeneous solid plan is a system with composite structures, represented in several layers, with or without perfect contact between them [4]. Each layer is considered to be homogeneous. Heat propagation will be considered unidirectional or will be approximated with a one-way process (figure 3). Thermal contact between layers is imperfect. In the same time, having in view the particularities of the soils, we have to consider the thermal instability in nature and the magnetohydrodynamic aspects [5].

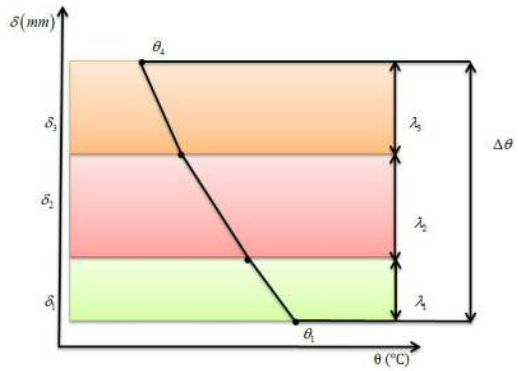


Fig.3: Temperature variation through solid inhomogeneous structures

The conduction equation is:

$$q = \frac{\theta_1 - \theta_4}{\frac{\delta_1}{\lambda_1} + r_{C1} + \frac{\delta_2}{\lambda_2} + r_{C2} + \frac{\delta_3}{\lambda_3}} \quad (1)$$

If the surface temperature of the soil is higher than the air temperature (fig. 4), then we have the equations:

$$\Delta\theta_{S1} = \theta_1 - \theta_2 = q \cdot r_{S1} = q\frac{\delta_1}{\lambda_1} \quad (2)$$

$$\Delta\theta_{C1} = \theta_2 - \theta_2' = q \cdot r_{C1} = q\frac{1}{\chi_1} \quad (3)$$

$$\Delta\theta_{S2} = \theta_2' - \theta_3 = q \cdot r_{S2} = q\frac{\delta_2}{\lambda_2} \quad (4)$$

$$\Delta\theta_{C2} = \theta_3 - \theta_3' = q \cdot r_{C2} = q\frac{1}{\chi_2} \quad (5)$$

$$\Delta\theta_{S3} = \theta_3' - \theta_4 = q \cdot r_{S3} = q\frac{\delta_3}{\lambda_3} \quad (6)$$

$$\Delta\theta_{S-a} = \theta_4 - \theta_a = q \cdot \alpha_1 \quad (7)$$

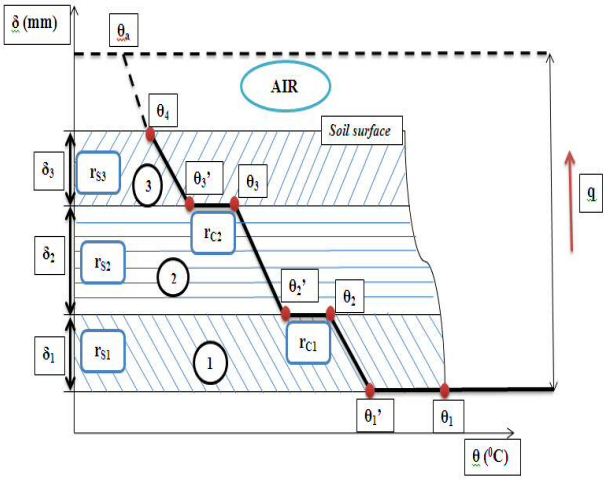


Fig.4: Temperature variation thermal resistances of the earth layers in the case when the air temperature is higher as the surface temperature of the soil

r_{S1}, r_{S2}, r_{S3} – thermal resistance in the layers;

r_{C1}, r_{C3} – contact thermal resistance;

– thermal contact conductance $\chi = \frac{1}{r}$

- coefficient of heat transfer by convection α_1

θ_a – air temperature.

In order to start an analysis of the heat transfer in the system soil-atmosphere, it is proposed for the beginning to have in view the equations proposed in [6], as follow:

According to the Fourier hypothesis, the concentration of heat flux q is proportional to the temperature gradient *grad(T)* and it is connected with it by the thermal conductivity coefficient, λ. The minus sign shows the sense of the thermal flow from the interior to the external layers.

$$q = -\lambda\, grad\ (T) \quad (8)$$

The thermal flow is given by:

$$q_{n-(n-i)} = \kappa(\theta_n - \theta_{n-i}) \quad (9)$$

κ : global coefficient of heat transfer in solid soil

In the case of a geological structure composed by 3 different layers, introducing the limit conditions, it is obtained:

$$\kappa = \frac{\lambda_2}{\delta \cdot \theta_c} \int_0^{\tau_c} e^{C\tau}\left[1 - \phi\left(\sqrt{C \cdot \tau}\right)\right] d\tau \quad (10)$$

$$C = a_3 \cdot \chi^2 \quad (11)$$

a_3 – thermal diffusivity for layer 3

τ: time, measured during the experiment or time unit

The final form of the coefficient κ:

$$(12)\kappa = \frac{b_3}{2\sqrt{\tau_C}}\left\{\frac{e^{n^2}}{n}[1-\phi(n)] - \frac{1}{n} + \frac{2}{\sqrt{\pi}}\right\}$$

Where:

$$b_3 = \frac{\lambda_3}{\sqrt{a_3}} = \sqrt{\lambda_3 \cdot c_3 \cdot \delta_3} \quad (13)$$

$$(14)\phi(n) = \frac{2}{\sqrt{\pi}} n\left(1 - \frac{n^2}{3\cdot 1!} + \frac{n^4}{5\cdot 2!} - \frac{n^6}{7\cdot 3!} + \cdots\right)$$

At the separation limit between the geological surface and the atmosphere, a part of thermal flow is absorbed by the gases. The absorption process by radiation depends on the partial pressure of CO_2 and H_2O. The absorbed thermal energy by radiation, Q_{abs}, is equal to the quantity of the energy that the geological structure could receive from gases (15):

$$Q_{abs} = \alpha_{a-s} \cdot \varepsilon_s \cdot S \cdot (\theta_a - \theta_s) \quad (15)$$

α_{a-s}: coefficient of the heat exchange from the air (atmosphere) to the geological structure surface, or from the geological surface to the atmosphere, depending on the thermal heat sense; [kJ·m^{-2}·h^{-1}·K^{-1}]

θ_S: temperature of the geological surface;

S: geological surface area, [m^2].

ε_s: coefficient of the thermal emissivity of the surface; we have to estimate here the local "albedo" value.

III. DATA CONCERNING THE GEOLOGICAL SURFACE AND THE AIR TEMPERATURE

The soil temperatures were recorded in Abisko Research Station since 1982, when the investigated deepness fluctuated between 0.2m and 1m and only later, the soil temperatures were measured for the deepness of 0.05m . The obtained data have numerous applications, as the explaining of the past distribution of the forest and permafrost and are currently used as a predicting model to the future ecosystem responses to the climate changes (Mitchell J. M., 1976).

In figure 5 are presented the temperature of the geological layers from *2014* to *2015*. The soil temperatures are fluctuating, depending of the deepness.

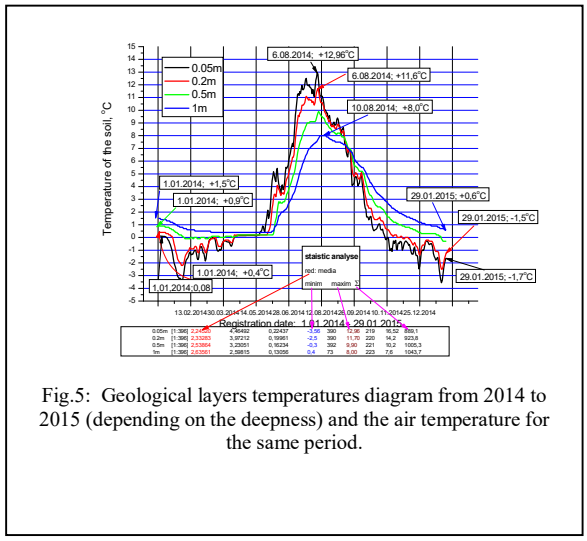


Fig.5: Geological layers temperatures diagram from 2014 to 2015 (depending on the deepness) and the air temperature for the same period.

A. *Tendencies and evaluations for the soil temperature in the period 1982 – 2015*

Having in view the yearly soil temperature evolution, it is interesting to compare its values during the entire analyzed period, taking into consideration the deepness (0.2m, 0.5m, 1m) where the temperatures were measured. The figures 6 to 8 present the geological layers temperature diagram for the period 05.01.1982 – 30.12.2012, depending on deepness.

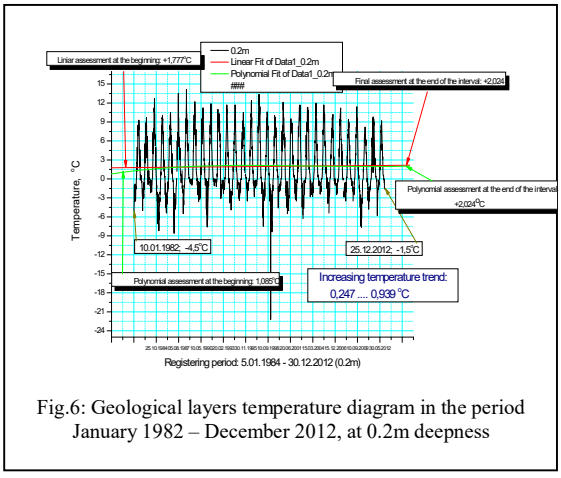
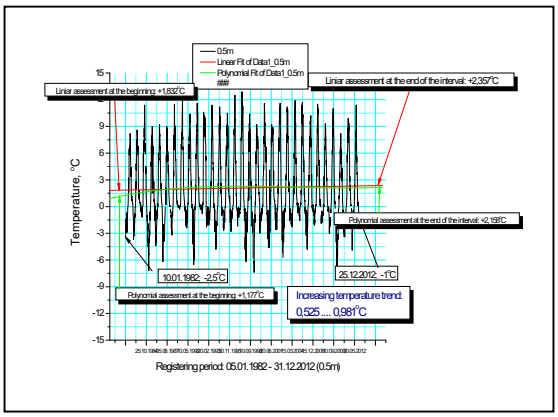


Fig.6: Geological layers temperature diagram in the period January 1982 – December 2012, at 0.2m deepness



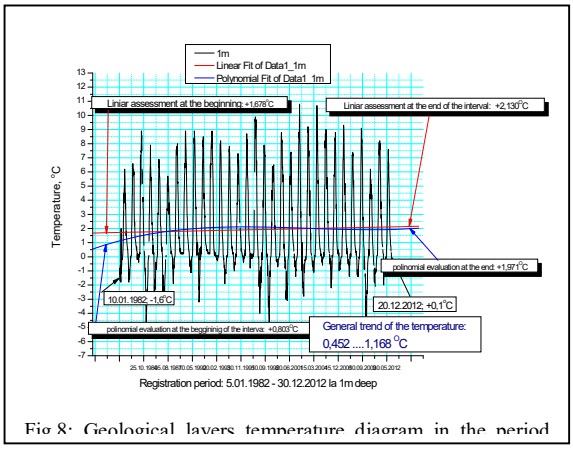


Fig.8: Geological layers temperature diagram in the period

After this interval (1982 – 2012), the temperature started to be measured to 0.05m deepness, in order to observe the fluctuations in the superficial layer and to compare them with the anterior obtained data. In figure 9, there can be observed the geological layers temperature evolution in the period 01.01.2013 – 31.01.2015, compared with the air temperatures, in the same interval.

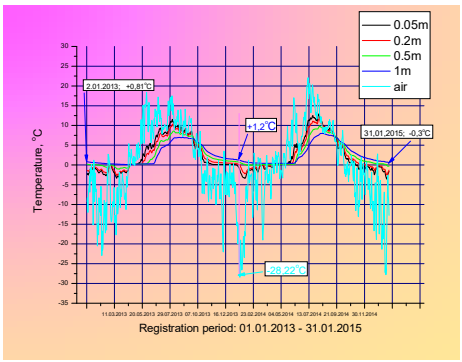


Fig.9: Geological layers and air (atmosphere) temperature diagram in the period 01.01.2013 – 31.01.2015

IV.DISCUSSIONS AND CONCLUSIONS

- The temperature fluctuations are reducing with the increase of the deepness of the geological layers;
- In 1982, the lower and higher soil temperatures were registered on the 0.2 deepness and have the values of -5.1^{0}C and +9.3^{0}C; in 2014, the lower and higher soil temperatures were registered on 0.05m and have the values of -3.3^{0}C and +12.9^{0}C;
- On superior deepness, of 0.05m or 0.2m, it can be considered that the soil temperature is influenced by the atmospheric temperature;
- On the level of 1m, we can observe that the geological layers temperatures do not depend on the atmospheric temperatures;
- Analyzing the obtained data, we can be remarked that on high deepness of the geological layers, the temperature variations are more reduced, indicating that, while the deepness is increasing, the temperature fluctuations are diminishing;
- It can be observed an increase of the temperatures since 1982;
- Sami Population is the most affected by the global warming tendency, because their main sources of activities are the reindeers. But these animals are remaining without the grazing grounds, because of the tourists (which are encouraged by the high temperatures), but also because instead of nature, they found different constructions, used for r
- With the late winters and autumn rains, the vegetation is rising more and more, disturbing the ecosystem (figure 10).

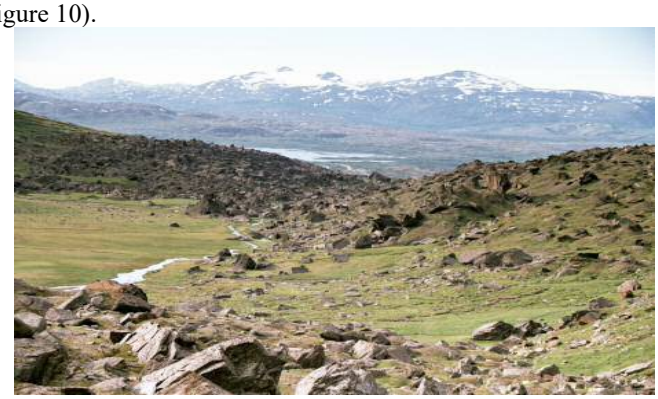


Fig. 10: Kärkevagge, in Norrboten, Abisko Reservation, (D. Constantinescu, July 2012)

ACKNOWLEDGEMENTS

We would like to show our gratitude to Magnus Augner, the Head of Department of Terrestrial research and to Annika Kristoffersson, the IT Officer, from Abisko Research Station (Sweden), for supporting our research in Northern Scandinavia, by easing our on-land and laboratory work and sharing their experience.

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Lab scale experimental investigations regarding the efficacy of using humic substances in heavy metals removal by soil washing

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*corresponding author

Abstract: In this study, humic substances originating from German Leonardite was used in an ex-situ soil washing experiment as washing agent for extraction of copper and lead from heavy metal polluted soil nearby "Larga de Sus" mine (Zlatna, Romania). Extraction experiments were performed under batch conditions by single step extraction. The results showed an important decrease in Cu and Pb concentrations in soil after 360 min of stirring at a L/S ratio of 5:1 (mL:g) and at a humic washing solution concentration of 5% indicating the great potential of this alternative washing agent to remove heavy metals from soil.

Keywords: environmental pollution, soil washing, humic substances, heavy metals.

AIMS AND BACKGROUND

Soil is the main environmental component permanently interacting with the others environmental components such as air and waters. Therefore, its contamination with heavy metals directly propagate pollution to the others environmental components [1] and thus creates large imbalances that cause harm to natural ecosystem, animals and human health [2]. Thus, there is a need to develop suitable remediation technologies for heavy metal polluted soils that doesn't cause secondary negative effects to the environment.

Soil washing is one of the few effective and relatively inexpensive technology [1] for rapid remediation of heavy metal polluted soils. But, to minimize its effect on environment the appropriate washing agent for satisfactory soil decontamination [3] must be in the same time inexpensive, effective, natural, easily available and environmentally benign [4].

In this regard, humic substances that are one of the soil constituents with well-known properties of bounding heavy metals could be considered as washing agent for removal of heavy metals from soil [3]. Even if many studies tested the efficacy of humic substances originating from various sources (compost, sewage sludge, manure, coal deposits, straw) to remove heavy metals from polluted soil by soil washing [4] [5] [6] [7], only few of them [8] [9] have been focused on testing of humic substances originating from Leonardite (naturally-oxidized lignite) to extract heavy metals through soil washing.

Therefore, the present study aims to evaluate, at laboratory scale, the possibility of using humic substances originating from German Leonardite as washing agent for the extraction of copper and lead from the heavy metal contaminated soil nearby "Larga de Sus" mine (Zlatna, Romania).

EXPERIMENTAL

A. Study area and soil sampling

The extraction experiments were performed on a soil sample that was collected from a 10-90 cm depth from a pasture located at about 800 meters downstream the "Larga de Sus" mine. This site was the main mining exploitation of the Zlatna mining perimeter located in South Apuseni mountains (Romania). Currently, the site is in an advanced state of decay [10] and till now, no remediation technology was implemented even if the mine is subject to closing and greening according to the Mining Strategy for the period 2008-2020 [11].

The initial concentrations of heavy metals from soil was determined by Atomic Absorption Spectrometry (AAS) using a SHIMADZU AA-6800 spectrometer.

B. Characterization of the humic substances

For extraction experiments, washing solutions with a concentration of 2% and 5% humic substances were prepared by dissolving of a solid humic substance sample originating from German Leonardite (commercially found as Powhumus

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WSG-85) in distilled water. Humic sample was used as received from supplier.

C. Extraction experiments

For the laboratory scale extraction experiments the soil was air dried and used in its natural state. The extraction experiments were carried at a L/S ratio of 5:1 (mL:g) under batch conditions by single step extraction in a batch reactor with continuous orbital rotation-oscillation stirring at 100 oscillations/minute. Polluted soil was added in contact with 2% and 5% humic washing solution and stirred for various time intervals (120, 240, 360, 720, 1440 and 2400 min) then samples were collected and filtered through 0.45 μm pore size filter.

The copper and lead concentration from soil after the extraction process was determined by AAS.

RESULTS AND DISCUSSION

A. Heavy metal content of soil collected from "Larga de Sus" mine

The average concentrations of heavy metals identified in soil sample nearby "Larga de Sus" mine are 633.05, 424.81, 201.76, 45.38 and 13.68 mgkg^{-1} in case of Pb, Cu, Zn, Cr and Ni, respectively. The intervention thresholds stated by

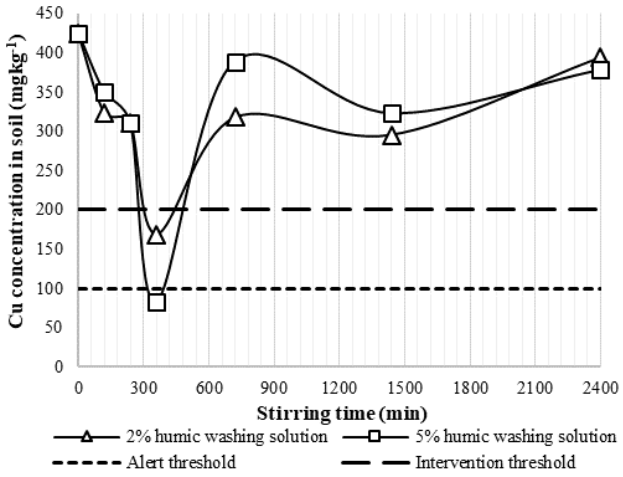

Fig. 1. The variation of Cu concentration from soil along soil stirring with 2% and 5% humic washing solution (L/S ratio of 5:1 and pH of humic washing solution of 9.6)

Romanian Legislation [12] were exceeded in case of Cu and Pb with more than 2 times. Normal values stated by the same legislation were exceeded in case of Cr and Zn.

B. Extraction of Cu and Pb from soil using humic washing solution

The variation of Cu and Pb concentration from soil along soil stirring with 2% and 5% humic washing solution is illustrated in Fig. 1 and Fig.2, respectively.

After 360 minutes of stirring, concentration of Cu from soil (83.1 mgkg^{-1}) was decreased below the alert threshold limit stated in Romanian Legislation when concentration of humic washing solution was increased from 2% to 5%. In the same experimental conditions, the intervention threshold limit was not reached in case of Pb even if its concentration was decreased more than 3 times unlike its initial value. By increasing concentration of humic washing solution, more binding sites are available for heavy metals, resulting in an increasing of heavy metals removal from soil and thus, in a higher decrease of heavy metals concentration from soil [13].

During experiments was noted that removal of Cu and Pb from soil is fast in the first 360 minutes of stirring and then gradually decrease as equilibrium is reached. This indicates the release of Cu and Pb from the water-soluble fraction and also from the adsorption sites of lower bonding energy [5]. Also, the results have shown that the removal of heavy metals from soil nearby "Larga de Sus" mine using humic washing solution follow the order: Cu > Pb.

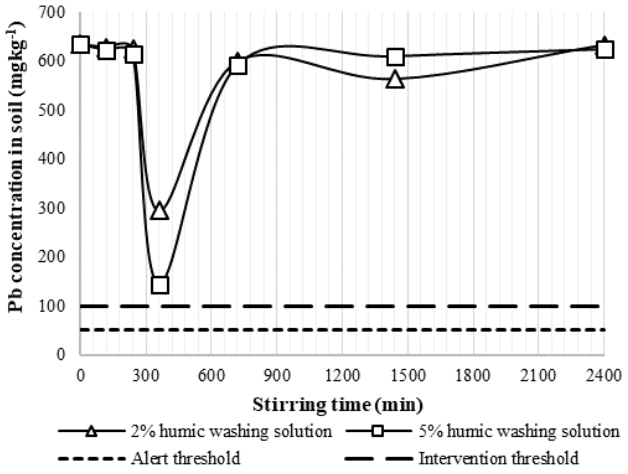

Fig. 2. The variation of Pb concentration from soil along soil stirring with 2% and 5% humic washing solution (L/S ratio of 5:1 and pH of humic washing solution of 9.6)

CONCLUSION

In spite of the fact that the results of the present study showed that humic substances originating from German Leonardite have a great potential to be used as efficient washing agent in the removal of Cu and Pb from polluted soil nearby "Larga de Sus" mine, further research regarding the optimum conditions for soil remediation are needed.

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Management of Sweet Cherry Tree Lands and Orchards in Expert Systems-Crom

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Abstract: The expert system-CROM tests a set of criteria and indicators on the basis of climate, land and infrastructure information in order to create an ecologic integrated model for fruit-trees land and orchard.

The main objective of this paper was the monitoring of the natural and artificial resources, at Păltiniş farm, in Banat region, in order to establish the restrictions and recommendations for the improvement of the land and of the sweet cherry orchards.

Keywords: sweet cherry production, land, orchard, expert system, area

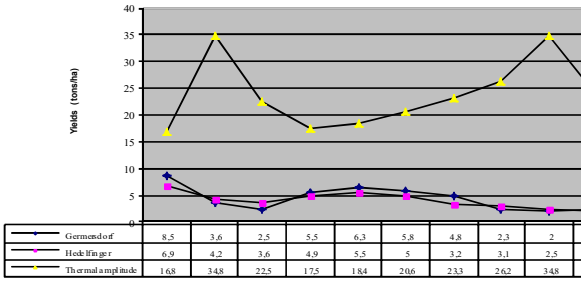

Fig. 1. The variation of the yields levels in relation to thermal amplitude (°C, XI-II months) for sweet cherry trees, Gemersdorf and Hedelfinger varieties, at the Păltiniş farm, Banat

INTRODUCTION

People and policy markers start to feel very strongly about environment issue. This may be at the fruit-tree farmer level, a branch that needs investments and is a long term business, and also at national and trans-national level [2]. The European Union Council was established its own strategies for effectiveness in environmental integration and rural development in various policy areas. In communication "Indicators for the integration of environmental concerns into the Common Agriculture Policy" reasserted the interest of Commission in establishing the environmental indicators [1, 4]. At the sometime, the member state are ask to adopt environment practice, supplementary measures following fulfillment of good farming practice [1, 4, 5].

Regarding the area cultivated with sweet cherries, Romania ranks 9th in the European Union, with 3.28 thousand ha in 2017. The production recorded for our country in the same year was 55.49 thousand tons [3].

MATERIALS AND METHODS

The expert system CROM was used in order to characterize the natural and artificial resources at Păltiniş farm in Banat region. The study was made on the sweet cherry tree orchards,

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where was applied expert system CROM. This system was developed in accordance with original methodology by "I.C.P.A.", which quantifies the soil, land, climate and infrastructure resources, the production and the quality of fruit [2, 7, 8].

For this study were taken and processed statistics from the National Institute of Statistics and Eurostat.

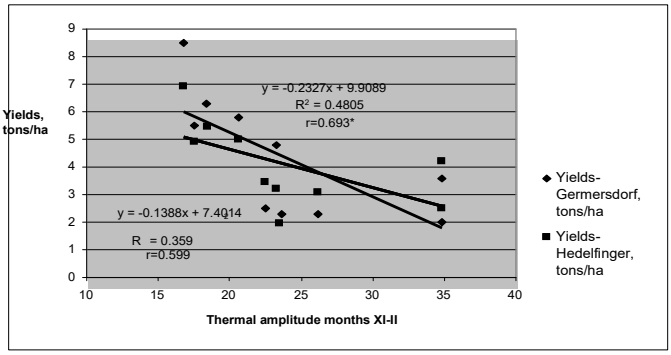

Fig. 2. The relation between the yields levels and the thermal amplitude (°C, XI-II months) for sweet cherry trees, Gemersdorf and Hedelfinger varieties, at the Păltiniş farm, Banat

RESULTS AND DISCUSSIONS

Climate resources expertise

For the sweet cherry cultivation, the optimal average air temperature is between 8°C and 11°C and in the study period it was 10.7°C. Fig. 1 presents the frequency of repetitiveness of the optimum intervals that were about 90%.

The absolute minimum temperature of -20°C for sweet cherry species was not recorded.

From Fig. 2 it may be observed, that the thermal amplitude in November-February, greater that 20 °C, had a frequency of repetitiveness about 60 %.

Table I shows the quantification of the climatic resources for sweet cherry trees, in the expert system-CROM. From monitoring of these, 43 addition points were obtained.

Table I. The quantification of the climatic resources for sweet cherry trees, Gemersdorf and Hedelfinger varieties, at the Păltiniş farm, Banat

Species/variety/rootstock/age	Class of expertise	Addition points
Gemersdorf, Hedelfinger/sweet cherry/25	With climate restrictions	43

Soil resources expertise

Depending on the baselines values, the soil resources, at the Păltiniş farm, Banat, receive 25 addition points. In Table II you can see that the soil resources were included in the class without soil restrictions.

Table II. The quantification of the soil resources for sweet cherry trees, Gemersdorf and Hedelfinger varieties, at the Păltiniş farm, Banat

Species/variety/rootstock/age	Class of expertise	Addition points
Gemersdorf, Hedelfinger/sweet cherry/25	Without soil restrictions	25

Land resources expertise

The relief conditions and the drainage conditions are quantified into the Table III and are granted 15 addition points. The sweet cherry lands and orchards were included in the category without land restrictions.

Table III. The quantification of the land resources for sweet cherry trees, Gemersdorf and Hedelfinger varieties, at the Păltiniş farm, Banat

Species/variety/rootstock/age	Class of expertise	Addition points
Gemersdorf, Hedelfinger/sweet cherry/25	Without land restrictions	15

Expertise for sweet cherry orchards characterization criteria, production and the quality of the fruit

Table IV. The expertise of the sweet cherry orchards, Gemersdorf and Hedelfinger varieties, at the Păltiniş farm, Banat

Species/variety/rootstock/age	Class of expertise	Addition points	Indicators of characterisation
Gemersdorf, Hedelfinger/ sweet cherry/25	> 18 years	10	Age of sweet cherry trees
	High	40	Assortment of species
	Good	17	Stage of vegetation for the orchards
	Total addition points	67	-

Table IV shows the indicators for the characterization of the sweet cherry orchards, and all of these are granted 67 addition points in an expert system-CROM.

Expertise for sweet cherry orchards infrastructure

From Table V you can see that orchards infrastructure received 0 depreciation points and the production potential is in a proper balance with a proper management. The economic indicators and the profitability of investment are not affected.

Table V. The expertise of the sweet cherry orchards infrastructure, Gemersdorf and Hedelfinger varieties, at the Păltiniş farm, Banat

Species/variety/ rootstock/age	Class of expertise	Depreciation points	Indicators of characterisation
Gemersdorf, Hedelfinger/ sweet cherry/25	High	0	The equipping degree of the lands and orchards
	High	0	Possibilities for valorizing fruit production
	High	0	Proximity of the market
	High	0	Possibilities of access to the market
	Total depreciation points	0	-

The evaluation of sweet cherry land and orchard

The application of the expert system-CROM at the Păltiniş farm, Banat, is presented in Table VI. The sweet cherry lands and orchards received 150 points and were included in the category with natural and artificial restrictions.

Table VI. The evaluation of the sweet cherry trees lands and orchards, obtained by application of expert system CROM, Gemersdorf and Hedelfinger varieties, at the Păltiniş farm, Banat

Species/ variety/ rootstock/ age	Class of expertise	Natural resources			Artificial resources		Total points
Gemersdorf, Hedelfinger/ sweet cherry/25	With natural and artificial restrict tions	Clima te	Soil	Land	Indicators of orchard characterisa tion	Orchard infra structure	
		43	25	15	67	0	150

The conclusion presented in the above tables is that Romania has favorable conditions for the cultivation of sweet cherries. Due to the increased consumption of fruit, sweet cherry production is an opportunity for Romanian farmers [6].

In the following, we will present Romania's situation regarding the cultivation and production of sweet cherries.

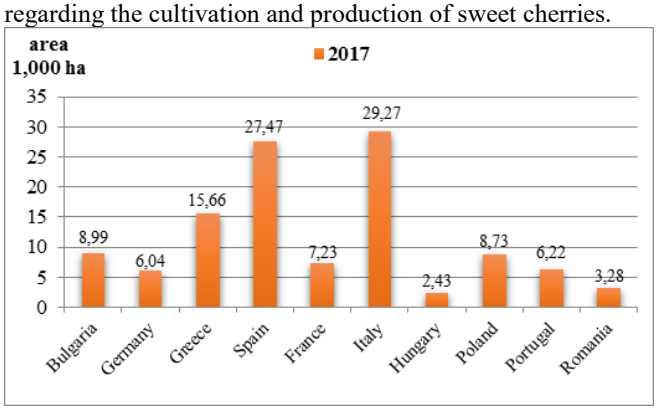

Fig.3. Area cultivated with sweet cherries in the main producing countries of the European Union
Source: [3], own interpretation

The analysis of the data presented in Fig. 3 shows that Italy (29.27 thousand ha), Spain (27.47 thousand ha) and Greece (15.66 thousand ha) are the main sweet cherry-growing countries in the European Union. With an area of 3.28 thousand hectares, Romania is far from reaching its potential.

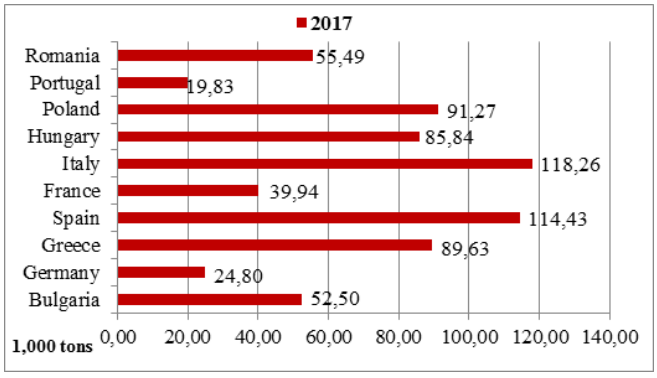

Fig. 4. The production of sweet cherries in the main producing countries of the European Union.

Source: [3], own interpretation

In terms of sweet cherry production, Italy ranks first with 118.26 thousand tons, followed by Spain and Poland. For Romania, the cherry production registered in 2017 was 55.49 thousand tons, a production that places our country on the 6th place among the top producers in the European Union.

Conclusion

Natural conditions favor sweet cherry cultivation and the optimal average air temperature is between 8°C and 11°C at Paltinis farm, Banat.

The thermal amplitude (XI-II months), greater than 20°C, it is a climate factor with negative effect on the sweet cherry yields.

In order to avoid production fluctuations, it is recommended to use a larger assortment of varieties to compensate the decrease of sweet cherry yields caused by the climate resources.

The access to the market is good and there are the possibilities for high valorizing fruit production.

Acknowledgment

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Optimal solutions and advanced technologies for innovative products to build smart mechatronics systems using life cycle assessment

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Abstract: the last years society requires intelligent solutions for specific consumption and creates room for innovative products to use in smart mechatronics systems. As engineering address new trends to offer novel materials and modern technologies that are more efficient and environmental friendly, production of these hi-tech equipments confront with different challenges from materials choices, energy reliance and maintenance processes by proving a need for life cycle engineering. In the actual path towards sustainable long-lasting product development and maintenance of mechatronics systems, there are specific approaches to invest in eco-design from life cycle assessment - LCA perspective. This paper analyse an intelligent mechatronic system dedicated to be used for space applications or for dangerous environments interventions, which integrates optimal solutions for eco-friendly materials and advanced technologies, including precise production, ICT based on virtual reality and remote sensing for long-living and cost-effective equipment.

Keywords: novel and eco-friendly materials, eco-design, smart mechatronics, precise technologies, ICT

I.INTRODUCTION

Considering sustainable production a stringent target towards circular economy, specialists are interested to introduce new methods and concepts corresponding to similar approaches as Circular Product Design (CPD), System Lifecycle Management or sustainable design (or eco-design) based on Life Cycle Assessment - LCA and these can be more effective associated and often used integrated [1,2]. Mechatronics systems are built from multi-disciplinary engineering that includes advanced technologies and smart products developed from usual components which gradually are replaced by the newest eco-friendly materials and technologies. The System Lifecycle Management represents a key component of intelligent manufacturing to achieve a sustainable engineering design process [2].

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Circular Product Design focuses on the development of methods and tools that enable the design of products and is used more than once (i.e. that have multiple lifecycles) that includes Product-Service Systems (PSS), Maintenance Repair and Overhaul (MRO) processes, sustainability with LCA, reengineering, all based on life cycle engineering LCE (product costs express 70% from its first design). This research area explores circular design strategies and models, such as product life-extension, reuse, remanufacturing and recycling, and the business models that enable these strategies, all connected by a digital loop using information and data exchange. [3]

Eco-design of smart mechatronic systems (SMeS) responds directly to individualization of products by creating flexible ways for mass production based on information and services availability in clouds, pointed to reach production facility and interaction control as in `Industry 4.0`. This approach integrates exchange methods and intelligent autonomous services that will help to make products more durable and easier to repair: in particular, requirements concerning the availability of spare parts and repair information (e.g. through online repair manuals) will be considered, including through exploring the possibility of horizontal requirements on the provision of repair information. Therefore planned obsolescence practices can also be limited to ensure a long-useful lifetime of products [3, 4].

There are available specific tools as LCA for environmental low impact and competitive eco-design of mechatronic systems, where an important step is to analyses the potential effects of the components in the whole product life that will have on the environment, throughout its life from production, maintenance, recycling and end of life (EoL) stages in order to have a positive impact on resource consumption, energy efficiency and low emissions [4,5]. Therefore, this methodology should be included from the first steps of a SMeS design because allows in the conception procedure, to make an inventory of the environmental impacts. This phase is

associated with accessible or innovative products and/or services and ensure a critical evaluation in order to generate a series of opportunities to improve the stage-diagnose [5,6].

Consequently, in this research, for optimal design of smart mecatronic system were been selected some innovative mechanical parts, electronic components and ICT (Information and Communications Technologies) with integrated products and software, all correlated with materials choices, energy dependency, advanced manufacturing technologies and digital connections through artificial intelligence system coordination. This study presents the selective processes and optimal products used or designed by our team for kinetic mechanism of the a SMeS, as well as autonomous electrical and electronical modules with computing models governed by virtual reality or augmented reality (VR/AR), smart solutions to coordinate interventions for security purposes or space explorations connected by AI devices.

II.CIRCULAR PRODUCT DESIGN OF SMES

The normal approach for traditionally design of a mechatronic systems includes some processes separated in three stages: System Design, Multi-disciplines design and System Integration with focus on environmental means [6].

From the outset design, the most important step to build a SMeS is to select the best suitable products necessary to make

Fig. 1. SMeS design construction
a) Mechanical parts (left); b) Electrical parts (right)

functional all mechanical and electronical parts integrated with a dedicated ICT system created on a basis of cradle to grave design concept (fig. 1a mechanical parts, 2b - electronic devices). The mechatronic system comprises the usual components:

• body – a structure that protect the vital mechanisms of whole systems (hard plastic and Alucobond® board);

• wheels (250 mm in diameter), suspension, steering system and engine – 6 individual powered and suspension wheels (BLDC type) with Ackerman steering system and FeeTECH engine (5Nm) that ensure the mobility of the SMS;

• Artificial Intelligence (AI) (controllers and computation microsystems) – ZTECH controller, Raspberry Pi V3, Printed circuit boards, for computing and structure the received information;

• sensors – collect information and send it to controllers from the environment;

• prehensile arms (with actuators) – interaction and intervention in the environment;

• ICT components (WiFi, GPS, Radio) – send and receive the information useful for operators and mission database;

• energy (3 accumulators and solar panel) – individual energy caption and storage system used for any actions is required.

The specific mechanical parts selected for the controlled mechatronic system are based on: powered wheels, suspensions, engine, prehensile arm, median boards from Alucobond® and hard plastic and variable fittings.

The electrical components integrates: electronical control board, controllers and computation microsystem, Laser telemeter, electric cables (Cu, Al) and printed circuit boards – PCBs including special metal Cu, Sn, Fe, Ni, Cr, Mo, Ag, Au, Pd and others non-quantifiable due to the very low content [8].

It is critical also to investigate the cyber-physical properties of the SMeS to create a functional architecture, minimizing the constraints and to integrate efficient technological processes and specific methods during the software design and modelling as well as testing technologies for environmental positive impact [6,7].

III.OPTIMAL SOLUTIONS USING LCA

In the aim of this research there is a focus to identify environmental impact LCA for this new intelligent prototype of mechatronic system that includes different materials comprise in some divided module, selected for long life expectancy and easy to control and manage during operational and maintenance processes until its EoL. Because the research team is more dedicated on the operational design for critical functionality, during the concept design this study analyses variable materials advanced technologies for production and smart AI devices. Materials composition of the SMeS building design of 27.2 kg correlated with references [4-11] are detailed in table I.

Table I. Materials used in the SMeS conception

Materials	Elements	Content Mass (kg)
SMeS Body		
Chassis & suspension	Steel	**9**
Steering System	Steel	**1.5**
Alucobond	Al	**0.25**
	Plastic	**0.3**
Board	Hard Plastic	**4**
Wheels, engines		
Wheels	Steel	**1.8**
	Magnets	**0.1**
	Cu	**0.2**
	Rubber tires	**1.6**
Engine RC	Al alloy	**0.16**

	Steel	**0.114**
	Cu	**0.06**
	Zn	**0.01**
	Plastic	**0.02**
Electronics and AI devices		
Controllers, Arduino Raspberry Pi	Cu	**0.1**
	Al	**0.005**
	Si	**0.003**
	Plastic ABS	**0.01**
	Hard plastic	**0.08**
PCBs	Heavy metals: Cu, Sn, Fe, Ni, Cr, Mo	**0.003**
	Rare metals: Ag, Au, Pd	**0.001**
	Glass fibre	**0.015**
	Epoxy resin	**0.013**
	Hard plastic	**0.4**
Robotic arm	Steel	**3**
	Stainless steel	**0.2**
	Plastic ABS	**0.05**
	Al	**0.04**
	Cu	**0.015**
	Hard plastic	**0.030**
Cables	Plastic PE	**0.**
	Cu	**0.185**
	Al	**0.280**
Lidar Telemeter	Glass	**0.01**
	Cu	**0.005**
	Steel	**0.002**
	Plastic	**0.05**
Energy		
Battery	Li $FeSO_4$	**0.3**
	Plastic PE	**0.05**
	Al	**0.3**
	Cu	**0.15**
	Steel	**0.01**
Solar panel	Glass	**0.3**
	GaAs	**0.01**
	Cu	**0.2**
Miscellaneous		
Insulator and oil	Silicon	**0.05**
Small Fittings	Steel	**2**
Small Fittings	Nylon	**0.01**
Soldering alloy	**Sn**	**0.2**

Considering the LCA a strategic study in this stage for a CPD concept, the impact assessment used LCIA method with OpenLCA software based on ecoinvent v3.1 and other available databases (Simapro, Gabi et.), where products are analysed for end of life - EoL criteria including: construction, maintenance and recycling or waste treatment stages. SMeS is an integrated system including EEE (electric and electronic equipments) and since EoL management is established by EU Directive on Waste of EEE 19/2012, environmental aspects are required to be integrated during lifetime of an EEE, by recovering or recycling materials at the end of life. In order to build a predictable EoL for 10 years scenario the following information are considered: advanced technologies for construction, operational and disassembly of specific components, values and amount of the materials, current barriers of actual resource efficiency of WEEE management, smart controlling and testing methods and intelligent computing models for cumulative datasets, easy to use, repair or replace (with recycling target) by identifying separately the modules errors and disturbance for critical functionality.

During the LCA were included analysis of inventory datasets and was evaluated the main indicators of environmental impact for SMeS, as following: abiotic depletion potential (ADP) - expressed in MJ of fossil fuels equivalent, global warming potential (GWP) – in kg CO_2^- equivalents and the cumulative energy demand (CED) – in kWh, expressed as energy ratio (ER = Eoutput/Einput). Calculations were determined on using selected materials and processing stage of each component in order to determine environmental impacts set up and results are presented in table II and fig. 2.

Table II. Environmental impacts for End of Life of SMeS after 10 years use

Environmental impact indicators	Construction	Maintenance processes	Recovering (recycling / treatment)
EoL of SMeS after 10 years use scenario			
ADP (MJ of fossil fuel eq.)	6.95E+01	2.45E-01	**3.25E+01**
GWP (kg CO_2^- eq)	4.34E+01	1.64E+00	**1.87E-01**
CED (kWh)	**5.83E+02**	**2.32E+02**	**1.96E+00**

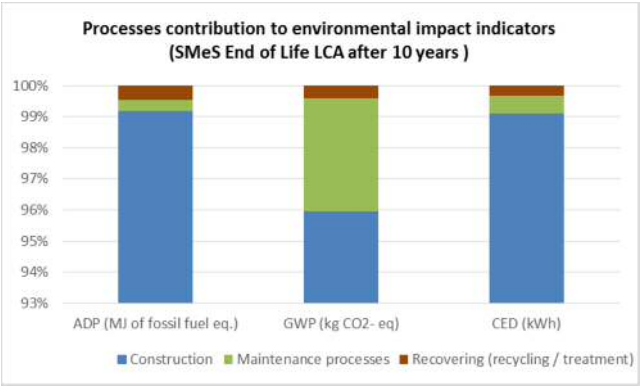

Fig. 2. SMeS End of Life LCA results, 10 years use

Preliminary acquired results are expressed in percentage, and is relevant to see the construction period were more than 99,2% of ADP, 99.3% of CED and 96% GWP conclude a substantial impact during the construction phase due to the metal, plastic and other substances content, which involves mining and heavy transport, less in the maintenance period and during recovering processes with some positive impact than for the situation when replacing with new ones that involves additional production, specific for obsolete products.

During the maintenance period, all intelligent computing and cloud verification methods shows processes performance of SMeS, including by LCA environmental indicators: ADP fossil, CED and GWP that have a positive impact due to modular design and high-quality technologies used in quality control for the Product-Service Systems (PSS), as well as for Maintenance Repair and Overhaul (MRO) work.

IV.CONCLUSION

Compering with traditional mechatronics production, this study offers a basic structural selective methods that includes Circular Product Design approach using LCA analysis that demonstrate reduction of environmental impacts in term of wise resources consumption, gases emissions mitigation and energy efficiency. Nonetheless, some difficulties to model deeply the EoL of a smart mechatronic system may appear because of the limited datasets available, which are not sufficiently described or with unclear specific parameters.

Recurrent topic of analyzing specific product used in SMeS construction from the first design step may help production to adopt suitable spare parts with long life and integrate them in divided modules that require simple operational tests and maintenance. These LCA achievements demonstrate the need of individual study for each procedural step during a SMeS production and especially with End of Life scenario estimations in order to increase its life expectancy and materials recovery.

ACKNOWLEDGMENT

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Air quality: assessing natural ventilation on controlling indoor environmental parameters

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Abstract: In the present study ammonia concentrations, air speed, temperature and relative humidity were monitored in a naturally ventilated organic laying hen house in Northern Greece, using a simple but reliable open source device technology and low cost instruments. Measurements for ammonia concentration, humidity and temperature were performed at three sampling points by using open source device technology and compatible sensors. Air speed measurements were also taken using anemometers at the two sampling points adjacent to the openings of the livestock structure during a 12-day period in spring. With the aim to estimate the contribution and the efficiency of natural ventilation in controlling air quality within the poultry house two different days under different outdoors climate conditions were chosen during which the openings were closed for one hour and opened after this short time period. Results identified the efficient function of the openings and indicated that the existing side windows of the poultry house under study provides a suitable environment with consistent interior variation of the studied parameters within minutes after their opening.

Keywords: Environmental pollution, Environmental informatics, Natural ventilation.

INTRODUCTION

Natural ventilation in livestock buildings is considered a cost-effective and energy - saving ventilation method used to control air pollutant concentrations such as ammonia produced by animal activity and regulate indoor environmental parameters such as air speed, temperature and humidity. Temperature and relative humidity are parameters of the thermal environment of a livestock building, which along with those of the chemical environment – presence of gaseous pollutants such as ammonia, dust and odors - form the climatic environment within a livestock confinement [1].

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Because of the growing interest in investigating air quality in different types of poultry houses, numerous studies have been carried out under different environmental conditions, different ventilation systems and manure management practices in various countries. Kilic and Yaslioglou [2], focused on measurements of the concentrations of ammonia (NH_3) and carbon dioxide (CO_2) in a naturally ventilated laying henhouse for approximately 11,000 laying hens located in Bursa, west Turkey and determined the effects of indoor and ambient environmental conditions such as temperature and relative humidity on pollutant gas concentrations during the summer months. Zhu et al. [3] recorded the highest concentrations 10.58 ppm for NH_3 during the first summer month. Additionally, they characterized concentrations and emission rates of NH_3 and greenhouse gases including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) from a naturally ventilated laying hen house with daily manure removal in Northeast China during different seasons. The higher concentrations of NH_3 occurred in autumn and winter, due to cooler temperatures and therefore lower ventilation rate resulting in higher NH_3 concentrations reaching approximately 17 ppm.at noon, when ventilation rate was the lowest. In a work of Anthonisen et al. [4] is found that the NH_3 concentration increases with increasing temperature and vice-versa, representing this relationship by an equation.

The aim of this study is to estimate the effect of the natural ventilation to the quality of the environmental conditions inside a poultry house.

MATERIALS AND METHODS

The distinguishing feature of this experimental study was the use of a simple but reliable open source device technology and low cost instruments for measuring the ammonia concentrations and the indoor climatic factors in a livestock building and finally establish a relationship among them. The experiment was conducted in a naturally ventilated loose hen housing farm with laying hens of organic husbandry located in the region of Lakkia, 30km east of Thessaloniki in Northern Greece. The poultry house has dimensions of 18m × 8m (L×W) with an east-west orientation and with a total holding

capacity of 830 laying hens. The height of the side wall is 2.70m which is also the height to the ceiling, since the building is a rectangular structure.

The farm is naturally ventilated with 7 protected by net windows (100× 42cm) along the west side wall and 16 along the east side wall in two rows, 8 screened openings along the lower row (90×50cm) and another 8 above them (145×50cm). Additionally, at the bottom along the east side there are 11 exit windows for the hens (50.5× 60cm). All measurements were taken on a 24-hour basis at 3 locations within the poultry house along a transverse section in the middle of the building and at height 2.0m above the floor. The first sampling point (SP1) was on the right at a distance of 1.90m from the west side wall with the two rows of openings. The second sampling point (SP2) was on the opposite side at a distance of 2.0m and (SP3) was placed at the building's center - 4m away from both walls and 0.65m below the air vents.

The results presented in this study have been transferred by a more advanced central microcontroller (ATmega 1280), on board connected to an open source device (Arduino mega 2560) comparing to those used by other researchers [5], [6]. It is a cost effective and reliable technology used in several applications for air quality measurements especially NH_3 concentration.

In order to check the diurnal variation of ammonia concentrations, temperature and humidity on the second day of the experiment 24/03 was chosen. This date was chosen because it was one of the two days during which the windows were intentionally closed from 09:00 – 10:00 am to check the accumulation of ammonia within the building and how it was affected by the respective changes of the environmental conditions. For the same reason the date 28/03 was also chosen because throughout this day no windows were closed and the daily routine was followed as usual.

Results and Discussion

The diurnal indoor temperatures in all three sampling positions reached a maximum value of 22°C between 9:40-9:50 am, as shown in Fig. 1(a) - (c). Regarding the indoor RH, peak values of about 61% were reported during the same time period, since windows were closed for more than half an hour. As far as ammonia concentration is concerned, values followed the same trend. In the warmest time period of the day the highest values of ammonia were recorded (9:40 am). However, the spatial distribution of ammonia among sampling points showed noticeable differences between points SP1 & SP2 and point SP3.

The highest recorded ammonia concentrations for SP1 (57.44 ppm) and SP2 (52.49 ppm) show negligible differences. On the other hand, there is considerable variation with SP3 (36.22 ppm), with ammonia concentration almost twice as low not only in the maximum values but also in the lower ones at night when compared to the other two sampling points near the side walls. This is probably because this specific measuring point is in the central area of the hen house, below the air vent on the ceiling and, therefore, is more exposed to the air flows generated by natural ventilation which disperse ammonia gas.

It is worth to be noted that in 15 minutes after the windows opening, ammonia concentrations obtain values around or even below the threshold limit of 25 ppm in the laying hen house keeping them for the rest of the day. This finding proves that natural ventilation is more than sufficient in dispersing accumulated ammonia within the poultry house and in keeping ammonia concentration levels within acceptable limits.

Additionally, clear diurnal NH_3 variations was observed during the day and night for sampling locations, showing a sharp decrease of ammonia concentration by 78% at night after 22:00 pm, compared with the most frequently recorded value during day time. Relative humidity stabilized at a lower value for all sampling points from 14:00pm to 23:00 am, whereas temperature presented a sharp decline during the same time frame. Interaction mainly with temperature and less with humidity created diurnal patterns of NH_3 concentrations since a considerable decrease in indoor air temperature and a slight decrease to a steady value for humidity was found to decrease ammonia concentration. This observation is in line with the equation presented by Anthonisen et al., [4]. Another possible explanation could be that at night there is no intense animal activity, birds are not active on the litter floor since laying hens are in their nest boxes resulting in the reduction of ammonia levels.

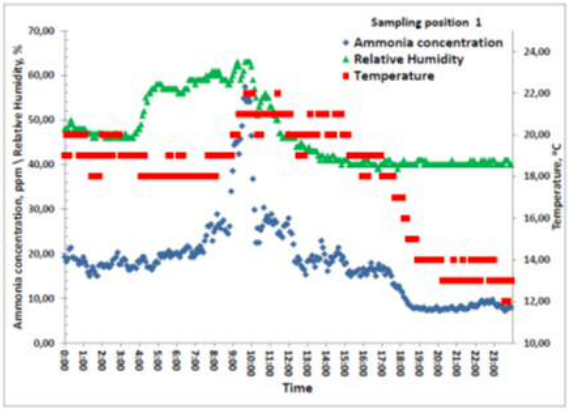
Outside air temperature and relative humidity was shown to have peaks (18°C and 77%) around 9:50 am (Fig. 3(a)). The occurrences of peaks on indoor temperature and humidity followed the variations in outdoor air temperature and relative humidity, pinpointing that in naturally ventilated buildings internal microclimatic parameters greatly depend on external environmental conditions.

A different trend regarding the indoor environmental parameters was observed on 28/03 (Fig. 2(a) – (c)) during a typical day at the house with windows constantly opened. The daily temperature and relative humidity variations in terms of the minimum and maximum values between sampling points were practically the same. Maximum temperature values (18°C) are recorded around 14:00 pm and minimum (9°C) before sunrise between 04:40 - 05:40 am. Relative humidity highest values around 60% were observed in the morning and minimum values when it was much warmer within the day at 13:00-13:15pm. When temperature was reaching peak values relative humidity had a decline 1/3 of its high value, which was also the trend that the outdoor respective parameters followed according to the meteorological data of the nearby weather station (Fig. 3(b)).

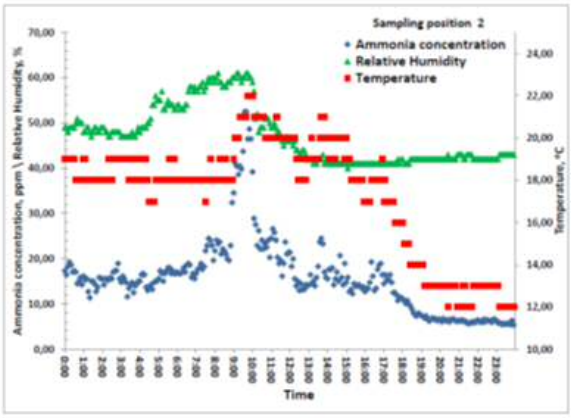
Ammonia indoor concentration presented a more gentle distribution of values with regards to those on 24/03, since windows were kept open throughout the day. The spatial distribution of ammonia concentration between SP1 and SP2 presented negligible difference and in comparison with SP3 the fluctuations were less intense. The maximum values

(37.98 for SP1&SP2 and 26.32 for SP3) were recorded around 14:00-14:40 pm when temperature was high and relative humidity was low. It was verified through measurements that when indoor temperatures reached the lowest values it was also when indoor ammonia concentration was influenced accordingly, 30% lower than the daytime values.

It should be emphasized that for both days on which diurnal variations were examined and for the vast majority of the measurements ammonia concentrations were below the threshold limit of 25ppm.



(a)



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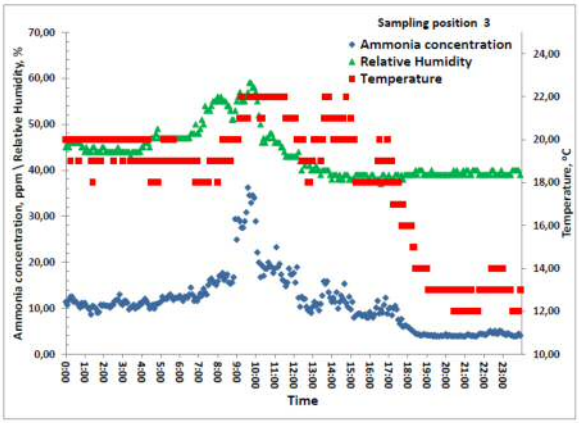
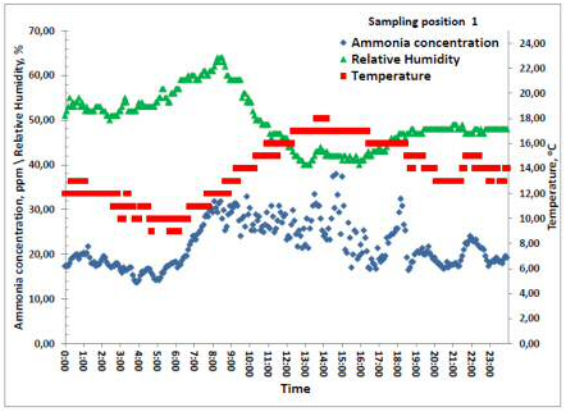


(c)

Fig. 1. Diurnal variation of NH_3 concentration, temperature and relative humidity at different sampling points inside the laying hen house on 24/3/2016.
a. Sampling Position1, b. Sampling Position 2, c. Sampling Position 3.



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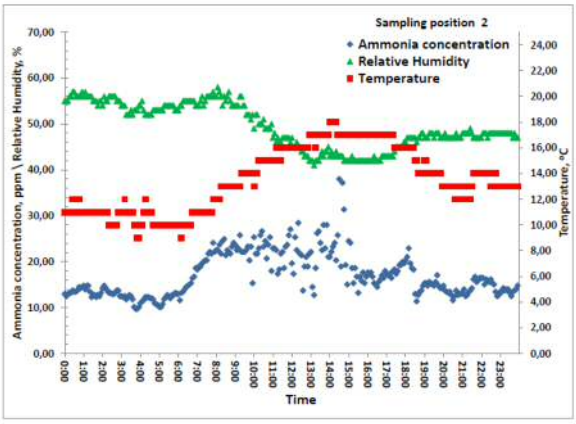

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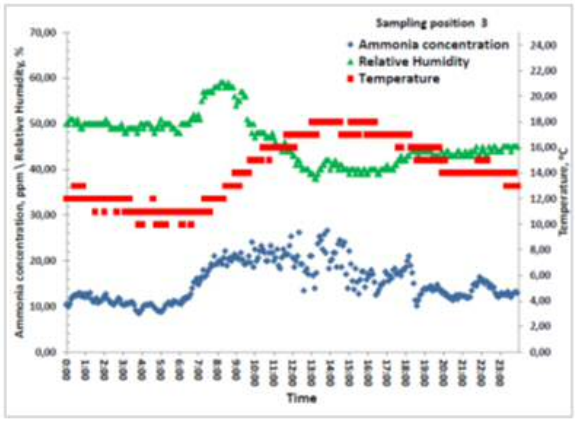
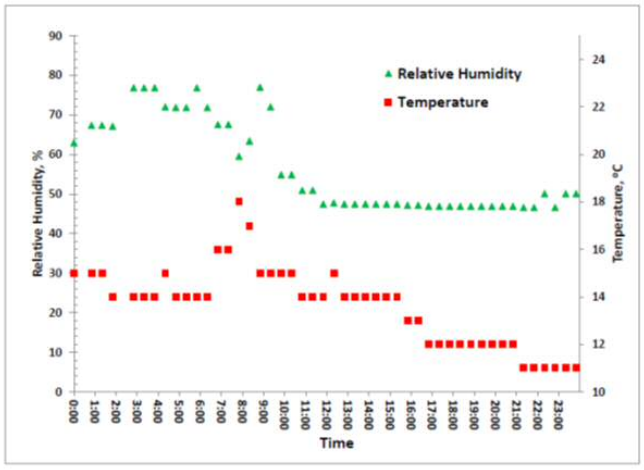
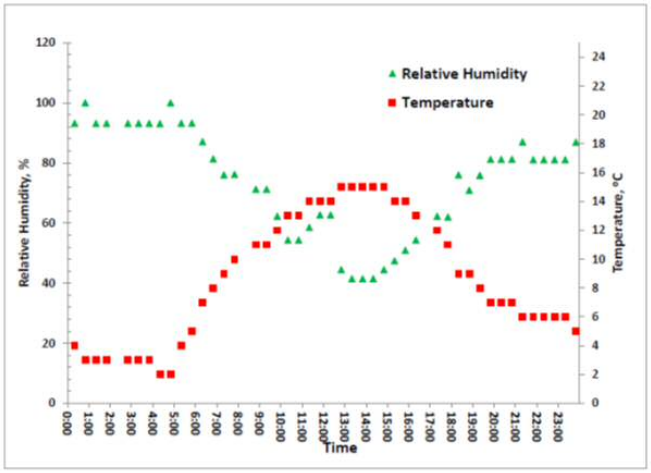


(c)

Fig. 2. Diurnal variation of NH3 concentration, temperature and relative humidity at different sampling points inside the laying hen house on 28/3/2016.
a. Sampling Position1, b. Sampling Position 2, c. Sampling Position 3.



(a)



(b)

Fig. 3. Outdoor temperature and relative humidity on 24/3/2016 (a) and on 28/3/2016 (b).

CONCLUSIONS

Ammonia concentration and environmental parameters such as temperature and relative humidity were monitored at three sampling points at 2.0 m above the ground inside a naturally ventilated organic laying hen facility of floor housing type with no manure removal until a complete rearing cycle and the following conclusions can be drawn:

- The daily mean values of ammonia concentration in this study varied between 13.49±4.15 to 28.50±5.71 ppm for SP1, 9.32±3.49 to 29.55±13.52 ppm for SP2 and 7.99±2.97 to 29.82±4.16 ppm for SP3 showing negligible variation regarding ammonia distribution among sampling locations.
- A significant increase of ammonia concentration with increase in temperature and relative humidity was found in the present study, since the maximum ammonia concentration for all sampling points (66.59 ppm, 73.76 ppm and 72.69 ppm for sampling points 1, 2 and 3 respectively) occurred on the day when temperature and humidity reached highest values.
- Large diurnal variations in ammonia concentrations, temperature and relative humidity were observed between daytime and night time on the day of the hourly closure of windows, a fact which was much less intense on a typical day demonstrating the effectiveness of natural ventilation.
- The spatial distribution of ammonia among sampling points showed insignificant differences between points SP1 & SP2 but noticeable variations compared to point SP3 because of its position in the central area of the naturally ventilated laying hen house.
- The results published in this study are within range with those of other studies verifying reliability of open source device technology and making it a practical and trustworthy tool for farmers to monitor indoor air quality.

Future investigation is needed regarding the measurements of ammonia and of other pollutant gases in poultry houses such as carbon dioxide (CO_2) and Hydrogen Sulfide (H_2S) and other environmental parameters such as wind speed at different heights from the ground and at different indoor at outdoor locations. It is also, suggested to apply open source device technology using respective sensors in order to measure other pollutant gases generated within a naturally ventilated poultry house and determine how environmental factors regulate not only concentrations but also emissions to surrounding environment.

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Soil Degradation Processes in Sandy Soils Areas from Western Romanian Plain

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*corresponding author

Abstract: In the context of climate change, areas occupied by sandy soils from south Oltenia are directly affected by drought and prone to desertification. The paper aims to asses some aspects of soil degradation in Western Romanian Plain. Five sites have been examined, representing four different land-use types, located in Desa area. The soil profiles were morphologically described, and disturbed soil samples were collected from the diagnostic horizons. Physical and chemical measurements have been done: particle size distribution, pH, calcium carbonate (CaCO3) content, EC-value, exchangeable cations, total N, organic C, and available P contents, according to RISSA Soil Survey Methodology (1987). In Western Romanian Plain, sandy soils are exposed to high (6%) and very high (27%) risk to wind erosion, mainly due to unsuitable land management practices that lead to spread of the uncovered ground areas (bare soil) and to diminution of areas covered with forest (fixing plantations). The analyzed soils inherited the textural characteristics from the parent material, having coarse texture, with up to 70% sand content (coarse and fine sand, between 2–0.02 mm). The main limitative factors on the sandy soils in the study area are the moisture deficit, wind erosion, loss of nutrients and compaction.

Keywords: ecology, soil degradation, sandy soils, Western Romanian Plain.

INTRODUCTION

SOUTHERN OLTENIA IS CURRENTLY IN A FULL PROCESS OF ARIDIZATION, THE CAUSES BEING RELATED TO THE CONTEXT OF CLIMATE CHANGES AND TO THE CHANGES IN LAND USE AT LOCAL LEVEL [1]. ACCORDING TO CURRENT PROJECTIONS, THERE IS A TENDENCY OF INCREASING FOR DROUGHT FREQUENCY AND INTENSITY IN THE SOUTHERN PART OF OLTENIA [2].

PREVIOUS STUDIES IN THE AREA IDENTIFIED TWO CATEGORIES OF SOIL DEGRADATION PROCESS: FIRST, DISPLACEMENT OF SOIL EROSION BY WIND FORCES) AND THE SECOND, IN SITU SOIL DETERIORATION COVERING CHEMICAL OR PHYSICAL SOIL DEGRADATION [3].

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THE PAPER AIMS TO ASSES SOME ASPECTS OF SOIL DEGRADATION IN WESTERN ROMANIAN PLAIN (OLTENIA PLAIN) AT REGIONAL LEVEL (THE ASSESSMENT OF RISK TO WIND EROSION) AND AT LOCAL LEVEL (INVESTIGATIONS OF SOIL PROPERTIES ON SELECTED SITES).

THE STUDY AREA IS LOCATED IN THE SOUTHWEST PART OF THE ROMANIAN PLAIN (BĂILEȘTI PLAIN). THE LANDSCAPE IS A SERIES OF DUNES AND INTERDUNES COVERING TERRACES AND DANUBE PLAIN, WITH A PREDOMINANTLY AGRICULTURAL LAND USE. THE PARENT MATERIALS OF THE SOILS CONSIST OF CARBONATED AND UNCARBONATED SANDS DEPOSITED AS DUNES AND INTERDUNES. THE CLIMATE IS CHARACTERIZED BY HOT AND DRY SUMMERS WITH FEW PRECIPITATIONS. THE AVERAGE ANNUAL TEMPERATURES EXCEED 11°C AND THE AVERAGE ANNUAL VALUES OF PRECIPITATION VARIES BETWEEN 525 AND 550 MM. NATURAL VEGETATION IS CHARACTERIZED BY FOREST-STEPPE VEGETATION, WITH XEROPHYTE OAK AS REPRESENTATIVE SPECIES, SEVERELY RESTRICTED DUE TO INCREASING ARABLE LAND AREAS[4].

MATERIAL AND METHOD

A. Risk to wind erosion assessment at regional level.

The classes of risk to wind erosion were derived from the Geographic Information System of Soil Resources "SIGSTAR-200", developed based on the information contained in the fifty tiles constituting "The Soil Map of Romania at the scale 1:200,000" [5]. The software used was the ESRI ArcView 3.2.

The pedotransfer rule used for estimating risk to wind erosion do not require accurate input data (numeric), but only general information, such as topsoil texture and land non-uniformity [6] (fig. 1).

Topsoil texture	Land non-uniformity					
	Uniform	Very low	Low	Moderate	High	Very high
Sand	low		medium	high	very high	
Loamy sand – sandy loam			low	medium	high	
Loam, loamy clay, clay	absent					

Fig. 1. Pedotransfer rule for risk to wind erosion assessment (RISSA Soil Survey Methodology, 1987, p. 180)

B. Soil sampling and laboratory analysis

The soil samples were collected from five sites, with four different land-use types. Location and a short description of the soil profiles are given in Table I. The soils were classified according to the World Reference Base for Soil Resources (WRB system) [7].

Table I. Location and a short description of the soil profiles

Soil profile	Location	Altitude (m)	Soil type (WRB, 2014)	Landform	Land use
P1	N: 43°50'55.07'' E: 23°0'8.24''	32	Aric Arenosol	waved interdune area on alluvial terrace	pasture
P2	N: 43°49'13.55'' E: 22°58'49.08"	31	Mollic Arenosol	interdune on Danube meadow	pasture
P3	N: 43°51'21.55'' E: 23°1'21.27''	36	Aric Arenosol	dune on alluvial terrace	vineyard
P4	N: 43°51'27.14'' E: 23°1'22.30''	34	Arenic Chernozem	interdune on alluvial terrace	arable land
P5	N: 43°51'44.75'' E: 23°1'10.13''	42	Eutric Arenosol	dune on alluvial terrace	acacia forest

The soil profiles were morphologically described, and disturbed soil samples were collected from each diagnostic horizon of the soil profiles.

The main physical and chemical parameters that were measured are as follows: particle size distribution, pH, calcium carbonate ($CaCO_3$) content, organic matter content, EC-value, exchangeable cations, total N, organic C, and available P content, according to the RISSA Soil Survey Methodology (1987) [8].

The analytical data were statistically computed, spreading parameters (minimum value X_{min}, maximum value X_{max}, and standard deviation σ) and the arithmetic mean $\overline{X}$ were calculated using Excel programme.

RESULTS AND DISCUSSSION

A. Risk to wind erosion

The soil cover of the study area consists in Eutric, and Mollic Arenosols developing on areas occupied with mobile sands, while in interdunes and on stabilized areas, due to changed texture, Arenic Chernozems and Arenic Luvisols are developed. Human intervention lead to formation of Aric subtipes, defined as soils ploughed to a depth of ≥ 20 cm from the soil surface, which associates mainly with sand dune areas fixed with vineyards.

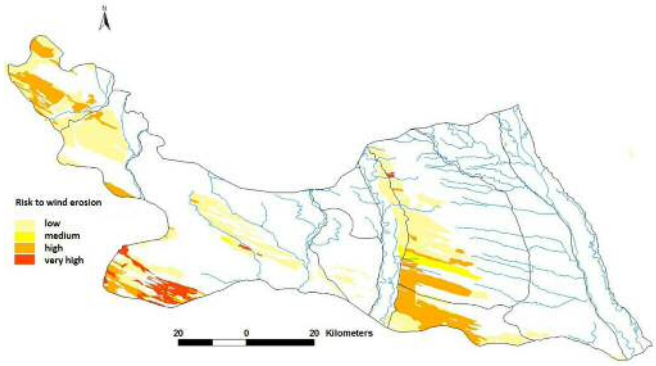

Fig. 2. Risk to wind erosion in Oltenia Plain

In Western Romanian Plain, sandy soils are exposed to high (6%) and very high risk (27%) to wind erosion (fig. 2), mainly due to unsuitable land management practices that lead to the extent of uncovered ground areas (bare soil) and to the diminution of areas covered with forest and vineyards (fixing plantations).

B. Soil physical properties

The studied soils inherited the textural characteristics from the parent material, with a coarse texture, with up to 70 % sand content (coarse and fine sand, between 2–0.02 mm) (table II).

The colloidal clay content (< 0.002 mm) has the lowest values for P3 – vineyard (between 5.8 and 4.2%) and P5 – forest (between 5.9 and 3.9%), while P2 – pasture has the highest clay content (17.9% in At, decreasing to 10.2% in Am2 horizon). Also, P2 profile has the lowest coarse sand content (0.2–2 mm), between 10.0 and 11.6%, while within P3 soil profile the coarse sand values exceed 60%.

Table II. Soil physical properties

Profile number			P1	P2	P3	P4	P5
Clay *(mm)*	Profile	Topsoil	8.5	17.9	4.5	16.5	5.9
		X_{min}	6.8	8.5	4.2	10.8	3.9
		X_{max}	10.7	17.9	5.8	16.5	5.9
		$\overline{X} \pm \sigma$	8.3±1.3	12.19±3.1	4.84±0.6	13.86±2.3	4.63±0.7
Silt *(mm)*	Profile	Topsoil	4.3	11.3	0.9	12.8	1.5
		X_{min}	3.4	6.6	0.7	6.5	0.2
		X_{max}	4.8	11.3	3.0	12.8	2.3
		$\overline{X} \pm \sigma$	4.07±0.5	8.64±2.0	1.43±0.9	9.10±2.6	1.09±0.7
Fine Sand *(mm)*	Profile	Topsoil	54.3	60.7	33.1	50.3	45.5
		X_{min}	51.1	60.7	30.2	50.3	32.4
		X_{max}	56.4	74.3	37.4	68.6	48.5
		$\overline{X} \pm \sigma$	34.31±1.8	67.60±4.6	34.39±3.2	59.81±6.7	42.37±6.6
Coarse sand *(mm)*	Profile	Topsoil	32.9	10	61.6	20.4	47.1
		X_{min}	32.3	9.5	54.3	14.1	45.3
		X_{max}	37.3	13.6	64.7	20.4	63.0
		$\overline{X} \pm \sigma$	34.31±1.8	11.55+1.3	59.39±4.3	17.20±2.1	51.91±7.4
		$\overline{X} \pm \sigma$	1.6±0.1	5.9±0.8	0.6±0.1	3.6±0.8	0.8±0.2

C. Soil chemical properties

While physical soil properties are high influenced by the characteristics of parent material, the chemical properties and soil fertility are influenced mainly by human activities, i.e. land use and agricultural practices.

Table III. Soil chemical properties

Profile number			P1	P2	P3	P4	P5
SOM *(%)*	Topsoil		2.25	4.38	0.30	2.46	1.44
	Profile	X_{min}	0.18	0.36	0.30	0.66	0.3
		X_{max}	2.25	4.38	0.84	2.46	1.44
		$\overline{X} \pm \sigma$	0.77±0.8	1.40±1.4	0.50±0.2	1.41±0.7	0.63±0.4
Total N *(%)*	Topsoil		0.045	0.182	0.011	0.129	0.079
	Profile	X_{min}	0.006	0.019	0.005	0.044	0.013
		X_{max}	0.047	0.182	0.041	0.129	0.096
		$\overline{X} \pm \sigma$	0.023±0.01	0.058±0.05	0.02±0.01	0.067±0.03	0.04±0.03
P Mobile *(ppm)*	Topsoil		23	10	13	7	9
	Profile	X_{min}	19	1	4	1	4
		X_{max}	40	11	13	7	9
		$\overline{X} \pm \sigma$	28.14±6.7	7.75±3.4	6.71±3.1	4.0±2.4	6.14±1.8
K Mobile *(ppm)*	Topsoil		79	75	46	67	50
	Profile	X_{min}	43	40	26	60	41
		X_{max}	80	75	46	80	50
		$\overline{X} \pm \sigma$	59.43+15.1	54.25±11.1	39.0±8.1	68.38±6.9	47.14±3.2
pH *(-)*	Topsoil		5.72	7.73	7.94	6.28	6.29
	Profile	X_{min}	5.72	7.73	7.93	6.19	6.29
		X_{max}	8.23	8.55	8.16	8.33	7.83
		$\overline{X} \pm \sigma$	6.75+0.8	7.79±0.3	8.03±0.1	7.24±0.9	7.31±0.6

The soil organic matter content (SOM) varies from medium to low for the soil profiles in pastures and arable lands. The SOM values decrease from 2.52% in At to 0.78% in AB within the P1 (pasture), and from 4.38% in At to 1.50% in Am2 within the P2 (pasture), while the values determined for P4 (arable) are more closed and vary between 2.46% in Ap to 2.04% in AB horizon.

Soil reaction (pH) is slightly acid for P1 (pasture), excepting the topsoil which is moderate acid: 5.72), with values of 5.93 in Am and 6.64 in AB, and for P4 (arable), with pH values between 6.28 in Ap and 6.64 in AB horizon.

P2 (pasture) and P3 (vineyard) have slightly alkaline reaction, with values varying between 7.73 and 7.87 for P1 and between 7.94 and 8.16 to P3.

The total nitrogen (N) is very low and low in all samples analyzed, with values between 0.011 and 0.129 percent in topsoil, excepting P2, with medium content (0.182%).

The content of mobile phosphorus (P) varies from very low (7 ppm in the topsoil) for P4 (arable) and medium (23 ppm in the topsoil) for P1 (pasture).

D.Soil degradation processes

The human intervention in land use changes in this area amplified the processes which led to soil degradation, such as erosion and soil structure degradation, insufficient water holding capacity, groundwater contamination, increasing susceptibility to pests, decreased soil fertility, the reactivation of the sandy substrate and the formation of mobile sand dunes [3].

The main limitative factors on the sandy soils in the study area are the moisture deficit, wind erosion, loss of nutrients and compaction.

The coarse texture determines a strong mineralization of organic matter and a more active mobilization of the various constituents of soil, with consequences regarding the migration of substances - including the nutrients – as the result of faster and deeper penetration of water into the soil [9]. Displacement or coverage (fig. 3) of soil material represents the main degradation processes which affect the sandy soils.

The soil profiles located on dune ridge (P3 and P5) have very high content of coarse sand compared with the other soil profiles and are degraded as a result of wind deflation.

Fig.3. Shifting sands cover the vineyard in interdune

CONCLUSION

From the granulometric point of view, the studied soils are characterized by the predominance of the coarse sand fraction. In the case of soils fixed by plantations and protected against deflation, a decrease of coarse sand and an increase of fine sand were observed. The influence of the relief microforms is noticeable in the thickness of the A horizon, higher in interdunar compared to the ridge of the dunes. The chemical characteristics of the studied soil profiles point out a low potential for fertility.

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The insulating façade system with parallel air chambers

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Abstract: The present paper presents the theoretical results of an innovative thermal-insulating façade system (THFS) that can be used for new buildings or for thermal rehabilitation of existing ones. The THFS is composed by a vertical system with multiple parallel air stripes embodied in rockwool insulating panels. The thermotechnical properties of the THFS as thermal resistance, permeability to vapours and general behavior in defined conditions are evaluated using the software "WUFI Plus 3.1". Using the obtained results, a comparative study is performed on an energy efficient high school building (HSB) built in Salonta (RO), with the aim to evaluate the general efficiency of this system versus the already in use system, according to the Passive House standards

Keywords: sustainable civil engineering and urban planning, thermal insulating façade system, energy consumption, insulating air chambers.

V. INTRODUCTION

According to several studies performed at European level, the energy demand for heating the interior spaces declined and the efficiency of households improved by around 1.5% to 1.9% since 2009 [1].

Even the improvements in the building sector, the scenarios developed by the experts of IPCC, an intergovernmental body of the United Nations, predict based on ranging economic and political conditions, a global temperature change from 1.5 to 6 ^{O}C [2].

The share of the energy used for space heating remains significant (Figure 1), posing 52% of the total commercial energy end-use in Europe [3].

Previous studies have should that in east european countries, CO_2 emissions per unit GDP is considerable bigger than in west European countries. One of the reasons for this variation is the aged building sector [4].

Therefore improving the thermal performances of the building sector i.e improving the thermal resistance of the buildings envelope should have a considerable impact in decreasing the CO_2 emissions.

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VI. THE INSULATING FAÇADE SYSTEM WITH PARALLEL AIR CHAMBERS

The common insulation materials i.e. rock wool, glass wool and polystyrene are widely used in the building industry.

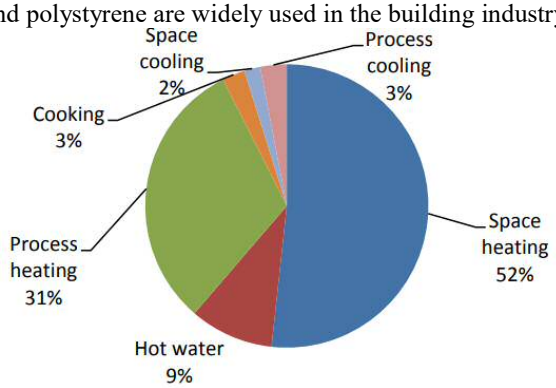


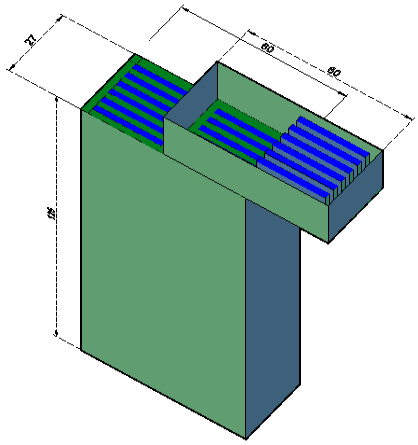
Fig. 1. Commercial energy end-uses in Europe [3]

The thermal resistances of the materials depend on their thickness (geometrical parameter) and their conductivity (material propriety). New systems are required by industries to cover the request to have breathable buildings but in the mean time energy efficient ones. The aim of this study refers to the analysis of thermal performances of a new proposed solution (THFS) [Fig.2]. The thermal performances of the new system will be compared with the existing insulating system. It is intended to improve the performances of the insulating system by maintaining the same amount of insulating material used in the common solution and production process. The proposed THFS consists of a rock wool panel with a regular mesh of air chambers embedded into the panel. The air chambers are separated in between by rock wool stripes in order to reduce the heat transfer caused by the convection currents [5].

The length and width of the rock wool panel (Fig.2) have standard dimensions, i.e 1250 mm x 600 mm. The total thickness of the insulation panel was increased by 140 mm from 100 mm to 240 mm by adding the 7 additional air chambers. Each air chamber has a thickness of 20 mm.

The edges of the panel consists of a continuous stripe of stone wool (25 mm wide) in order to assure a stiff area for the mechanical fixing system composed of polypropylene dowels and polyamide anchors. Using the geometrical data and thermal properties of the panel a theoretical study was proposed to analyze the general behavior of the system and

make comparisons with the traditional solution used on the new High School Building (HSB) in Salonta. The exterior climate data was simulated using the actual climate measurements recorded between 2010 and 2011 by the weather stations in proximity of the buildings location. The data was provided by *Shinyweatherdata*, an application built at Mälardalen University, Sweden [6].



VII. High School Building in Salonta. General Description

The simulations were carried out on an energy efficient high school building in Salonta, Romania. The building is one of the first administrative/public building built in Romania according to the Passive House (PH) prescriptions, general concept and details.

The architecture [Fig.3] of the building was developed so that it fits to the local site requirements, i.e. a central area with old classic buildings. The building has 4 levels and a total area of 4000 m^2. In order to evaluate in real time the energy consumption of the building and to understand the behavior of materials over time, a complex monitoring system has been developed and mounted in the building elements [7].

Fig. 2. The façade of the high school building

The exterior closing walls consist out of autoclaved aerated concrete masonry (AAC) GBN25 insulated with a system of rock wool panels 1200mm x600mm x 150mm. The properties of the consisting materials are presented in table 1.

The calculations were performed using the software "Wufi 2D-3" intended for 2D non-stationary heat–moisture calculations of building structures[8].

The initial conditions of the building materials were assumed constant for both designs according to table 2. The initial relative humidity of the consisting layers was assumed substantial (RH = 80%) in order to include the initial absorption of the construction materials [9][10][10].

Table 1.Properties of building material

Material	AAC GBN 25	Stone wool	plaster	Insulation adhesive
Thermal conductivity [W/m²·K]	0.125	0.037	0.8	0.45
water absorption rate [g/m²·s$^{0.5}$](10 min)	110	300	260	3.1
heat capacity [J/kg·K]	1350	1030	1150	1150
Dry density [kg/m³]	450	155	1500	1500
Compression strength	2.0	0.03	4.5	18
Share strength N/mm²	0.15	-	1.5	5.0
Water vapor diffusion resistance factor [-]	10	1	11	11
Gross Density [kg/m³]	450	150	1500	1400
Water vapor diffusion factor [-]	8	10	19	15.1

Table 2. Initial conditions of the building materials

Initial temperature of the wall [°C]		20.0
Initial moisture in component [%]		80.0
Water content [kg/m³]	Cement lime plaster	45.00
	Stone wool	1.16
	Masonry cement	85.75
	AAC	18.02
	Mineral plaster	45.00

VIII. Energy Demand of the Buildings

The energy demand of the building was distinctive studied for heating and cooling period under the assumption that it is insulated first with the existing system and with the new system, THFS.

The heating period [table 3] is reduced by 4 days in case the walls are insulated with the THFS. Meanwhile, the heating demand over the studied period is reduced by 6.3% from 415070.7 kWh to 39093.8 kWh.

The thermal performances of the THFS are lower though over the cooling period than the thermal performances of the existing insulating system. The total energy demand of the

The thermal performances of the THFS are lower though over the cooling period than the thermal performances of the existing insulating system. The total energy demand of the THFS is lower by 0.85% than the energy demand of the existing system [table. 4].

Case	existing system			THFS		
period [d]	114.2			115.9		
Total energy demand [kWh]	50958.6			50572.2		
Power demand [kW]	min	max	average	min	max	average
	0	41.9	5.8	0	41.7	5.9

Table 3. Total energy consumption for heating the interior spaces

Even if the total energy demand of the building insulated with the THFS exceeds the demand of the existing building, the maximum power demand of the THFS reaches only 41.7 kW, slightly smaller than the power demand of the existing building that exceeds 41.9 kW.

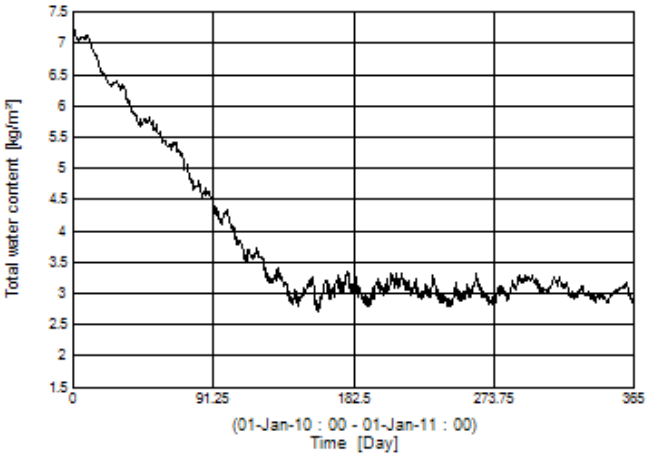


Fig. 3. Moisture state of the existing wall

Considering the entire period of 1 year, and summing the energy demand for both cooling and heating period, the total energy demand of the building insulated with the THFS is lower by 4,81 % than the total energy demand of the actual building insulated according to the PH standards.

Table 4. Total energy consumption for cooling the interior spaces

Case	existing system			THFS		
period [d]	96.3			92.6		
Total energy demand [kWh]	41570.7			39093.8		
Power demand [kW]	min	max	average	min	max	average
	0	41.5	4.7	0	48.1	4.5

IX. Moisture State of the Walls

During its lifetime, a insulation material absorbs water during exposure to moisture. Previous studies revealed an increase of up to 28% of the specific heat loss of a layer consisting of rock wool when exposed to an increase water content of 12.8 g/m^2 [11][12] [13] [14].

Fig.4 and Fig. 5 present the total water variation over the analyzed period of the wall. In case of both insulation systems, the water content drops down from the initial high water content (7.12 kg/m^2) caused by the initial absorption phenomena of the building materials to values under 3.3 kg/m^2, short after passing 120 days from calculation beginning.

After the initial decrease, the water content shall be retained at an average of 3.12 kg/m^2. The slight variations between the somewhat greater water content during months August and September (day 240-270) and the winter months (day 273-365) is caused by the variations of the temperature. In short terms the high temperature combined with the high relative humidity during August and September cause a higher water content (3.4 kg/m^2) than the water content of the colder air during winter months when the average water content is decreasing to around 3.0 kg/m^2.

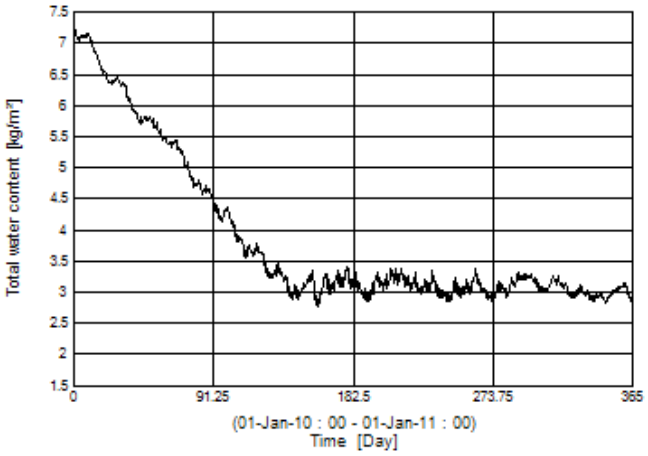


Fig. 4. Moisture state of the wall insulated by the THFS

Table I. An example of a table

X. Conclusion

The thermal performances of the proposed insulation system were theoretically determined. The energy demand of the proposed insulation system was computed related to the energy demand of an insulation system designed according to the Passive House standards. According to the initial outcomes, the system reduces the energy demand of a building in a temperate continental climate by a mean 4.81% if we sum the decreases over the heating period and the minor increases over the cooling period.

Furthermore, the water content of the both designs was examined. The water content remained constant in both cases.

Further studies are planned on laboratory to examine the performances of the proposed insulation system. The results provided in this paper are based on theoretical analysis of the general behavior of the building under the assumptions that it is insulated according to the existing insulation system and the according to the proposed insulation system.

Acknowledgment

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Soil phytoremediation from Pesteana Sud mining perimeter

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Abstract: Environmental disruptions at coal reserves extraction begins with prospecting stage and continue in exploitation stage. Opencast mining have a strong impact on soil due to scraping and dumping processes. The disappearance of the soil must be understood as the disappearance of a „living body" formed in time, with all its features - primarily fertility - which provides a favorable environment for plant development. On the tailing dump of the Peşteana Sud open pit, anthropic soils called protosoils are formed. The phytoremediation of these anthropogenic soils is recognized as a cheap and environmentally friendly alternative technology that uses plants, microorganisms and enzymes to remove, retain, immobilize or transform pollutants, mainly of anthropogenic origin, from the soil. The paper provides solutions for the phytoremediation of the tailing dump in the Peşteana Sud mining perimeter using grass and legume species.

Keywords: Novel materials and environmental friendly technologies (NM&FT), phytoremediation, microorganisms, grasses

INTRODUCTION

The Peşteana mining perimeter is administratively located on the territory of Gorj County, occupying the southern area of the Oltenia mining basin. Situated on the territory of Bîlteni commune, which currently consists of 5 villages (from N to S: Moi, Vlăduleni, Bîlteni, Peşteana-Jiu and Cocoreni) and the residence is in the village of Bîlteni [2].

The present surface of the commune is 9161 ha, of which over 5000 ha are covered with forests, the rest are agricultural land, land under construction, land occupied by infrastructure, water, etc.

The mining activity from Pesteana Sud open pit area is currently ceased. The location of Pesteana Sud mining perimeter is in the southern part of the Rovinari carboniferous basin, on the right bank of the Jiu River on the territory of the Urdari and Plopsoru communes and comprises the central Jiu river meadow area and adjacent hillsides to the north and south. (Figure 1).

The opening of the open pit was carried out through an internal opening trench, completed in 1984, by excavating a volume of 12.7 million m^3, located inside the perimeter, on the western boundary, with north-south orientation.

The opening trench was carried out with two bucketwheel excavators ERC 1400 x 30/7 by the execution of two excavation steps.

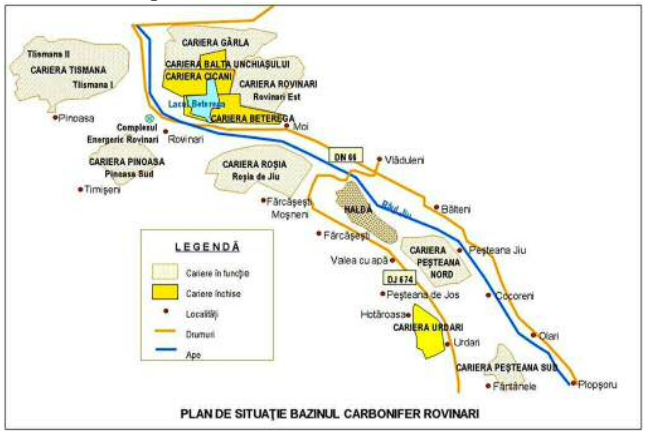

Fig. 1 Situation plan - Rovinari carboniferous basin

The excavated tailings was transported to the outer waste dump located in the southwestern part of the open pit, respectively in the area where the stripping ratio is over 15 m^3/t. Beginning in June 1985, the tailings were dumped inside the perimeter.

The exploitation method applied in the Peşteana Sud open pit was the combined method with the partial transport of the tailings into the internal waste dumps and the partial transshipment into the internal waste dumps (class IV.3) [2].

The exploitation was done in parallel blocks with a width of 40-45 m. The exploitation works consist in the extraction of the coal from the three lignite seams X, XI, XII and the tailings between them. Seam XII is exploited in bench I. Seam XI can be excavated from both bench I and bench II. Seam X is exploited from bench II.

The technological flow of the quarry was made up of two technological lines of excavation located on the working

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benches, made up of a 1400 bucketwheel excavator and two front conveyor belts [2].

The excavated mining mass was discharged into the front conveyor belts and then onto the conveyor belts connecting to the inner dump and the coal transport line, respectively, to the Cocoreni coal storage.

THE IMPACT OF TAILINGS DUMPS ON THE SOIL

In the processes of the coal mining area, is to update the geological ages of different materials, a wide range of physico-chemical, materials that are heterogeneously distributed in a horizontally and vertically. Because of these conditions, all dumps, there can be a ground cover [3].

If cast mining, the impact on the ground was very hard, through the process of stripping or disappeared dumping ground or by mixing tailings inseparable, whether it was stripped separately. The disappearance of the soil must be understood as the disappearance, primarily of fertility - which gives the environment favorable to the development of plants.

The destructive effect of tailings dumps on the soil requires the environment to be sanitized for environment, sanogenetic (parks, green areas), landscape, agriculture or forest, anti-erosion or protection against current and prospective climate and technological changes.

Phytoremediation, applied to tailings dumps, discarding materials and other residues from mining and other industrial activities, operates as a biological method that can provide ecological or secondary ecological succession [5], namely:

• establishment of phytocoenoses and pioneering zoocenoses, concomitant with pedogenesis, restoration of microbiota, humus and soil properties;

• phytocenotic and zoocenotic reconstruction, cultivation, colonization of species and stabilization of interspecific relations favorable to the biocenotic productivity and balance of the new ecosystem.

Phytoremediation is an alternative technology that uses plants to extract and degrade pollutants [4]. The method is efficient, non-invasive, economically efficient, aesthetically and socially accepted to remedy polluted areas. Plants are ideal soil remediation due to their genetics, biochemical and physiological properties [2].

MATERIAL AND METHOD

From the total area of the 162,5 ha inside heap, modeling works will be carried out, which will be projected on approximately 54,5 hectares of the heap surface. Through reprofiling works, it is desired to obtain cumulatively the following aspects of general interest:

- obtaining a relief with the smallest slope differences between two adjoining profiles, namely obtaining a uniform relief on sloping groups of slopes;
- avoiding depression areas after landscaping leading to local accumulations of rainwater;
- connection of the area of interest with the definitive shares of the forested land area on the north and north-west side;
- ensuring the possibilities of subsequent improvement of the heap, without affecting the surface of the economic circuit.

The slope stability reserve will be enhanced by subsequent afforestation works, which ensure a biodrainage of the area.

Phytoremediation of the waste material aims at increasing natural fertility by using leguminous and grass species, leading to increased biological activity in the soil.

By maintaining soil covered throughout the year, soil compaction, keeping pH within optimal limits is avoided [7]. Biological activity at a weak acid pH results in maximum intensity.

Subsequent use of the soil can be made much easier for any type of use, with priority being the agricultural destination, which is the basic preoccupation of the inhabitants.

Phytoremediation will be carried out using the phytostabilization technique to restore the vegetal mat in places where natural vegetation is missing due to physical degradation of surface materials [2].

Tolerant species can be used to restore the vegetation of the site, while reducing the potential for migration of contaminants under the influence of wind and water erosion and leachate to groundwater [1]. Plants suitable for phytostabilization at a specific site must:

- have high tolerance for the contaminant concerned;
- to ensure a high production of radish biomass capable of immobilizing these contaminants by picking up, precipitation or reduction;
- to retain the contaminants in the root, preventing the transfer into stems and leaves, to avoid a special deposition [6].

Phytostabilization ensures risk reduction by stabilizing contaminants located near the surface of the soil [3]. This result is provided by the plant secretion of compounds that influence the pH of the soil and form metallic complexes of low solubility. In addition, plants help reduce soil erosion and reduce leaching by increasing evapotranspiration.

Phytoremediation by grasshopping with legumes and grasses

To test the capacity of the herbaceous species to grow on the dump material, the material from the inner dump was harvested and placed in 63 pots which were germinated for 2 years.

Various legume and gaminess species (Table I) were selected with a deep rooting system, in this respect 7 soil samples were taken from the waste dumps from different areas.

Table I. *Species of grasses and legumes chosen for the experiment*

Crt. no.	Species of grasses and legumes
1	*Lucerne (Medicago sativa)*
2	*Small trefoil (Lotus corniculatus)*
3	*Red clover (Trifolium pratense)*
4	*Milkvetch (Astragalus onobrychis)*
5	*Trefoil(Lotus corniculatus)*
6	*Cat grass (Dactylis glomerata)*
7	*Timothy-grass (Phleum pratense)*
8	*Fescue orchards* (*Festuca partensis*)
9	*Sainfoin (Onobrychis viciifolia)*

Germinability was tested for 9 different herbaceous plants with deep rooting system. Each sample pot of 16 cm in diameter was filled with waste heap in which seeds of grass species were placed.

The 63 pots were monitored (Figure 2). The pots were watered every two days.

Choosing plants with roots has important advantages in increasing genotype and phenotype stability than in other differentiated crops, resulting in a reliable and reproducible experimental system over time. It is well known that they are able to metabolize dangerous compounds via metabolic pathways.

Fig. 2. Experimental pots with legumes and grasses.
a) Sample pots. b) Developing unit root inside the pot

RESULTS AND DISCUSSIONS

The phytoremediation experiment was carried out in two stages:

A. The ***first stage*** was a laboratory experiment, when sowing was carried out in pots. One month after sowing, the following results were highlighted:

- of the 9 herbaceous species tested (Table II), only 4 were able to germinate in all sterile samples, which developed a radicular apparatus on the whole soil volume of the pots. The other 5 species did not grow; the plants in the experimental pot did not rise;
- then it was identified which of the herbaceous species placed in the experimental pots adapted to critical conditions and which of these can be used for the phytoremediation of material from the tailings dumps.

Table II. *The laboratory experiment results*

Crt. no.	Species of grasses and legumes	The depth of roots in vegetation pots (cm)
1	*Lucerne (Medicago sativa)*	25
2	*Small trefoil (Lotus corniculatus)*	20
3	*Red clover (Trifolium pratense)*	18
4	*Milkvetch (Astragalus onobrychis)*	17,5
5	*Trefoil(Lotus corniculatus)*	4,1
6	*Cat grass (Dactylis glomerata)*	3,4
7	*Timothy-grass (Phleum pratense)*	2,2
8	*Fescue orchards* (*Festuca partensis*)	1,17
9	*Sainfoin (Onobrychis viciifolia)*	0,78

B. The ***second stage*** consisted of planting the 4 species that responded to the laboratory experiment directly in the dump tailings.

The plants were placed on an area of 2 x 2.5 m (Figure 3), followed weekly and moistened once a week. In the second year, it was decided to determine the deep development of the roots of the 4 species located on the landfill.

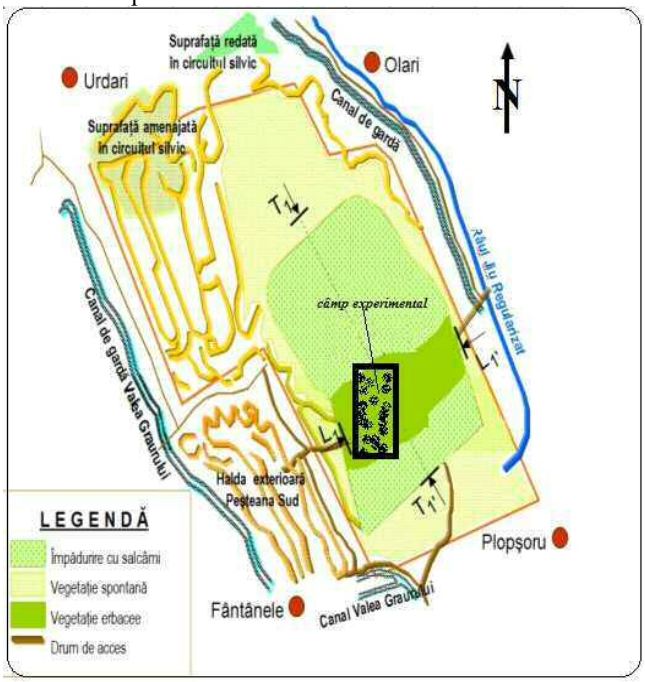

Fig. 3. Experimental lot on the inner tailings dump of the Peşteana Sud open pit

Table III shows the development of radicular apparatus in the two laboratories and dump experiments. It can be noticed that in the laboratory the species developed the radicular system better than the experiment placed in the dump.

The development of the radicular system on the tailings dump is also influenced by the weather conditions and physico-chemical properties of the soil.

Table III. *Comparison between the laboratory and "in situ"experiments*

Crt no.	Species of grasses	The depth of roots in vegetation pots (cm)	The depth of roots in experimental field (cm)
1	*Lucerne (Medicago sativa)*	25	18
2	*Small trefoil (Lotus corniculatus)*	20	16
3	*Red clover (Trifolium pratense)*	18	7,5
4	*Milkvetch (Astragalus onobrychis)*	17,5	6,0

Approximately one year after sowing, it was highlighted that the growth of legumes and grasses was not intense except for the lucerne species, which reached 18 cm in depth and small trefoil which reached 16 cm in depth. The other two species tested did not develop such deep roots in depth.

In Figure 4, we graphically represented the evolution of plant roots placed in vegetation vessels in the experimental laboratory phase, and their location in situ on the tailings pond. Of this, the best result was the lucerne species, which developed the radicular system in both laboratory and in situ.

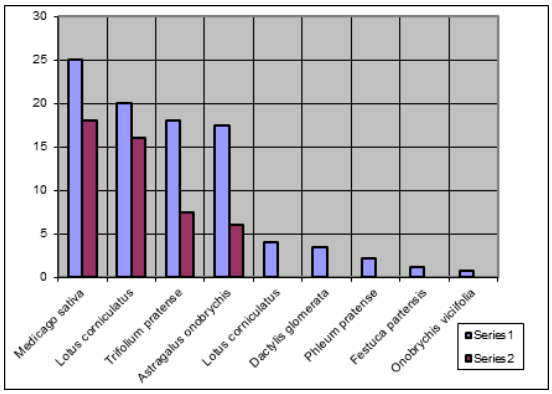

Fig. 4. Evolution of the roots of the species in the laboratory and in situ phase

CONCLUSIONS

From the laboratory and field tests, the following conclusions were drawn:

– the in-depth root development test demonstrated not only that the legume and grass species were able to germinate in the dump material, but also that they managed to grow and deepen the radicular system that will contribute to the phytoremediation of the deposited waste in these tailings dumps;

– through this experiment, it was possible to identify which of the leguminous and grass species tested were able to grow in the sterile material in the dump. In this way, it will be possible to use these species for the phytoremediation of the inner tailings dump.

- the use of perennial herbaceous plants with profound rooting system allows the erosion to be blocked and the re-naturalization of the areas where the pedoclimatic conditions have until some years been considered unfit for vegetation development. With this technique, a quick refurbishment can be achieved, where the vegetation is usually difficult to install.

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Methodological issues concerning the preparation of tourism climate studies

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Abstract: This paper presents the main indices and quantitative methods through which over the last 80 years it was attempted to express the tourism climate potential in different geographical units and even on the entire land surface. First, the indices are presented, followed by the methods with their benefits and limits, revealing the superiority of the methods in pointing out the tourism climate potential, and finally, it is recommended the most suitable method which currently exists: the Besancenot-Mounier-Lavenne method (1978).

Keywords:indices, methods, potential, tourism climatology.

INTRODUCTION

Once climatology was set up as a science (19th century), it took almost a century for the researchers to focus on and use the results obtained in general climatology towards a direction applied to tourism. This happened, of course, with the development of tourism activities in Western Europe and later on in other countries, as reflected also in the scientific concerns in this branch of climatology, the first climate indices appearing in the Western European countries. Subsequently, concerns have emerged in other European countries, former communist states, but also on other continents. It was gradually demonstrated that the initially proposed indices do not involve only advantages, but also many limitations. Therefore, methods were created, more or less complex, more or less applicable, but also with disadvantages. The best method for quick, clear and simple illustration of the tourism climate potential for a region is the method of the French physicians J.P. Besancenot, J. Mounier and F. de Lavenne (1978) [1].

LITERATURE REVIEW

Over time, from the very beginning, simple indices were developed, such as *Clausse-Guerout index* (1955) [2], *Poulter index* (1962) [3], *Burnet index* (1963) [4], *Hughes index* (1967) [5], *Davis index* (1968) [6], *Flocas index* (1975) [7], *Marchand index* (1986) [8], some of them being applied also in Romania. Thus, the Clausse-Guerout index (1955) was applied by Fărcaş and collab. (1968, 1970) [9, 10], the data obtained for the month of July being compared with the ones obtained by France; by Teodoreanu and collab. (1984) [11] for January, the results obtained being less significant; by Dragotă and collab. (1999) [12] for the hot season of the year on the route Băişoara - Vlădeasa - Stâna de Vale – Oradea. Poulter (1962), Burnet (1963) and Hughes indices (1967) were applied by Gaceu and Herman (2010) at Stâna de Vale balneoclimate resort for the hot season, but the results, although conclusive, did not have a particular significance [13, 14]. At international level, observing that the indices proposed did not have satisfactory results, the development of more **complex** indices was attempted, in order to make use of more climate elements and detailed data: *the biomedical aggressive index* (Rivolier, Campos, Lemee, Wolfromm, 1967) [15], *marine-climate index* (Sarramea, 1980) [16], planetary index (Mieczkowski, 1983, 1985) [17, 18]. It was noted that even these indices have limits and the development of **methods** was initiated. The first attempts took place in bioclimatology, where *the Russian school* has excelled through *the method developed by Feodorov* (1924) [19] *and perfected by Ciubukov* (1949) [20] *and Baibakova and collab.* (1964) [21]. This method was presented in the Romanian literature by Belozerov and Fărcaş (1971) [22], Teodoreanu (2002) [23] and it was used by Elena Teodoreanu and collab. (1984) [24]. Next, were *the Canadian meteorological school led by R. B. Crowe, G. A. McKay, W. M. Baker* (1977) [25], *A. D. Gates* (1975) [26], *J. M. Masterton, R.B. Crowe, W. M. Baker* (1976) [27] and *the Brazilian meteorological school represented by Barbiere* (1981) [28]. The most recent method was developed by the French physicians *Besancenot, Mounier and Lavenne* (1978) [1]. While trying to compensate for the limits of the first three methods, this method was applied to the Romanian Black Sea coast during the hot season by Apostol, Gaceu (2011) with very good results [29].

METHODOLOGY

In terms of methodology the major indices and methods used so far in tourism climatology were analysed, trying to identify the main positive and negative features resulting from their use. Therefore, *the Clausse-Guerout index* (1955) has good results, limited, only for the hot season, *the Marchand index* (1986) requires a large amount of evapotranspiration data available to very few weather stations and it does not take into consideration wind values and air temperature values

which have an essential influence on tourist activities, *the Burnet index* (1963) obtains arbitrary values as numbers which have no absolute meaning, i.e. it does not show that the tourist activities are, for example, twice more favourable in a specific region than in another one, but that there are more favourable conditions also by failing to consider climate elements such as sunstroke, wind, etc., if applicable to other regions than the Mediterranean region, there is the possibility of giving incorrect results. *The biomedical aggressive index* (Rivolier, Campos, Lemee, Wolfromm, 1967) [15] is more applicable in medicine than tourism climatology because it makes use of parameters which characterize lung diseases, *the marine-climate index* (Sarramea, 1980) [16] can be applied only to the Atlantic and Mediterranean coast and the *planetary index* (Mieczkowski, 1983, 1985) [17, 22] cannot apply to the entire land surface because at the same latitude, in January, it indicates a favourable potential in Peking, in mountain climate, and unfavourable potential in South-Western France in Bordeaux!

Regarding the tourism climate methods, it was noted that the *method of the Brazilian meteorologists* (Barbiere, 1981) [28] is extremely complex and requires great efforts to use it; *the method of the Canadian meteorologists (Crowe and collab.,*1977) [25], *Gates* (1975) [26], *Masterton and collab.* (1976) [27] quoted by Besancenot (1990) [29], Gaceu (2002) [30], Apostol, Gaceu (2011) [31] has questionable results, *the Russian method* (Feodorov-Ciubukov-Baibakova, 1924, 1949, 1964) [19, 20, 21] is cumbersome, requiring a large amount of calculations; the results obtained are relative, it does not provide a quantitative or qualitative correlation with the weather manifestations and it is limited to a range of only 24 hours, which does not correspond to the actual duration of the phases and types of weather in their sequence Besancenot, 1990 [30] and Gaceu, 2002 [31].*The Besancenot-Mounier-Lavenne method* (1978) [1] is intermediate between that of types of weather and types of indices, and synthetic, simple, easy to use, and the obtained values are real, measurable when it comes to the number of days favourable to outdoor activities or not Besancenot, 1990 [30], Gaceu, 2002 [31]. Applied to the Romanian Black Sea coast, this method gave many interesting results. We present below two of these results:

1. The highest frequency of the *sunny weather* in July-August is recorded on the northern Black Sea coast, namely in the Danube Delta at the stations Gura Portiţei (37-61%) and Sf. Gheorghe (25-54%), and the lowest frequency is recorded in the south of the Black Sea coast where the majority of the touristic resorts are located, namely the stations Constanţa (29-50%) and Mangalia (12-34%);

2. June is much more favourable for tourism than September because it has a decadal frequency of 15-36% *sunny weather* compared to 3-20% in September (Apostol, Gaceu, 2011) [29].

For these reasons we intend to apply the *Besancenot-Mounier-Lavenne method* (1978) [1] also to the balneoclimate resorts located in the Romanian Carpathians, such as: Moneasa, Stâna de Vale, Semenic, Ţarcu, Parâng, Voineasa, Păltiniş, Fundata, Predeal, Sinaia, Ceahlău, Rarău, Poiana Stampei etc.

CONCLUSION

The performance of this analysis leads to the following conclusions:

1. The tourism climate indices have a positive role in characterizing the tourism climate potential because: they involve making several calculations, they make use of various climate parameters and provide results easy to understand and interpret, but they use measurement units that do not meet the international system and, in terms of mathematics, they cannot enter combinations, so that sometimes information can be lost and abstract results can be frequently obtained.

2. The analysed methods are more extensive, taking into consideration several climate elements, but some of them are very difficult to use. They require a huge amount of data whose processing and interpretation involve hard work and effort, which is why we consider conducting tourism climate studies using the Besancenot-Mounier-Lavenne method (1978) [1] which, as presented above, it is synthetic, simple and easy to use and the values obtained are real and measurable when it comes to the number of days favourable to tourism activities or not.

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Preservation analysis of the Tyrolean Grey Cattle from 1940´s and nowadays (2014) under original rural environment

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Abstract: The paper is concerned with the Tyrolean Grey Cattle breed, an autochthon, dual purpose, alpine mountain cattle breed. The objective of the paper is to describe the typical characterization of that breed and reveal the possible changes of major body measurements by time.

For the analysis body measurements of 59 animals were recorded in 2014, and with the collaboration of the "Südtiroler Rinderzuchtverband" herd book body measurements data of 46 individuals (from 1946 until 1957) were collected. Adjustments for 3 years of age were achieved for each body measurement by quadratic regression, then analysis of variance was performed according to time era.

Regarding the body measurements the results showed increased body parts caused by selection for larger frame and dairy type during that time (in all cases $p<0.05$). The conclusion of the investigation is that the Tyrolean Grey Cattle breed is still today a robust cattle and related to the aboriginal form despite of some discernible modification proven.

Keywords: Preservation of biodiversity in periurban and rural areas (PB), Tyrolean Grey Cattle, body measurements.

INTRODUCTION

This study shall carry out a recent evaluation and a review about the differences between the present and former Tyrolean Grey Cattle. It should contribute successfully the preservation of that breed, which is still considered as an endangered livestock breed of Alpine region. At the beginning of the investigation, the South Tyrolean Grey Alpine Cattle Association ("Südtiroler Rinderzuchtverband") was contacted to receive information.

The investigation was realized in evaluation of the conformation by taking the body measurements with respect of the age of the animals and period of time.

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The evaluation of conformation is important to determine the breed characteristics, as well as to compare the results got 80 years ago and today in order to reveal any possible changes.

The Tyrolean Grey Cattle breed or Grey Alpine (in German called „Tiroler Grauvieh", in Italian „Razza Grigio Alpina Tirolese") is an autochthonous, dual purpose, mountain cattle breed. The majority of the Austrian population which consists of about 18,000 cattle is situated in county Tirol [1]. In Italy the Grey Alpine cattle is distributed primarily in the Province of Bolzano (South Tyrol) and in valleys of the Dolomites in the Provinces of Trentino and Belluno; total population in Italy counts approximately 14,000 heads [2]. It is expected that aboriginal peoples brought the so called „Torf breed" along from Asia Minor/Middle East to the Alpine regions. This breed was a small short horned cattle. Later, this original" Short Horn" cattle was crossed with the larger „Allemannen-breed" and „Kelten-breed", and so resulted the progenitor of the Tyrolean Grey Cattle [3]. The presence of the Tyrolean Grey Cattle is documented since 800 A.D. Roman authors, like Plinius and Strabo, reported about the Grey Alpine breed and lauded the high milk yield. Nineteen Seven were made the first uniform standards for the Tyrolean Grey Cattle containing the compilation of the physical characteristics, behavioural traits and performances of all these little different livestock, creating one standardized breed [4].

According to the breed standard the animals are of medium size (height at withers is 126/133 cm, cows and bulls) and weight (body weight is 575/950 kg, cows and bulls) and have a robust constitution, a correct fundament, very hard claws and hardiness. They are rustic, frugal, have a strong instinct for finding their own food and are able to convert even coarse vegetation efficiently. This mountain pasture competence is also really important for pastures and meadows, because the Grey Alpine is grazing in a sparing way. The colour of the coat is determined in a greyscale. Characteristics are also the dark, nearly black muzzles and claws. On the back there is often a dorsal stripe of lighter shade. The horns are varnish-black or dark-grey and at their end mostly brighter.

MATERIAL AND METHOD

All present data (59 cows) were recorded by Axel Mederle, a former veterinary student in South Tyrol in the surroundings of Bozen/Bolzano in the summer 2014. The former data (46 cows) of the Grey Alpine Cattle from were collected from the first existing herdbook of the South Tyrolean Grey Cattle Association covering a ten-year-long period (from 1940 until 1950.

Adjustments for 3 years of age were achieved for each major body measurements (height at withers, chest depth, heart girth and coxal distance) by quadratic regression, then analysis of variance was performed according to time era. The difference between time area was proven by Tukey's post-hoc test.

RESULTS

Regarding the body measurements the results showed increased body parts, caused by selection for larger frame and dairy type, during that time (Table 1 and Table 2).

Table 1: Results on hight at withers and chest depth adjusted for 3 years according the time era (in cm)

Time era	n	Height at withers Mean ±SD	Chest depth Mean ±SD
Grey Alpine cattle 1940-1950	46	113.8^{a} 5.12	60.6^{a} 3.11
Grey Alpine cattle 2014	59	125.9^{b} 4.87	72.9^{b} 3.14
Total average	105	120.7 7.80	67.6 6.84

a, b – different letters mean significant ($p< 0.001$) differences

Table 2: Results on heart girth and coxal distance adjusted for 3 years according the time era (in cm)

Time era	n	Heart girth Mean ±SD	Coxal distance Mean ±SD
Grey Alpine cattle 1940-1950	46	165.7^{a} 0.11	41.6^{a} 3.92
Grey Alpine cattle 2014	59	187.9^{b} 8.82	48.3^{b} 3.04
Total average	105	178.3 14.49	45.4 4.77

a, b – different letters mean significant ($p< 0.001$) differences

Results show us that all the body measurements investigated have went through a change. All body measurements became statistically significant higher by nowadays.

CONCLUSION

The conclusion of the investigation is that the Tyrolean Grey Cattle is still nowadays a robust cattle and related to the aboriginal form despite of some discernible modification proven.

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Faeces of the stray dog, the sourse of zoonotic pathogens

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Abstract: **Bacteria with zoonotic potential, found in the intestine of dogs, proved to be a significant risk factor for the human health, if accidentally ingested. The exposure to zoonotic bacteria from the faeces of stray dogs could pose an important health problem to the municipality of Timisoara.**

The aim of this study is to evaluate the presence of the enterobacteria responsible for the transmittable zoonotic diseases as well as to evaluate the presence of *Enterococcus faecalis* in dog faeces samples collected from parks in Timisoara, and their antimicrobial resistance.

Out of 60 faeces samples, 34 samples were positive for *Escherichia coli* (56.67%), 28 were positive for *Klebsiella pneumonia* (46.67%), 11 were positive for *Proteus mirabilis* (18.34%), 14 for *Pseudomonas aeruginosa* (23.34%) and 43 were positive for *Enterococcus faecalis* (71.67%). Antimicrobial resistance to various classes of antibiotics was noticed in all the isolated bacterial strains.

Dog faeces from the urban environment may represent an important source of potentially pathogenic microorganisms, both for dog owners and for the regional community, especially children.

Keywords: bacteria, dog, faeces, health

I. MATERIALS AND METHODS

Sixty faeces samples were randomly collected (29 were fresh and 31 were old) from children's parks in Timisoara, during May-June 2017. The samples have been collected respecting the individual safety measures (spatula and single-use gloves), in sterile, plastic containers (sterile collector swab 30 ml). The samples were individualized according to their origins and date of collection.

The samples were processed in the bacteriology laboratory of the Infectious Diseases and Preventive Medicine department from the Veterinary Medicine faculty in Timisoara.

The first step of the process was to make a faecal suspension by adding 5 ml of sterile saline over the faeces samples from the container used for collection and maintaining them in contact at room temperature (25-28˚C), for 20-30 minutes.

The suspension was homogenized through mild manual shaking.

We proceeded to seed special chromogenic culture media-Chromatic Detection (Mikrobiologie Labor Technik) with material from the suspension. The chromogenic media allows the listing and identification of the microorganisms present in the clinical samples. The special content in peptones, tryptones and yeast extracts (source of amino acids and vitamins) in association with sodium chloride (maintains the osmotic balance of the medium) allows the identification of microorganisms based on their colour and colony morphology. After interpreting the results on the Chromatic Detection medium, the characteristic colonies for the enterobacteria as well as *Enterococcus faecalis* were re-cultivated on nutritive broth with ram blood 5%, in order to obtain fresh cultures that are necessary for antibiograms.

After 24 hour incubation, seedings were made from the obtained cultures on the Muller Hinton agar medium using the specific technique Kirby Bauer.

The reaction to antibiotics was tested for all the isolated bacterial strains using the semi-quantitative method, *in vitro*, through the agar diffusion method. The testing of sensitivity towards antibiotics included the following active substances (Liofilschen Italy): gentamicin-CN-10 µg, tetracycline –TE-30 µG, cyprofloxacine-CIP 30 µg, kanamycin-K-30 µg, novobiocin –NV-30 µg, doxicyclin- DO-30 µg, erythromycin-E-15 µg, vancomycin-VA-30 µg, ceftriaxone-CRO-30 µg, cefoxitin-FOX-10 µg, rifampicin- RA-30 µg, lincomycin-L-30 µg, cefaclor-CEC-30 µg, pristinamycin-PT-15 µg and ampicillin/sulbactam-SAM-30 µg. The results interpretation was in accordance with the rules of the producer, by respecting the WHO standard procedures generally accepted by CLSI, CA-SFM and EUCAST (3, 4, 6).

II. RESULTS AND DISCUSSIONS

After interpreting the colonies from the Chromatic detection medium plates, seeded with faeces samples from dogs, we

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have successfully isolated various microorganisms, which are potentially pathogenic for humans.

Out of a total of sixty samples, thirty four were positive for Escherichia coli (34/60; 56.67), 28 for *Klebsiella pneumonia* (28/60; 46.67%), 11 for *Proteus mirabilis* (11/60; 18.34%), 14 for *Pseudomonas aeruginosa* (14/60; 23.34%) and respectively, 43 for *Enterococcus faecalis* (43/60; 71.67%). Most of the enterobacterial strains and most strains of isolated *Enterococcus faecalis,* which were not exposed to the pressure of antibiotics, proved to be sensitive to most of the tested antimicrobial substances. However, multiple resistance phenomena have been encountered.

The strains of *E.coli* proved to be resistant towards gentamicin (52.94%), tetracycline (20.58%), erythromycin (8.82%), kanamycin, rifampicin (5.88%) and a low percentage were resistant to doxycycline, vancomycin and respectively lincomycin (2.94%).

The bacteria *Klebsiella pneumoniae* has shown resistance towards gentamicin (39.28%, kanamycin (14.28%), tetracycline, doxycycline (10.71%), erythromycin and lincomycin (3.57%).

The antimicrobial resistance phenomenon has been also described in the *Proteus mirablis* strains. The resistance was of 27.27% towards gentamicin, rifampicin and lincomycin.

In the case of *Pseudomonas aeruginosa,* we noticed a high resistance towards gentamicin (35.71%), and towards tetracycline and erythromycin (28.57%).

The most frequently isolated bacteria from the dog faeces samples was *Enterococcus faecalis.* In this case, the result of the antimicrobial sensitivity test showed low resistance. It was seen in the case of rifampicin (27.90%), tetracycline (25.58%), doxycycline (23.25%), gentamicin and lincomycin (20.93%).

In the case of novobiocin, pristinamycin, ciprofloxacin, ceftriaxone, cefoxitin, cefaclor and ampicillin/sulbactan, the strains showed 100% sensitivity.

This aspect suggests that the isolated and tested strains have come from animals that have not received treatment with any of the above.

Compared to aminoglycosides (gentamicin, kanamycin) and macrolides (erythromycin and vancomycin) the antimicrobial sensitivity proved different. In the case of gentamicin, we managed to isolate 46 resistant strains (35.58%), 15 strains (11.53%) were resistant to kanamycin and 17 strains (13.07%) were resistant to erythromycin.

Resistance towards tetracycline agents (tetracycline, doxycycline) was mildly increased with 46 strains showing resistance towards this group of antibiotics. The resistance phenomenon in this situation is plasmidic or chromosomal (27 strains resistant to tetracycline and 19 to doxycycline).

The resistance of bacteria usually implicated in infections, such as *Escherichia coli* and *Klebsiella pneumoniae,* has risen in Europe towards all the classes of antibiotics found under surveillance (1, 5, 7).

The emergence of resistance to antibiotics of *E.coli* continues to rise throughout all of Europe regarding both the multiple resistance and resistance towards each antibiotic separately (2, 8, 9).

Dog faeces from the urban environment can represent an important source of microorganisms with a pathogenic potential both for dog owners and for the community, especially children.

III CONCLUSION

In the dog faeces samples collected from the parks of Timisoara, we have isolated various microorganisms, potentially pathogenic for humans such as: *Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Pseudomonas aeruginosa* and *Enterococcus faecalis.*

Dog faeces in the urban environment can represent an important source of microorganisms that are potentially pathogenic for dog owners and for the local community.

Sensitivity towards antibiotics is variable according to the antibiotic group. It was maximal for antibiotics like novobiocin, pristinamycin, ciprofloxacin, cephtriaxone, cefoxitin, cefaclor and ampicillin/sulbactan.

The multiple resistance phenomena has also been identified. Strains of enterobacteria and *Enterococcus faecalis* showed resistance to gentamicin, tetracycline, erythromycin, kanamycin, rifampicin, doxycycline, vancomycin and lincomycin. Most strains were resistant to three or four antibiotics.

Antimicrobial resistance is a complex issue, which implies various bacterial species, resistance mechanisms, transfer mechanisms and reservoirs for these bacteria. Intempestive use of antimicrobials in pets clearly contributes to the selection of antimicrobial resistance and due to the transmission of these genes to human strains; they have become a threat for public health.

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Detection of *Salmonella spp.* with Zoonotic Risk in Household Dog, Stray Dogs and Environmental Impact

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Abstract: Salmonellosis is a disease common to both animals and humans, with a wide geographical spread and natural focus. It is transmitted from animal to human but also inversely, with a high zoonotic risk. The access of salmonella-carrier dogs to parks or green areas is an important source of environmental contamination with infected feces and ensures their permanent presence in the environment. Research has been carried out in 3 counties in the west of the country, and 76 samples of dog feces were analyzed for this purpose. These dogs had access to the public parks in the 5 locations where fecal samples were collected, with the possibility of contamination of the environment. Of the 50 strains of *Salmonella spp*, 38 were included in serogroup B (76%) and 12 in D (24%). Of the 76 samples, other bacteria such as *E. coli* and *Pseudomonas* were also isolated. An alarming increase in the resistance of *Salmonella* strains to common antibiotics has been observed. 50 strains of *Salmonella spp* were isolated from the feces examined, representing 67% positive samples.

Keywords: *Salmonella*, dog, zoonotic risk

I AIMS AND BACKGROUND

Salmonellosis is a common bacterial infection that affects the intestinal tract. Salmonella lives in the intestines of humans and animals. People are most often infected through contaminated food, water and environement, but there is also the danger of them being contaminated by their pets. The incubation period varies between a few hours and two days [1].

Salmonellosis is common to both animals and humans, with a wide geographical spread and natural focus, which ensures the permanent presence of bacteria and sources of infection. It is transmitted from animal to human but also the other way around, with a high zoonotic risk.

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More than 95% of infections with *Salmonella* are transmitted via food. The type of *Salmonella*, usually associated with infections in humans, can be captured from sources such as: Poultry meat, pork, beef, if raw, incorrectly prepared or contaminated with *Salmonella* after preparation.

Rarely from pets: turtles, snakes, lizards, dogs, cats, salamanders, birds and mice [1, 2, 3, 4, 5, 6].

Close contact between dogs and owners (especially in the case of children) can lead to the disease being caused by ingestion of bacteria from non-clinical carriers [1, 7, 13, 20].

Infected feces are an important source of contamination of green spaces and the environment.

In view of these considerations and the epidemiological aspects, the research underlying the study aimed to detect strains of *Salmonella* from dogs, which could be pathogenic to humans, could be an indicator of environmental contamination, and could be an indicator of environmental contamination [8].

II EXPERIMENTAL

The studies were carried out on a number of 76 samples from 5 different environments locations: Deva HD (19 samples), Timişoara (Hospital of USAMVBT and University Veterinary Clinics 16 samples), private shelter AR (22 samples), Dumbrăvita area (9 samples), sheepfold TM 2 (10 samples). The animals tested were fed differently with commercial, household or mixed feed, ranging in age from 2 months to 12 years, and different clinical situations.

Samples were processed according to ISO 6579, within the laboratory of infectious bacterial diseases, within the discipline of Infectious Diseases and Preventive Medicine, at the University of Agricultural Sciences and Veterinary Medicine of Banat [9, 10].

Bacteriological and bacterioscopic examination

Samples were collected directly from the rectum using sterile containers. These were then placed in tubes containing 10 ml of peptone water (non-selective enrichment medium) and incubated for 24 hours at 37 ° C. Samples were then passed to SS medium (this being a selective culture medium)

using a flame-sterilized loop after each use. Plates were incubated for 24 hours at 37 ° C. Possible positive colonies (black, some also having the appearance of cat eyes) were transferred on selective XLD medium (xylose-lysine-deoxycholate) and subsequently on nutrient agar to be stored for a longer period of time [9, 11, 12].

On the aforementioned environments sowings were made from lactose negative colonies taken from the SS environment. After sowing the media was incubated in the thermostat for 18-20 hours after which the interpretation was performed [9, 11, 12].

Subsequently, cultures identified as *Salmonella* were also passed to API 20 E (Analitical Profile Index) galleries, and interpreted according to the methodology [9, 10].

The bacterioscopic examination was performed by taking the colonies with the bacteriological loop and displaying them on a microscope blade

They were then stained using the Gram method and examined under a microscope with the immersion objective (100X).

Interpretation: Gram-positive microorganisms appear in purple-blue color, and Gram-negative bacteria are colored in red [9, 10, 13].

Antibioresistance

The antibiotic resistance profile was performed through the disc-difuzimetric method (Kirby-Bauer method), using the Muller-Hinton medium and antibiotic disks provided by the producing companies, respectively 11 antibiotics: ciprofloxacin (CIP 10), gentamicin (CN 50) , amoxicillin (AM 10), chloramphenicol (C30), enrofloxacin (ENR 5), kanamycin (K), neomycin (N 10), sulfatoxazole (SXT 25), streptomycin (S 10), oxytetracycline 10 [2, 3, 5, 11, 12].

The Muller-Hinton medium was poured into Petri dishes which, after solidification and drying, was inseminated with young cultures from the strains of Salmonella tested. A total of 50 samples were subjected to this test. Sowing was carried out in the turf, and after drying (20 minutes) the disks were placed on the surface of the agar [9].

Interpretation of the results was done according to the European Committee for Antimicrobial Susceptibility Testing (EUCAST). Thus, the diameter of the inhibition zone was measured with the ruler and expressed in millimeters. According to this document, the inhibition zone is an area free of bacterial growth due to the antibiotic inhibitory effect [14].

Depending on the diameter, the results were: sensitive (susceptible), intermediate and resistant.

Serological exam

The serological typing of isolated *Salmonella* strains was performed using the Bio-Rad Antiserum Salmonella kit.

Salmonella colonies and the following commercial antisera were used: Salmonella Polyvalent O antiserum OMA Group A, B, D, E, L, Salmonella Polyvalent O antiserum OMB Group C, F, G, H, Antiserum Salmonella monovalent O: 4.5 Group B, Antiserum Salmonella monovalent O: 6,7,8 Group C, Antiserum Salmonella monovalent O: 9 Group D, Antiserum Salmonella monovalent O: 13,22,23 Group G, Antiserum Salmonella monovalent O: 6,14 , 24 Group H. Antiserum Salmonella

III RESULTS AND DISCUSSIONS

The bacteriological examination performed according to the classical methodology provided the following results: Salmonella species characteristic cultures were obtained.

The research was conducted in 5 environment locations in 3 counties in the west of the country, for this purpose 76 samples were analyzed from dog feces.

Of the 76 samples examined, 50 strains of *Salmonella* spp were isolated, representing 67% positive samples. Of the 76 samples, other bacteria such as *E. coli* and *Pseudomonas* were also isolated.

Because dogs can be an indicator of environmental contamination *Salmonella* strains isolated from dogs are given by harvest in correlation with the type of food.

Table I. Distribution of *Salmonella* strains on locations

Place	**No. samples**	**No strains of *Salmonella* isolated**	**Serogroup D**	**Serogroup B**
HD	19	10	10	0
TM 1	16	15	14	1
TM 2	10	9	0	9
AR	22	14	12	2
TM 3	9	2	2	0
Total	76	50	38	12

Analyzing the data presented in Table I, we can see that 50 strains of *Salmonella* have been isolated, of which 38 were included in serogroup B and 12 in D.

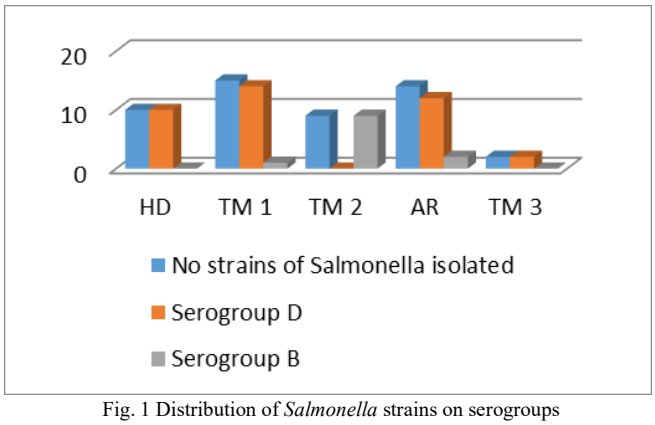

Fig. 1 Distribution of *Salmonella* strains on serogroups

Results of the bacteriological and bacterioscopic examination

On nutritional agar salmonella developed mainly S or R-like colonies similar to other Enterobacteriaceae.

On SS medium, suspected Salmonella colonies developed a black color, an indicator of H_2S production following environmental degradation of thiosulphate [15].

On the XLD medium the colonies were black in the center and showed a slightly transparent halo of red, sometimes pink areas on the medium.

MIU medium (indole urea mobility) is used to simultaneously highlight both indole and urea production and to show the mobility of bacteria. The yellow ones are considered positive and the negative ones are red.

On the API 20E system, isolated strains from dogs showed no deviations of the biochemical behavior characteristic of Salmonella species in which they were included.

The bacterioscopic examination revealed the presence of Gram-negative bacilli without a characteristic disposition.

Antibioresistance results

From the data analysis, we can see that there may be strains resistant to some of the 11 antibiotics used, but that most bacteria are susceptible to ciprofloxacin and enrofloxacin [7, 11, 12].

Results of the serological test

Regarding the detected serovars, we can see that they vary according to the location (Table I and Fig. 1).

In the Deva (HD) canine population predominated serogroup B (100%), serogroup D (100%) predominated in the sheepfold (TM 2), from the dogs in Arad both serogroup B (85,7%) and serogroup D (14.3%) were isolated.

Analyzing the results of the serogroups, it is noted that there are differences between the examined sites in the environmental. These differences are generated by several factors found in those locations, with sampling of the feces. The factors are: environment, accommodation conditions, age, immunological status, food and how it is prepared.

Dogs that eat household food are therefore likely to be *Salmonella* carriers. Of the 50 positive samples, 23 (44%) of these were from dogs with an exclusively domestic ratio, 22 (46%) of them had a mixed ratio, and 5 (10%) of the dogs were exclusively fed with commercial food [11, 16, 17].

The results have revealed that in canine populations in Romania there are serogroups with pathogenic potential for humans. As we have the goal has been to detect *Salmonella* strains and their frequency. Thus, the lowest percentage of carrier animals was found in the Dumbrăviţa (TM 3) area (28%). Being only part of serogroup B.

At the same time, differences in frequency of infectious serogroups were also revealed, with the following values: 76% of serogroup B and 24% of serogroup D.

The results obtained by bacteriological investigation confirmed the spread of *Salmonella* bacteria in the canine population and the existence of some of the strains with high resistance to a wide range of antibiotics. These results, even if provided by bacteriological exams, on a small number of dogs, can be correlated with the results reported by other authors [3, 11, 12, 18].

Some studies were conducted on 352 dogs. Of these, only 75 (21.3%) were identified as carriers. The presence of *Salmonella* typhimurium, *Salmonella Heidelberg* or *Salmonella Poona* was found [12, 15].

Following a study of 125 dogs from 5 regions of Aba (Nigeria) managed to detect only 16 dogs carrying *Salmonella*. All strains were susceptible to ciprofloxacin [12].

In the specialty literature claim that dogs can be carriers of 53 *Salmonella* serotypes. Simultaneous infection with 2-4 serotypes was observed.

The prevalence can be up to 27%, and the most common isolates are *S. typhimariun* and *S. anatum* [5, 6].

Following a study of 119 dogs in the city of Maiduguri, received 52 positive *Salmonella* samples. This shows a prevalence of 43.7% from the samples as positive [12].

These data confirm the risk of contamination of humans with different *Salmonella* serovars from environment and also non-clinical carrier dogs, and at the same time draws attention to the importance of sterilizing their food and using antibiotics only after an antibiogram has been performed.

IV CONCLUSIONS

Using a classical method of isolation of *Salmonella* bacteria we managed to isolate these bacteria from the canine faeces, can be arrived in the environment.

We were collected from environment (5 places in 3 county) 76 samples of dogs feces examined, 50 strains of *Salmonella* spp were isolated, representing 67% positive samples.

Of these strains, 22 were isolated from dogs with household ration, 23 from mixed food, and 5 strains from dogs with a commercial ration.

Of the 50 strains of *Salmonella spp*, 38 were included in serogroup B (76%) and 12 in serogroup D (24%).

Salmonella spp. strains and the frequency encountered in our research, as a high percentage of the strains were resistant to Amoxicillin (100%), Amoxiclav (78%), Neomycin (96%), Cotrimoxazole (76%), Gentamycin (66%), Oxitetracycline (84%).

A noteworthy increase in the resistance of *Salmonella* strains to common antibiotics may also be observed. The access of *salmonella*-carrier dogs to parks or green areas is an important source of environmental contamination with infected feces and ensures their permanent presence in the environment.

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Physicochemical Analysis of Honey Samples Collected From Local Markets of Tirana, Albania

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Abstract: The present study was carried out to determine the quality and authenticity of honey samples of local and imported brands available in Tirana markets. Physicochemical analysis of these samples were carried out in accordance with Harmonised Methods of the International Honey Commission (Bogdanov et al. 1997, updated in 2009) and for Free Acidity AOAC 962.19 method was used. The sugar profile of honey was determined by high performance anion exchange chromatography (HPAEC) with pulsed amperometric detection (PAD). The results obtained were compared with *Codex Alimentarius Commission (CODEX STAN 12-1981)* and European Union Council Directive (2001/110/EC). The ranges of different parameters are: moisture 11.1-18.57%, Electrical Conductivity 0.09-0.79 mS/cm, pH 3.37-4.58, Free Acidity 10.1-31.5 meq/kg and 5-hydroxymethylfurfural (HMF) 12.61-663.58 mg/kg. The most abundant sugars were fructose, glucose and sucrose, whereas two samples exhibit maltose concentration higher then 5g/100g. Generally the samples are within the limit values of standard of honey, except HMF values which the samples present high amounts, and specifically the samples M9 and M11 have respectively 638.7 and 663.58 mg/kg HMF, and of course in these samples the diastase activity is absent. The high values of HMF (over 500 mg/kg) and the absence of diastase activity, it is an indication of adulteration of honey with invert syrup. Also sugar profile confirmed such behavior i.e. content of sucrose and maltose were also above. In addition the influence on the health was examined. High disaccharides concentration doesn't have direct negative influence, on the other hand high HMF concentration can be very dangerous to human health. This compound is cancer genic and prolonged exposure of high amounts can produce development of diseases such as liver and kidney failure, diabetes and development of various types of cancers.

Keywords: Authenticity, adulteration, HMF, carbohydrates.

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I. INTRODUCTION

Honey is a complex mixture of various substances, and its composition depends on both botanical and geographical origin, as well as anthropogenic factors. The accurate identification of honey origin guarantees the satisfaction of consumers' needs and has an impact on the honey market value. Physicochemical parameters, some of which are used in routine analysis of honey quality, could be useful for the assessment of its origin [1]. According to Codex, Honey is defined as: "the natural sweet substance produced by honey bees from the nectar of plants or from secretions of living parts of plants or excretions of plant sucking insects on the living parts of plants, which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in the honey comb to ripen and mature"[2]. The European Directive 2001/110/EC defines honey as "the natural sweet substance produced by Apis mellifera bees" differentiating it by this way from the honey that is produced by other species of bees: *Micrapis, Megapis, Meliponines* [3], [4]. Thanks to its high nutritive value, as well as its pronounced antibacterial and antioxidant properties, honey has been used since ancient times as both food and medicine [5]. Chemically, honey is a concentrated aqueous solution of various sugars, mainly fructose and glucose, but it also contains other mono-, oligo-, and polysaccharides. Apart from sugars, honey contains a complex mixture of amino acids, proteins, organic acids, minerals, phenolic acids, flavonoids, and other phytochemicals; in a word, a few hundred substances. Some of these chemicals originate from the nectar of plants, others are added to the honey by bees, and some are the products of honey ripening [6]–[8].

The analytical characterization of honey in order to verify its botanical and/or geographical origins or to detect adulteration has been a long-time scientific preoccupation. Because the authentication of honey guarantees its quality and economic value, as well as many other properties, it is extremely important to determine accurately the origin of honey [9]. Recently, there is a worldwide increasing demand by consumers to natural foods and foods claimed to enhance human health. Honey has a priority in this concern as it

contains oligosaccharides beside a wide range of other valuable nutrients [10]. The quality and authenticity of honey is generally evaluated by physicochemical analysis of its constituents. These constituents influence the storage quality, granulation, texture, flavor and the nutritional quality of the honey. The International Honey Commission (IHC) has therefore proposed certain parameters as quality criteria for honey. These parameters include: moisture content, electrical conductivity, reducing sugars, sucrose content, enzyme activity, free acidity and 5-hydroxymethilfurfural (HMF). Most of the honey sold in grocery stores is not raw/processed/packed. In some cases it has been heated to kill any bacteria that might be present in it and to extend it shelf life, or to stop crystallization. Honey is a precious food and the enzymes in it are sensitive to heating. They are destroyed by the heat-treatment and render the honey unhealthy. The levels of enzymes present in honey and the concentration of HMF are assayed and used as a guide to honey quality and authenticity. The enzymes in honey (invertase, glucose oxidase, diastase, etc.) come from the bees, or from the plant where the bee foraged [11]. They are present in very small quantities, but may still have a nutritional importance in the human diet. The enzymes are very sensitive to overheating (above 35°C) or storage at too high a temperature. Because they are destroyed by heating, a low enzyme activity and a high amount of HMF may mean that honey has been heated.

A value of HMF above 200 mg/kg should be considered as possibly adulterated [12] and the absence of diastase activity, it is an indication of adulteration of honey with invert syrup. Most of the people are unaware about the quality of honey they consume. As a natural product with a relatively high price, honey has been for a long time a target for adulteration. Correct beekeeping practice ensures that sweeteners used to feed bees should not adulterate honey. This implies improper feeding of sugar during the honey flow or addition of sugars to honey. The following sweeteners have been used: acid inverted sugar syrups, corn syrups, syrups of natural origin such as maple, cane sugar, beet sugar, molasses, etc. In recent years, there has been a major adulteration problem in the world, concerning mainly Chinese honey. Presently these sweeteners are mainly bee feeding syrups, produced by the hydrolysis of maize, cane and beet sugar [13]. It is important to do the quality testing of commercial honey due to increasing problems related to adulteration and tampering with natural honeys sold in the market. Therefore a study was designed to test the quality of commercial honey available in the market for comparison with International Honey Standards to get a useful data for the honey consumers.

II. MATERIALS AND METHODS

The present study was carried out in the laboratory of Center of Excellence for Molecular Food Sciences, Faculty of Chemistry, University of Belgrade, Serbia. The study was designed to explore the quality and authenticity of 11 honey samples purchased from local markets in Tirana, Albania. Honey samples were analyzed for moisture, electrical conductivity, pH, free acidity, sugar profile, HMF, and diastase activity present in honey according to Harmonised Methods of the International Honey Commission [14] and for Free Acidity **AOAC 962.19** method was used. The sugar profile of honey was determined by high performance anion exchange chromatography (**HPAEC**) with pulsed amperometric detection (**PAD**).

III. RESULTS AND DISCUSSIONS

The results of physicochemical analysis of 11 honey samples collected from the local market of Tirana, Albania are given in Table I. All of 11 samples were tested for moisture, electrical conductivity, pH, free acidity, HMF, diastase activity and sugar profile.

Table I: Physicochemical analysis of honey samples

Sample	Moisture (%)	EC at 20°C (miliS/cm)	HMF (mg/Kg)	Diastase DN	pH	Free Acidity (meq/kg)
M1	14.98	0.24	33.62	11.25	4.02	15
M2	11.11	0.24	93.28	4.03	4.15	19.5
M3	18.57	0.45	59.92	4.72	4.2	21.5
M4	18.34	0.52	12.61	48.38	4.27	26.5
M5	15.2	0.29	14.94	8.73	4.17	10.42
M6	16	0.15	77.18	n/a	3.5	16.67
M7	15.73	0.15	101.64	n/a	3.49	16.42
M8	16.63	0.79	41.13	11.41	4.58	31.5
M9	16.98	0.15	638.97	n/a	3.37	20.5
M10	17.85	0.35	22.78	12.93	4	22.5
M11	17.81	0.09	663.58	n/a	3.91	10.1

The results of different parameters of all the honey samples collected, were compared with the Codex Alimentarius (CODEX STAN 12-19811) and European Standards (2001/110/EC) [2], [3]. It was observed that moisture, pH, acidity, reducing sugars and electrical conductivity are within the normal ranges. As it is shown in the table, 7 market samples have HMF amount above 40 mg/kg, and samples **M9** and **M11** have respectively **638.7** and **663.58** mg/kg HMF, and of course in these samples the diastase activity is absent. Even in the samples **M6** and **M7** (which show HMF amount above 40 mg/kg) the diastase activity is absent. The maximum limit for HMF in honey is set 40 mg/kg (with a higher limit of 80 mg/kg for honeys originating from tropical regions) to ensure that the product has not undergone extensive heating during processing and is safe for consumption [2], [3]. HMF and diastase enzyme values of honey are quality criteria for testing and as index of heat treatment and prolonged shelf life of honey. The excessive heat treatment during processing of honey or prolonged storage above 27°C lowers the diastase and increases the HMF. Values of HMF around 500 mg/kg are considered to be conclusive proof of the presence of acid invert syrup in honey [15]. The levels of diastase activity and HMF are used as a guide to honey quality and authenticity. HMF is a cyclic aldehyde produced by sugar degradation through the Maillard reaction (a nonenzymatic browning reaction) during food processing or long storage of honey. The presence of simple sugars (glucose and fructose) and many acids, as well as minerals, in honey can further enhance the production of this substance [16].

Diastase usually exceeds 25 DN in fresh unprocessed samples while HMF is virtually absent or very low. The higher values of HMF found in fresh, unprocessed samples were 10 to 15

mg/kg. Diastase is inactivated and HMF is formed when honey is heated for processing and blending. Both changes occur also during storage. When the diastase drops below the limit of 8 DN or HMF exceeds 40 mg/kg, the quality of honey is considered as degraded and the product should be designated as baker's honey. Diastase and HMF are also used to detect adulterated honey by excess feeding with syrup since diastase activity decreases dramatically and HMF remains unchanged [4].

The analysis of sugars showed that the most abundant sugars were fructose, glucose and sucrose, whereas two samples (**M9** and **M11**) exhibit maltose concentration higher than 5g/100g. Concentration of maltose and sucrose higher than 5g/100g in few samples. Also there was correlation of sugar profile and high HMF and low diastase activity which could be the evidence of adulteration of honey samples with invert or corn syrup.

IV. CONCLUSION

Through this work it is evident that the physicochemical analysis in routine work can serve as a key point in judging for the quality and authenticity of honey. In addition sugar profile could be also used as screening method for honey authenticity.

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Highlights on hiking trails presented in ecotourism products: the case of Creasta Cocosului protected area

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Abstract: (Creasta Cocosului - Mara Cosau Valley is one of the first Romanian ecotourism destinations, designated by the Ministry of Tourism in 2014. Nevertheless, eco-tourism activities have a longstanding history, since the area is covering seven important nature preservation sites and traditional villages, with marked hiking trails along 30km in mountain environment and 46km around the villages. Basic ecotourism services are mostly managed by the association leading the project (Ecologic Maramures), WWF, travel agents and private mountain guides. This variety of economic and environmental stakeholders triggered a differentiation in communication patterns on the features of the hiking trails. Therefore, this paper looks at the relevance of the information and the subsequent discursive highlights. The research design is organized around participant observation, field research and content analysis on the main outputs: maps, websites, travel blogs and official publications. The result is an in-depth analysis on the features of hiking trails in the study area, with focus on the concepts used to enhance tourists' experience.

Keywords: : eco-tourism, protected area, Creasta Cocosului, hiking trail

INTRODUCTION

Creasta Cocosului - Mara Cosau Valley located in the Northern part of Romania, in Maramures, it is one of the first Romanian ecotourism destinations, designated by the Ministry of Tourism in 2014. Nevertheless, eco-tourism activities have a longstanding history, since the area is covering seven important nature preservation sites and traditional villages, with marked hiking trails along 30km in mountain environment and 46km around the villages (Fig.1). The region is unique due to its natural and cultural features. The relief is molded on a volcanic area, Creasta Cocosului (The Rooster's Ridge or Cock's Comb - in loose translation) being the most prominent site. Moreover, from cultural perspective it forms the mountainous part of Maramures Land's traditional villages along two main valleys – Mara and Cosau, favoring the development of integrated tourism products.

Basic ecotourism services are mostly managed by the association leading the project (Ecologic Maramures), WWF- World Wide Fund for Nature (www.wwf.ro), travel agents and private mountain guides. The first is also designated as custodian of the protected areas in Gutai and Ignis Mountains, responsible for the management of the sites and the hiking trails. As consequence, the monitoring of these hiking trails could be used as tool for lowering the tourist pressure as well as to enhance tourists' experience.

On the other hand, the discourse on the protected area revolves around the main features of the attractions along the marked trails. That is why the main research objective is to trace different communication patterns about the hiking trails in order to substantiate the relevance of the conveyed information.

DATA AND METHODS

Given the research objectives, this study is organized in three sections: technical analysis on the marked hiking trails using GPS tools and participant observation (Table I.), comparative analysis of the available maps (Table II.) and content analysis (and related interpretation models) on presentation texts (Table III). Field research and participant observation was also used to determine the effect of several discursive patterns, including one model provided by the research team. QGIS and Google Earth™ were used in spatial and network analysis.

Conversely, we conducted an adapted content analysis on a number of seven official websites which features hiking trails as text, photographs and maps, a series of 14 travel blogs with post on personal bloggers' experience on these trails. Ultimately we confronted them with social media posts and the available tourist maps. However, due to the relatively small amount of

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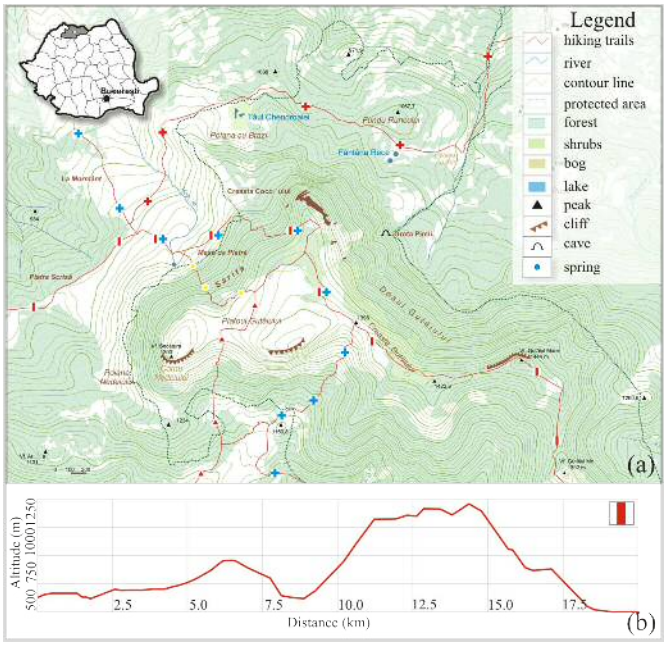

Fig. 1. Study area: Creasta Cocosului natural reserve with marked hiking trails (a) and one longitudinal profile (b).

reading materials, we lightly used machine coding software in the first stage of the content analysis (GATE – General Architecture for Text Engineering, an open source product featuring Romanian).

Consequently, a wide range of data was retrieved and organized according to a geodatabase model. Spatial and textual data derived from existing cartography products for the study area was included. The result is an in-depth analysis on the features of hiking trails in the study area, with focus on the concepts used to enhance tourists' experience.

RESULTS

The discourse on hiking trails has its aim and scope, usually to enhance visitor number or to draw attention on the carrying capacity. Printed or online guidebooks describe the features of the marked trails using a specific pattern which ranges from a very technical voice (with data on difficulty, length, checkpoints, GPS info, etc) through a more poeticized narrative (filled with figures of speech, images and stories). Therefore, within this study we tackled a set of websites, blogs, social media posts and recent maps using content analysis in order to describe the features of communication and to make inference on the consequences of communication. The entire coding and decoding process was based on the concepts used in experience design, as outlined by Pine and Gilmore's experience realms [1]: absorption-immersion and passive-active approach, also determining the shifting point between them.

A. Technical analysis of a marked hiking trail

The hiking trails considered for technical analysis are the official marked paths, presented on the protected area's website and replicated along other sites and blogs. The concepts were tackled according to the model detailed in Table I.

Table I.

Concept	Method	Reference
Trail design	Least cost path Network analysis Trail slope extraction	**Anna Petrasova et al. 2018 [2]** **Laura Tirla et al. 2014 [3]**
Hikability	'Hikability' or practicality Natural interest Park management	**Jesús Vías Martínez, Carmen Ocaña Ocaña 2014 [4]**
Mobility patterns	**Trail network** **Stop places - Candidate nodes** **Edges - Patterns tracing algorithm**	**Lera I. et al. 2017 [5]**
Technical information	80% trailheads, 4-5 intermediate points, type of signage, duration and length	**Slows preparation process**

B. Comparative analysis of the messages conveyed via tourist maps

A tourist map is an excellent graphic message conveyer, depending on the layout, content, mapping techniques and visualization. That is why the maps were studied through content analysis, being both the message and the channel (Table II).

Table II. Abductive inferences based on content analysis for the printed maps

Layers	Features	Inference
Base map	75% terrain contour lines with forest area 25% shaded relief with contour lines and vegetation	**Image of flat land, ignoring/hiding steep slopes (over 12^0)**
Marked trail depiction	100% continuous red(ish) lines and icons for the marks	**Even difficulty, undifferentiated paths, boring, unsuitable for active tourism**
Attractions	Toponymy: 4-5 mountain peaks with elevation (in m), 3-7 local place names, Shape: protected area delineation, general forested areas, administrative units Point feature: 12-20 pictograms including natural and cultural features	**Strong resemblance to a topographic map, unstructured cartographic information**

	10% >5 intermediate points 1% difficulty and GPS coordinates attached	
Poetic text	**100% combine lacunar technical information on the trail and poetic text about some attractions outside the paragraphs describing the path.**	**Unattractive/Nice place but weak communication and marketing**

C.Content analysis on textual presentation of trails

K. Knipperdorf's [6] framework for content analysis offered the foundation for the most important highlights on the hiking trails. The method was applied to a body of texts describing the trails, available on-line and in printed form for the study area using GATE 8.5. Results are synthetized in Table III.

Table III. Highlights on hiking trails based on textual data content analysis

Stages	**Highlights**
Unitizing scheme	**Texts describing the hiking trails**
Sampling	**official websites**
	blogs
	social media posts
	GPS tracks with comments
	printed guides
Coding instructions	**for:**
	Experience design
	Emotions conveyed
	Warnings
Manageable representations	**Passive-active immersion**
	Figures of speech
	Warnings
Abductive inference	**No information on difficulty renders the hike risky.**
	Relevant stops naming – peaks, iconic place names, fantasy, could add to the experience.
	Photo, video, map and GPS content could interfere with the decisions on trajectory, length and type of activity.
Discursive conventions	**Undifferentiated texts, one-suits-all regardless of the type of tourism product to rich a wide audience.**
	High similarity across websites and publications.
	Weak correlation with the importance of the panoramic views.
	Emotions are conveyed through added media content and personal experience recorded on blogs and social media.

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Analysing indoor museum air quality implications: Case study of Sălacea Museum House in Romania

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Abstract: This study appraises the indoor air quality of museums and its consequences for visitors and museographers in the Romanian context. Using the Salacea Museum House located within the Bihor County as a case study, the broader aim was to determine this associated health risks, while making recommendations for better preservation of the important heritage elements/products found within the Museum. Consequently, the study employed multiple techniques to analyze the microclimate, by way of monitoring air and fungi related activities between 03.06.2018 - 02.07.2018. For temperature and humidity monitoring, we used data function logger Klimalogg Pro (nine sensors), Investigations of the diversity of fungi were made in the inside air of the museum house. The fungal contamination was determined using the conventional techniques of open plates called Koch sedimentation method. Based on the microscopy analysis of fungi isolated colonies the conidiophores and conidia fungal structures were examined with the Optical Microscope (Optic 40X). The fungal structures identified included: Geotrichum sp., Cladosporium sp., and Alternaria sp. The analysis of the results obtained further indicates that the space reserved for the preservation of cultural goods does not fully meet the fundamental conditions necessary to promote quality microclimate. Thus, the study advocates the need for the designing and implementation of a systematic monitoring mechanisms to ensure proper ventilation of the space for better air quality.

Keywords: microclimate, fungi, museum house, cultural heritage, Romania

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INTRODUCTION

The study proposes the microclimate monitoring inside of the Museum House Sălacea, Romania in the period 03.06.2018 - 02.10.2018. For temperature and humidity monitoring, we used data function logger Klimalogg Pro, for other parameters: Oxigenometer Extech SDL150; Luxmeter data logger Extech SDL400 and Piranometer digital Voltcraft PL-110SM. The fungal contamination was determined using the conventional techniques of open plates called Koch sedimentation method. The fungal structures identified were: Geotrichum sp. [1], Cladosporium sp. [2], and Alternaria sp. [3, 4]. Based on the obtained results, were analyzed the quality of air inside the museum related to potential risk to human health: locals, visitors and museographers etc.

LITERATURE REVIEW

The microclimate investigation was realized in Romania with special view on historical heritage [5, 6, 7, 8, 9, 10, 11, 12, 13]. Similar studies for some heritage buildings from the world were done for Modern Museum Building, The Sainsbury Centre for Visual Arts, Norwich, UK [14]; Emperor Qin's Terra-Cotta

Museum, Xi'an, China [15]; Havana (Cuba) [16]; Capodimonte Museum, Naples (Italy) [17]; Tagore's residence, India [18] etc.

METODOLOGY

For temperature and humidity monitoring, we used data function logger Klimalogg Pro (nine sensors), for other parameters: Oxigenometru Extech SDL150; Luxmeter data logger Extech SDL400 and Piranometer digital Voltcraft PL-110SM. Inside the museum house for isolation of fungi air, sampling techniques were used. The fungal contamination was determined using the conventional techniques of open plates called Koch sedimentation method. Based on the microscopy analysis of fungi isolated colonies the conidiophores and conidia fungal structures were examined with the Optical Microscope (Optic 40X). The cartographic materials were processed using softs 3D Studio Max, Corel Draw and Corel Photopaint.

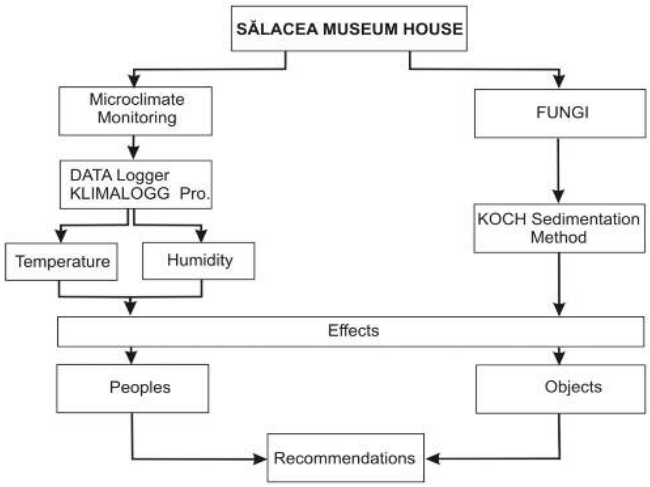

Fig. 1. Investigations regarding indoor air quality inside of Museum House Salacea, Romania

CONCLUSION

The obtained results indicate that the space reserved for the preservation of cultural goods does not fully meet the fundamental conditions necessary to promote quality microclimate. The colonization from fungi bacteria of materials air inside the museum can present a potential risk to human health. It imposes the need for the designing and implementation of a systematic monitoring mechanisms and to ensure proper ventilation.

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Mapping and spatial analysis of windthrow in the Gutâi Mountains, Romania: the case of the extratropical storm from 17.09.2017

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Abstract: gusts are considered the most important natural hazardous agent to European forests by volume of damage resulted during extratropical and convective storms. During most of these meteorological events forests stands are damaged by windthrow. Landform height and morphological complexity can significantly drive storm and wind conditions, tampering parameters such as wind speed and direction. The study focuses on two forest sites in the Gutâi Mountains (Maramureș County, Romania) that were affected by the extratropical storm that hit north-western Romania on 17 September 2017. The methodological framework highlights three essential stages: (1.) the field measurements, observations and mapping of the main geographical features, as well as the forestry damage in the two investigated areas; (2) detailed cartographic representations (scale 1:10.000) of the registered spatial data highlighting overthrown and severed trees by specie; (3) the interpretation of resulted cartographic materials compared to the scientific evidence concerning windthrow dynamics in a complex terrain.

Keywords: mountain terrain, forest stand, extratropical storm, windthrow, cartographic representations

INTRODUCTION

Windthrow represents the main risk factor for forestry and human made stands during high intensity storms and landforms can exacerbate this risk. *Terrain ruggedness* can significantly alter storm behavioural parameters when crossing topographic obstacles, increasing wind speed and implicitly, the eolian stress across land surfaces [1].

The main objective of the study is to validate *literature based assertions* regarding the influence of landform traits on the resilience capacity of forestry stands during violent storms by investigating two sites located in the Gutâi Mountains, in the aftermath of a storm that swept the north-western part of the country on 17 September 2017.

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A. Storm description

The 17 September 2017 derecho type storm had its origin in
a low pressure zone formed over the Adriatic Sea. Pressure maps provided by Mett Office thoroughly present the development of a cyclone formation that crossed northern Serbia and western and northern Romania, heading towards Ukraine. The low pressure system „was driven by a broad trough in the upper levels, evolving into a large cut-off low" (https://software.ecmwf.int/wiki/display/FCST/201709+-Wind gusts+-+Serbia+Romania#app-switcher).

The severe convection along the cold front and the rapid temperature drop in just a couple of hours produced a substitution of air masses and winds of up to 100 km/h.

B. Study area

The two investigated mountain sites, of *1250 ha each*, were choosen based on field observations shortly in the aftermath of the storm. The two sites are located in the Gutâi Mountains, Oriental Carpathians, and just 7 km apart, being traversed by two important roads that connect the Land of Maramureș to Transilvania over the Gutâi Pass (978 m) in the west and the Neteda Pass (1054 m) in the east.

THEORETICAL FRAMEWORK

The literature review concerning damages produced by windthrow to forests in Europe [1-11] and Romania [12] in the aftermath of extratropical and convective storms highlights several valuable statements regarding the effects of landform height and morphological complexity on forestry resilience.

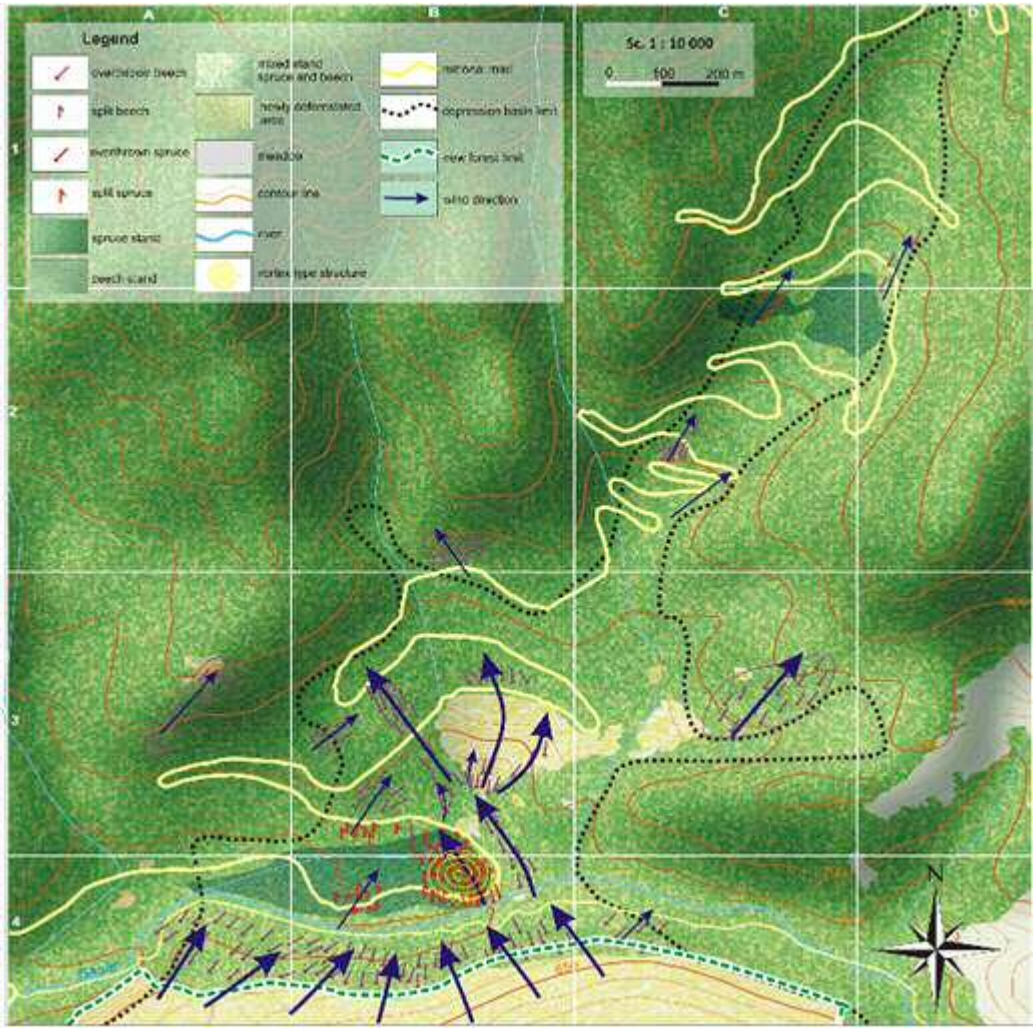

Fig. 1 Mapping storm impact on the site GUTÂI WEST

Table I Landform and forestry stands' features which determines the altering of storm behavioral parameters, based on literature review

landforms and morphology characteristics

1.topography – especially *mountain passes* and *wind exposed slopes* - influences the magnitude, profile and wind speed in the adjacend atmospheric layer [6,13]

2. wind channels on the main valleys, thus tributary and secondary valleys are less likely to be affected by windthrow [7].

3. the forestry stands located on the upper side of a wind exposed slope are less resilient to windthrow [14].

4. the forestry stands located on the upper, opposite side of a wind exposed slope are more resilient to windthrow. The lower side of the same slope becomes less resilient as windgusts can be active in these areas [14].

5. stand damage is high on a wind exposed, low gradient slope [13].

forestry characteristics

6. spruce species (ex. *Picea abies*) are up to 3 times more vulnerable to storm damage than beech species (ex. *Fagus sylvatica*) [14].

7.

low tree density can decrease the probability of whirl like wind movement [14].

8. windthrow probability is a function of the stand's slenderness coefficient [14].

METHODOLOGICAL FRAMEWORK

The methodological framework was formulated as to provide new information by combining the above literature review assertions with the corresponding spatial data of the two mountain sites. The proceeding can be summarized as follows:

A) The field stage – two field trips for in situ observations:

- assessment of landform characteristics;
- determination of rock types / sampling soil;
- assessment and mapping of recently deforestated areas (the last 5 years);
- assessment and mapping of downed trees;

** using GPS devices, electronic and classic compasses;

- tree allometry data collection;
- photographies;

B) Descriptive mapping – representing the main field findings over the base layers (DEM, infrastructure and hydrography)

- textured polygons representing vegetation types;
- textured polygons representing deforestated areas;
- symbols representing tree species, stand allometry

and density;
- markers representing detailed landform characteristics;
- markers representing vegetation discontinuities;

C) Mapping the storm impact on the forest stands
- symbols representing overthrown trees;
- symbols representing broken trees;
- markers and vectors representing wind speed and direction;

RESULTS

An interpretative approach was made based on the literature findings (Table 1) and the cartographic material (Fig. 1,2). For clarity, the findings are presented as a comparison between the two investigated sites.

Table II Assessment of windthrow effects in site A – GUTÂI WEST

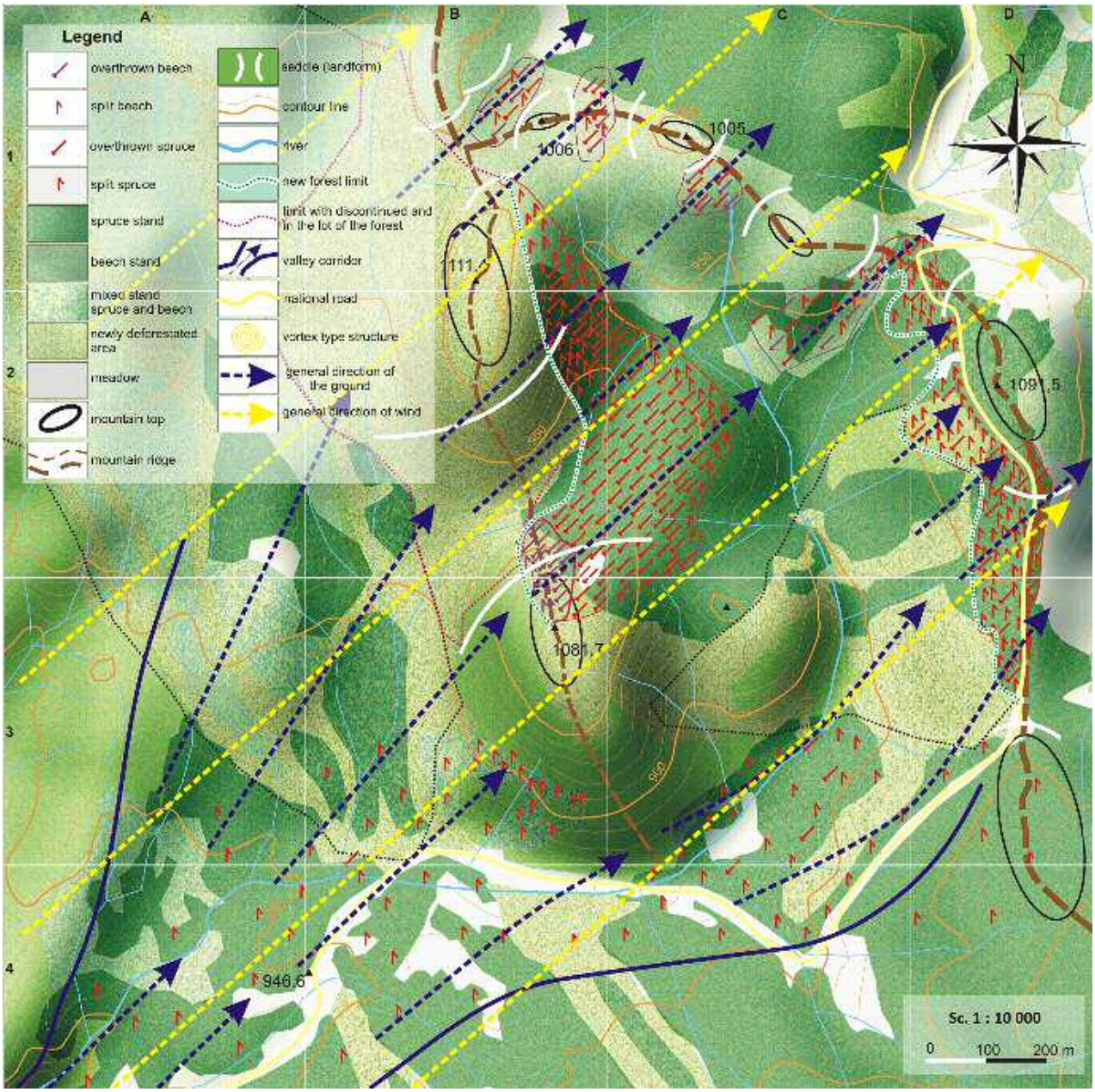

Fig. 2 Mapping storm impact on the site GUTÂI EAST

and site B – GUTÂI EAST

landforms and morphology characteristics

A – site GUTÂI WEST | B – site GUTÂI EAST

1.topography – especially mountain passes and wind exposed slopes - influences the magnitude, profile and wind speed in the adjacend atmospheric layer [6,13]

✓ ✓

in both sites, damages have been recorded especially on the SW-NE^{ern} valley corridors. Fewer damages were registered on the valleys oriented N-S and E-W.

- wind channeling produced forestry damages thourgh the saddles of the main ridge (ap. 1000 m altitude) without affecting the hillocks
- the high gradient slopes (over 60^{o}) connected to deforestated, low gradient slopes have been severely affected by windthrow, especially on the first 20-30 m.

2. wind channels on the main valleys, thus tributary and secondary valleys are less likely to be affected by windthrow [7].

✓ ✓

the wind channeled through the main valley and selectively severed spruce trees at a height of ap. 20 m

wind didn't produced damages on the tributary valleys of Săsar river.

wind didn't produced damages on the tributary valleys of Cavnic river.

3. the forestry stands located on the upper side of a wind exposed slope are less resilient to windthrow [14].

- ✓

the main ridge is wind exposed and the main affected areas are located at around 1000m altitude.

4. the forestry stands located on the upper, opposite side of a wind exposed slope are more resilient to windthrow. The lower side of the same slope becomes less resilient as windgusts can be active in these areas [14].

✓ -

the damaged stands are located on the lower western slope of Mogoșa hillock. The eastern slope is generally wind exposed.

the main forestry damages were mainly recorded in the upper sectors of the wind exposed slopes of the main ridge.

5. stand damage is high on a wind exposed, low gradient slope [13].

✓ ✓

the main affected area is located centrally in a flat depression on the upper course of Săsar river.

in this area the homogenous spruce stand was overthrown completely.

the main affected areas were the ridge saddles and the flat surfaces located behind them.

in one sector, the spruce stand was completely overthrown.

forestry characteristics

6. spruce species (ex. Picea abies) are up to 3 times more vulnerable to storm damage than beech species (ex. Fagus sylvatica) [14].

✓ ✓

the spruce stands are situated at lower altitudes than usual.

spruce trees have been severed.

spruce root systems are less resistant.

7. low tree density can decrease the probability of whirl like wind movement [14].

✓ -

the high density of the spruce stand from the central flat depression of site GUTÂI WEST enhanced the effects of the whirlwind – all trees have been overthrown / severed.

8. windthrow probability is a function of the stand's slenderness coefficient [14].

✓ ✓

the slenderness coefficient of the overthrown trees is between 42-63.

CONCLUSIONS

The study emphasises a series of literature findings on landform influence and forestry resilience during high intensity, extratropical storms through a comparative analysis of two mountain sites that were afected by storm of this type on 17 september 2017. The literature findings formed the basis for the field observations and in situ validation that were conducted in the aftermath of the storm. The field data were represented cartographycally in order to analyse and understand the spatial patterns of wind gusts in these two particular cases.

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Influence of the solar irradiance variability on a direct-coupled PV water pumping system

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*corresponding author

Abstract: Water pumping is one of the simplest and useful application of a photovoltaic system. In this paper the influence of the solar irradiance variability on the performance of a direct-coupled PV water pumping system is discussed. The study was conducted on data collected from a fully monitored direct-coupled photovoltaic water pumping system, operating in real meteorological conditions on the Solar Platform of the West University of Timisoara, Romania.

Keywords: renewable energy, photovoltaics, solar irradiance, water pumping.

INTRODUCTION

A photovoltaic (PV) water pumping system consists of a water pump powered by a stand-alone PV generator [1]. Generally, its aim is to elevate ground water in a storage tank. Certainly, the direct coupling of a PV module to a DC water pump is the most reliable low-cost system [2]. In the last two decades there was a constant interest in modeling of such direct-coupled PV pumping systems [3-4].

During the Spring-Summer of 2013, an extensive experiment consisting on completely monitoring of a direct-coupled PV water pumping system was conducted on the Solar Platform of the West University of Timisoara, Romania (http://solar.physics.uvt.ro/srms). Figure 1 presents the schematic of the experimental setup developed during this experiment. A three-chamber diaphragm pump SHURflo 2088-403-144/ was powered by a PV module FVG90M with the nominal power of 90W. The resistor R limits the current, aiming to protect the pump. In principle, water is pumped from a tank (say tank A) to another tank (B), located at a height of 4.5 meters. From the bottom of the tank B water flows back to tank A due to gravity [5]. Measurements of all parameters (radiometric, electrical, and meteorological) were performed simultaneously at equal time intervals of 15 seconds, 24/7. Several studies were conducted on basis of data collected during this experiment (modeling the cumulative volume of water pumped [5], linking the pumped water flow rate and the incoming total solar irradiance [6]).

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This paper reports results of investigation the database collected in 2013 from a different perspective: the relationship between the daily volume of water pumped and the solar radiative regime.

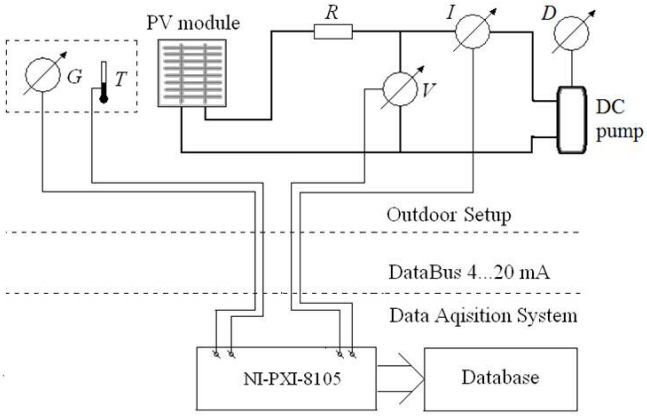

Fig. 1. Schematic of the experimental setup: The pyranometer G measures solar irradiance on the PV module surface. T is thermal sensor for measuring the environmental temperature. D is a standard flowmeter. (after [5,6]).

RESULTS AND DISCUSSIONS

A.Data

Global and diffuse solar irradiances recorded for five months, from 25/04/2013 to 30/09/2013 at 15 seconds resolution, were post-processed. Two parameters were computed: the sunshine number *SSN* and the sunshine stability number *SSSN*. *SSN* is defined as a time dependent binary variable stating whether the Sun shines or not. *SSN* can be computed from the WMO sunshine criterion [7]:

$$SSN_t = \begin{cases} 1 \text{ if } (G_t - G_{d,t}) / \sin h_t > 120 \text{ W/m}^2 \\ 0 \text{ otherwise} \end{cases} \quad (1)$$

where G_t and $G_{d,t}$ denote the global and diffuse solar irradiance at time t, respectively, and h_t is the Sun elevation angle. The daily average value of *SSN* equals the daily relative sunshine, a parameter measuring the sunshine duration in a day, as fraction of the day length. *SSSN*, also a binary parameter, counts the switching of *SSN* during a day [8]. The daily average of *SSSN* over a day, $\overline{SSSN}$, is an appropriate quantifier for the solar radiative regime variability [9].

B.Daily volume of water pumped

Using the database, preliminary results regarding the influence of the solar radiative regime on the volume of water pumped as a case study, are reported in [5]. In this study we resumed the research from [5], looking for a quantitative relationship between the volume of water pumped and the radiometric parameters. Figure 2 summarize the results.

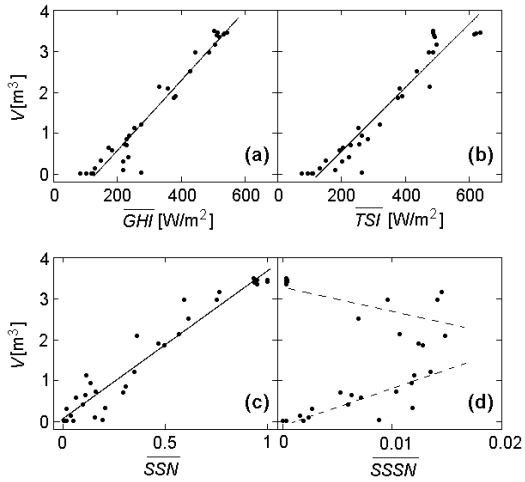

Fig. 2. Daily volume of water pumped in respect to: (a) daily mean of global horizontal irradiance ($\overline{GHI}$), (b) daily mean of in-plane total solar irradiance ($\overline{TSI}$), (c) relative sunshine ($\overline{SSN}$) and (d) daily mean of the sunshine stability number ($\overline{SSSN}$).

Visual inspection of Fig.2 shows that the daily volume of water pumped V is linearly correlated with the daily mean of global solar irradiance $\overline{GHI}$ (Fig 2a), daily mean of in-plane total solar irradiance $\overline{TSI}$ (Fig. 2b) and daily mean of relative sunshine $\overline{SSN}$ (Fig2c). The empirical equations fitted on data are:

$$V[\mathrm{m}^3] = 0.0085 \cdot \overline{GHI} - 1.135\,, \quad \overline{GHI} > 135\,\mathrm{W/m}^2 \qquad (2)$$

$$V[\mathrm{m}^3] = 0.0078 \cdot \overline{TSI} - 1\,, \quad \overline{TSI} > 125\,\mathrm{W/m}^2 \qquad (3)$$

$$V[\mathrm{m}^3] = 3.6 \cdot \overline{SSN} + 0.078 \qquad (4)$$

where $\overline{GHI}$ and $\overline{TSI}$ are in W/m^2. The limits in Eqs. (2-3) occur naturally because of the in-plane total solar irradiance threshold G_0 = 450 W/m^2 at which the pump starts/stops [5]. It means that when the instantaneous solar irradiance G_t is smaller than G_0 the pump does not operate, it starts when $G = G_0$ and the water flow increases with the increasing of the solar irradiance. In other words, this limitation indicates that there are cloudy days when the pump does not start.

The three equations (2-4) evaluate the same parameter V, in respect to three different radiometric parameters. By equalizing Eq. (2) to Eq. (3), an empirical relation between $\overline{TSI}$ and $\overline{GHI}$ can be inferred:

$$\overline{TSI} = 1.09 \cdot \overline{GHI} \qquad (5)$$

Apparently, a similar relationship could be inferred between $\overline{TSI}$ and $\overline{SSN}$. However, such relation must be regarded with care. Eq. (5) is possible because $\overline{TSI}$ and $\overline{GHI}$ depend similarly to the declination angle. Differently, relative sunshine does not depend to the declination angle.

Figure 2d displays the volume of water pumped in respect to the daily average of sunshine stability number. The relationship between V and $\overline{SSSN}$ is more complex. There are two different behaviors in $V\left(\overline{SSSN}\right)$, both indicated by dotted lines in Fig. (2). When the instability increases on a cloudy background the volume of water pumped increases, while when the instability increases on a sunny background, the volume of water pumped decreases. In a stable solar radiative regime $\overline{SSSN} \to 0$, V is either very high (a sunny day) or very small (a cloudy day). In a high unstable solar radiative regime ($\overline{SSSN} > 0.01$), V takes values close to the average of the values recorded in stable conditions.

CONCLUSION

The volume of water pumped by a direct-coupled PV water pumping system was investigated from the solar radiative regime point of view. The daily volume of water pumped is linearly related to the daily mean values of global horizontal irradiance, in-plane total solar irradiance and relative sunshine. The variability in solar radiative regime has a more complex influence on the volume of water pumped. A very simple empirical equation that roughly relates daily mean of global horizontal irradiance and the daily mean of in-plane total solar irradiance has been inferred in an unusual way. Such equation may be useful in locations around 45° northern latitude, with a similar climate as Timisoara and where only the daily global horizontal irradiance is measured.

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CO_2 reduction by using us field for coal combustion

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Abstract: Romanian coal is a low quality fuel. Therefore the ignition and combustion of coal powder in industrial furnaces is supported by an additional fuel: oil or gas. The paper focuses on two processes that are enhanced using an US (ultrasound) field:

- **Drying of coal powder in a US field, having special parameters for achieving mass and heat enhancement**
- **Burning of coal powder in a US field.**

The theory is completed by experimental results and interpretation. The selected burner is a Romanian patent.

***The conclusion of the paper draws attention* to pre-drying and combustion technologies in an US field, thus producing special conditions for improved combustion efficiency for the low calorific coal powder. As result, the stability ob combustion is achieved without extern support, the general efficiency of the boiler might be improved, and a CO_2 reduction might be achieved, for the same fuel input.**

Keywords: air quality, environmental protection, CO_2 emision

INTRODUCTION

Romanian energetic coals, because of their specific qualities, may require special combustion technologies:

(1) to intensify the burning processes, both in the kinetic and diffusive stages;
(2) to increase the ignition and burning stability;
(3) to achieve higher combustion efficiencies, and
(4) to reduce the support of the hydrocarbons.

Burning in an ultrasound (US) field is a possible method to achieve all the three purposes [3].

Arguments for the enhancement of the mass and heat exchange due to US

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The technical literature published by [1], [2], [3], [4], [10], [11], [12], [13], [14] presents many possible effects by applying of an US field on a two-phase medium:

- the activation of an ortho-kinetic effect (the relative movement between different particles), that is improved for bigger particles;
- the appearance of acoustic streams, both progressive and stationary;
- the generating of hot waves due to the reflection of the sound at interfaces;
- the initiation of the SACER (sound amplification from controlled excitation reactions) phenomenon, that determines the preferential heating of the compressed regions and the improvement of the caloric mass capacity at constant pressure and volume;
- the achievement of reduced baking of coal particles during burning, as a direct result of the growth of the reaction speed;
- the development of the Biot effect due to the cavitations, and the irreversible dispersion of the gas in the canals of the particles;
- the modification of the relative characteristics (activation energy and pre-exponential factor): in a US field the probability of active impact between the activated particles increases;
- the improvements in the diffusion around the particles, due to the US waves that break the Lignite layer.

EXPERIMENTS

Figure 1 indicates the third test facility used to study the particular behavior of the coal powder during heating and to compare the result in the absence and in the presence of the US. First the facility has been successfully tested by using naphthalene. Figure 4 and Figure 5 give the beneficial influence of the US upon the drying speed of the coal powder. Generally speaking, if the initial moisture content is higher, for the same quality of coal, the influence of the US is more evident and introduces a reduction of the time interval until a weight constancy of approximately 65 % is achieved. The particle distribution is also important; a poorer quality is influenced much more by US, in accordance with the results of Golesteanu [6]. An economic estimation indicates that drying coal, with US

and not electrically, represents an absolute economy of 10 %, as indicated in [6].

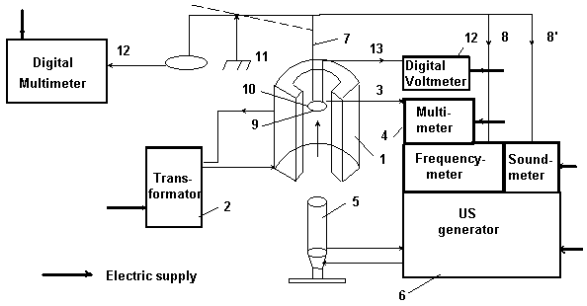

Figure 1: Third Lab Scale Facility for Testing the US Effectiveness upon the Drying Process: 1–Vertical Cylinder, 2–Transformer, 3–Thermo-element, 4–Digital Voltmeter, 5–US Concentrator, 6–US Generator, 7–Microphone, 8, 8'–Frequency Meter, 9–Sample, 10–Suspended Crucible, 11–Analytical Balance, 12–Multi-meter, 13–Thermo-element, 14–Voltmeter.

Onenotices that the presence of US determines not only the increase of the volatile matter release, but also a new burning law, which implies new reactive properties in the temperature interval, the maximum of the process being displaced to more reduced temperature levels. A computer program has been established in [6] to determine the activation energy and pre-exponential factor for each law, in the assumption of an Arrhenius law for the burning process of the volatile as in [8], and [15] are indicating.

One may also mention the initial series of tests for the mechanical Hartmann generator and its accessories, including adjustments for obtaining the desired characteristic for the general wave. One studied the effect of the level of the sound intensity and the frequency upon the dimensions of the resonance chamber and the feed pressure, in accordance to [1], and and [5]. The US mechanical Hartmann generator was preferable for industrial applications as it is more solid and needs no cooling. During the laboratory tests an electric generator of US was also used.

All the results obtained in the laboratory were used to design the prototype of an US burner (Figure 2 [5], [7]), The coal powder and its transport medium (primary air) are admitted through the fuel inlet 2 to the main body 1, where the mixture with the swirled secondary air occurs. The adjustable screws 9 and 11 and the adaptable nozzles 10 regulate the US characteristics for resonance. The pressurized air admitted through the air admission 6 flows in this status into the exponential main body 12. The connecting sleeve 5 is a safety device for the microphone, which is used during adjustment tests, to record the realized parameters for the US field.

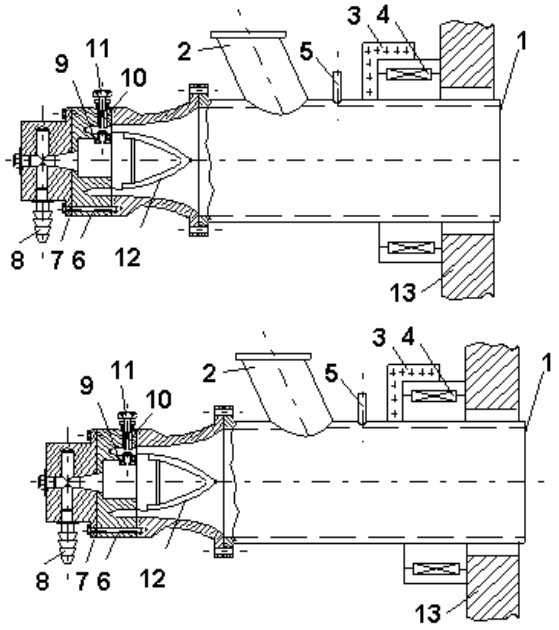

Figure 2: Coal burner with an US generator [5]: 1-Body, 2-Coal inlet, 3-Secondary air inlet, 4-Radial blades, 5-Connection sleeves, 6, 7, 8, 9, 10, 11, 12-Components of the Hartmann US generator, 13-Furnace wall.

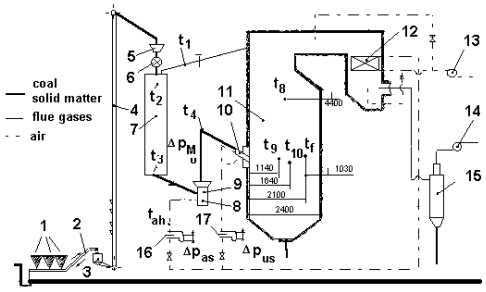

Figure 3: Pilot facility for general US test during combustion of coal. 1-Coal bunker, 2- Conveyer, 3- Crasher, 4- Elevator, 5-Crashed coal bunker, 6- Batches, 7- Drying tower, 8 Ventilator mill, 9 Mill separator, 10 Burner, 11-Furnace, 12-Air Pre-heater, 12-Air ventilator, 14 Flue gas ventilator, 15 Cyclone, 16, 17-Diaphragmes.

The test facility (Figure 3) consisted of a pilot furnace of 406 kW_{th} (1,885 x 3,085 x 7,400 mm), with an active volume of 9 m^3 and a radiation surface of 25 m^2. It can operate with gas (38 m^3_N/h) or with coal powder, since it is equipped with all necessary preparation system, control devices and measuring apparatus. The air is heated at t_{ah} in the heat exchanger. The furnace was started on gas, until the temperature at the end of the furnace was t_8 = 500 °C. Then, the US generator and the ventilator crusher were started. When the furnace finally reached 800 °C, one progressively increased the coal powder feed quantity, while simultaneously reducing the gas input, until one succeeded in totally eliminating the gas. The measurements along the air, coal, burning gases and slag canals were recorded at 15-minute intervals under stable conditions. The furnace ran first with the US generator functioning, then without it, after making some adjustments to maintain the same excess air value λ. With a periscope colored

pictures of the flame had been taken, both in the presence and absence of the US, thus enabling to distinguish visually different colored spots in the flame, proportional to the quality of the combustion. Calculations and comparative tests were made.

Table 1: Analyze of the tested coal (Doicesti).

Carbon	C_i = 20.05 %
Hydrogen	H_i = 1.6 %
Sulfur	S_{ci} = 2.3 %
Oxygen	O_i = 9.55 %
Nitrogen	N_i = 0.55 %
Ash	A_i = 21.65 %
Moisture	W_{ti} = 44.3 %
Law calorific power	H^i_i = 6545 kJ/kg

Table 2: Comparative concentrations during tests with and without US.

Concentration	IS units	Tests with US Mean values in reference to $O_{2.ref}$ = 6 %	Tests without US Mean values in reference to $O_{2.ref}$ = 6 %
C_{CO}	mg/m_N^3	121.70	165.95
C_{NOx}	mg/m_N^3	319.28	290.77
C_{SO2}	mg/m_N^3	5308.1	6406.2
C_{O2}	%	11.37	11.34

The gas analysis indicated a modification when the US field was shut down. Table 2 is giving the results. All concentrations are given for a reference of $O_{2.ref}$ = 6 %, as Romanian environmental low is requesting. The NO level was a little bit higher in the presence of the US, due to the small increase of the temperatures in the furnace. The other concentrations were reduced, especially the CO amount. With except of the SO_2, the levels fro the rest pollutants are under the maximum admitted limits for environmental control.

CONCLUSIONS

The general conclusions of the tests on the pilot furnace are as follows:

- In despite the worth quality of the used coal, one succeed in maintaining the stability of the flame without co-firing with gas, in both situations.
- Burning in the US field is a good solution in order to intensify the burning rates. One must also study in the future what practical influence the presence of the US on the N release speed may have. The following contradictory aspects are to be analyzed:

(i) The increase of the volatile matter release speed, in a certain temperature interval;
(ii) The compactness of the region with high temperatures;
(iii) The increase of the temperature profile, in the immediate burning region.

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The author dedicates this article to the memory of the distinguished Professor Mircea Postelnicescu for his valuable support as PhD coordinator.

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Methodological issues concerning the preparation of tourism climate studies

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Abstract: This paper presents the main indices and quantitative methods through which over the last 80 years it was attempted to express the tourism climate potential in different geographical units and even on the entire land surface. First, the indices are presented, followed by the methods with their benefits and limits, revealing the superiority of the methods in pointing out the tourism climate potential, and finally, it is recommended the most suitable method which currently exists: the Besancenot-Mounier-Lavenne method (1978).

Keywords:indices, methods, potential, tourism climatology.

INTRODUCTION

Once climatology was set up as a science (19th century), it took almost a century for the researchers to focus on and use the results obtained in general climatology towards a direction applied to tourism. This happened, of course, with the development of tourism activities in Western Europe and later on in other countries, as reflected also in the scientific concerns in this branch of climatology, the first climate indices appearing in the Western European countries. Subsequently, concerns have emerged in other European countries, former communist states, but also on other continents. It was gradually demonstrated that the initially proposed indices do not involve only advantages, but also many limitations. Therefore, methods were created, more or less complex, more or less applicable, but also with disadvantages. The best method for quick, clear and simple illustration of the tourism climate potential for a region is the method of the French physicians J.P. Besancenot, J. Mounier and F. de Lavenne (1978) [1].

LITERATURE REVIEW

Over time, from the very beginning, simple indices were developed, such as *Clausse-Guerout index* (1955) [2], *Poulter index* (1962) [3], *Burnet index* (1963) [4], *Hughes index* (1967) [5], *Davis index* (1968) [6], *Flocas index* (1975) [7], *Marchand index* (1986) [8], some of them being applied also in Romania. Thus, the Clausse-Guerout index (1955) was applied by Fărcaș and collab. (1968, 1970) [9, 10], the data obtained for the month of July being compared with the ones obtained by France; by Teodoreanu and collab. (1984) [11] for January, the results obtained being less significant; by Dragotă and collab. (1999) [12] for the hot season of the year on the route Băișoara - Vlădeasa - Stâna de Vale – Oradea. Poulter (1962), Burnet (1963) and Hughes indices (1967) were applied by Gaceu and Herman (2010) at Stâna de Vale balneoclimate resort for the hot season, but the results, although conclusive, did not have a particular significance [13, 14]. At international level, observing that the indices proposed did not have satisfactory results, the development of more **complex** indices was attempted, in order to make use of more climate elements and detailed data: *the biomedical aggressive index* (Rivolier, Campos, Lemee, Wolfromm, 1967) [15], *marine-climate index* (Sarramea, 1980) [16], planetary index (Mieczkowski, 1983, 1985) [17, 18]. It was noted that even these indices have limits and the development of **methods** was initiated. The first attempts took place in bioclimatology, where *the Russian school* has excelled through *the method developed by Feodorov* (1924) [19] *and perfected by Ciubukov* (1949) [20] *and Baibakova and collab.* (1964) [21]. This method was presented in the Romanian literature by Belozerov and Fărcaș (1971) [22], Teodoreanu (2002) [23] and it was used by Elena Teodoreanu and collab. (1984) [24]. Next, were *the Canadian meteorological school led by R. B. Crowe, G. A. McKay, W. M. Baker* (1977) [25], *A. D. Gates* (1975) [26], *J. M. Masterton, R.B. Crowe, W. M. Baker* (1976) [27] and *the Brazilian meteorological school represented by Barbiere* (1981) [28]. The most recent method was developed by the French physicians *Besancenot, Mounier and Lavenne* (1978) [1]. While trying to compensate for the limits of the first three methods, this method was applied to the Romanian Black Sea coast during the hot season by Apostol, Gaceu (2011) with very good results [29].

METHODOLOGY

In terms of methodology the major indices and methods used so far in tourism climatology were analysed, trying to identify the main positive and negative features resulting from their use. Therefore, *the Clausse-Guerout index* (1955) has good results, limited, only for the hot season, *the Marchand index* (1986) requires a large amount of evapotranspiration data available to very few weather stations and it does not take into consideration wind values and air temperature values

which have an essential influence on tourist activities, *the Burnet index* (1963) obtains arbitrary values as numbers which have no absolute meaning, i.e. it does not show that the tourist activities are, for example, twice more favourable in a specific region than in another one, but that there are more favourable conditions also by failing to consider climate elements such as sunstroke, wind, etc., if applicable to other regions than the Mediterranean region, there is the possibility of giving incorrect results. *The biomedical aggressive index* (Rivolier, Campos, Lemee, Wolfromm, 1967) [15] is more applicable in medicine than tourism climatology because it makes use of parameters which characterize lung diseases, *the marine-climate index* (Sarramea, 1980) [16] can be applied only to the Atlantic and Mediterranean coast and the *planetary index* (Mieczkowski, 1983, 1985) [17, 22] cannot apply to the entire land surface because at the same latitude, in January, it indicates a favourable potential in Peking, in mountain climate, and unfavourable potential in South-Western France in Bordeaux!

Regarding the tourism climate methods, it was noted that the *method of the Brazilian meteorologists* (Barbiere, 1981) [28] is extremely complex and requires great efforts to use it; *the method of the Canadian meteorologists (Crowe and collab.,*1977) [25], *Gates* (1975) [26], *Masterton and collab.* (1976) [27] quoted by Besancenot (1990) [29], Gaceu (2002) [30], Apostol, Gaceu (2011) [31] has questionable results, *the Russian method* (Feodorov-Ciubukov-Baibakova, 1924, 1949, 1964) [19, 20, 21] is cumbersome, requiring a large amount of calculations; the results obtained are relative, it does not provide a quantitative or qualitative correlation with the weather manifestations and it is limited to a range of only 24 hours, which does not correspond to the actual duration of the phases and types of weather in their sequence Besancenot, 1990 [30] and Gaceu, 2002 [31].*The Besancenot-Mounier-Lavenne method* (1978) [1] is intermediate between that of types of weather and types of indices, and synthetic, simple, easy to use, and the obtained values are real, measurable when it comes to the number of days favourable to outdoor activities or not Besancenot, 1990 [30], Gaceu, 2002 [31]. Applied to the Romanian Black Sea coast, this method gave many interesting results. We present below two of these results:

1. The highest frequency of the *sunny weather* in July-August is recorded on the northern Black Sea coast, namely in the Danube Delta at the stations Gura Portiţei (37-61%) and Sf. Gheorghe (25-54%), and the lowest frequency is recorded in the south of the Black Sea coast where the majority of the touristic resorts are located, namely the stations Constanţa (29-50%) and Mangalia (12-34%);

2. June is much more favourable for tourism than September because it has a decadal frequency of 15-36% *sunny weather* compared to 3-20% in September (Apostol, Gaceu, 2011) [29].

For these reasons we intend to apply the *Besancenot-Mounier-Lavenne method* (1978) [1] also to the balneoclimate resorts located in the Romanian Carpathians, such as: Moneasa, Stâna de Vale, Semenic, Ţarcu, Parâng, Voineasa, Păltiniş, Fundata, Predeal, Sinaia, Ceahlău, Rarău, Poiana Stampei etc.

CONCLUSION

The performance of this analysis leads to the following conclusions:

1. The tourism climate indices have a positive role in characterizing the tourism climate potential because: they involve making several calculations, they make use of various climate parameters and provide results easy to understand and interpret, but they use measurement units that do not meet the international system and, in terms of mathematics, they cannot enter combinations, so that sometimes information can be lost and abstract results can be frequently obtained.
2. The analysed methods are more extensive, taking into consideration several climate elements, but some of them are very difficult to use. They require a huge amount of data whose processing and interpretation involve hard work and effort, which is why we consider conducting tourism climate studies using the Besancenot-Mounier-Lavenne method (1978) [1] which, as presented above, it is synthetic, simple and easy to use and the values obtained are real and measurable when it comes to the number of days favourable to tourism activities or not.

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Importance of indoor air quality

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Abstract: Indoor air quality (IAQ) is a new item that is presently under research, as people spend much more time in closed environments, not in open air. Legislation is constantly asking for a better air quality , and controls by national and EU legislation the values for the level of emissions, for pollutants and recently also for greenhouse gases.

Key words: Indoor air quality (IAC), pollution, health, industrial hall, measurements

I. FACTS AND EFFECTS

The average adult at rest inhales and exhales something like 7 or 8 liters of air per minute. That totals around 11,000 liters of air in a day. The air that is inhaled is about 20 % oxygen, and the air that is exhaled is about 15% oxygen, so about 5% of the volume of air is consumed in each breath and converted to carbon dioxide. Therefore, a human being uses about 550 liters of pure oxygen per day (/r https://health.howstuffworks.com/human-body/systems espiratory/ question98.htm). The air one breathes is full of chemicals and harmful substances, including dust, soot, mold, fungi, bacteria, viruses and pollutants. However, the respiratory system has several ways to protect itself against most harmful airborne particles. Only very small particles (those of 3-5 μm in size) can reach the deep lungs. Nevertheless, contaminated air is traversing the mouth and nose tissues, and is retained there as well. Air quantity is hardly person-dependent (age, gender, height, weight, activity, fitness level, etc.). The average adult male working at a moderate activity level inhales 16.8 m^3_N of air during an 8-hour working day ([https://iqpowertools.com/air-how-much-do-i-breathe/).

Indoor air is a dominant exposure for humans. 50-90% of the body's intake during a lifetime is air inhaled in the home. Thus, most illnesses related to environmental exposures stem from indoor air exposure (Tsakas et al., 2011). Indoor air was believed to be a major environmental factor for more than a hundred years, from the start of the hygienic revolution, around 1850, until outdoor environmental issues entered the scene, and became dominant around 1960. Main environmental issues today are outdoor air quality, energy use, and sustainable buildings, but not indoor air quality (IAQ). However, for many people, the risks to health are greater due to exposure to air pollution indoors than outdoors. Indoor air may contain over 900 chemicals, particles, and biological materials with potential health effects. Their concentrations are usually higher than outdoors (Autrup et al., 2007). There is a mounting evidence that exposure to IAQ is the cause of excessive morbidity and mortality (Sundell, 2004; https://www.cpsc.gov/Safety-Education/Safety-Guides/Home /The-Inside-Story-A-Guide-to-Indoor-Air-Quality).IAQ refers to the air quality within and around buildings and structures. It affects occupant health, comfort, and productivity, and in some cases even building usability. Understanding and controlling common pollutants indoors can help reduce risk of indoor health concerns (Mudarri, 2009; https://www.epa.gov/ indoor-air-quality-iaq/introduction-indoor-air-quality).

Health effects from indoor air pollutants may be experienced soon after exposure or, possibly, years later. Some health effects may show up shortly after a single exposure or repeated exposures to a pollutant. These include irritation of the eyes, nose, and throat, headaches, dizziness, and fatigue. Such immediate effects are usually short-term and treatable. But because effects are similar to those from colds or other viral diseases, it is often difficult to determine if the symptoms are a result of exposure to indoor air pollution.Other health effects may show up either years after exposure has occurred or only after long or repeated periods of exposure. These effects, which include some respiratory diseases, heart disease and cancer, can be severely debilitating or fatal. Also, it is very important to stress out that, according to health status, age, life style, and other influencing parameters (mostly unknown), people also react very differently to exposure to indoor air pollutants (https://www.epa.gov/indoor-air-quality-iaq/introduction-indoor-air-quality).

Changes in building design devised to improve energy efficiency have meant that modern homes and offices are frequently more airtight than older structures. Furthermore, advances in construction technology have caused a much greater use of synthetic building materials. Whilst these

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improvements have led to more comfortable buildings with lower running costs, they also provide indoor environments in which contaminants are readily produced and may build up to much higher concentrations than are found outside (Bluyssen et al., 1996; Jones, 1999). Indoor air pollutants can come from a range of sources. Inhaled biological particles may induce illness through immune mechanisms, infectious processes, and direct toxicity. The health impacts may come from indoor exposure to combustion products from heating, cooking, and the smoking of tobacco. Symptoms associated with pollutants emitted from building materials, as well as volatile organic compounds (VOCs), arising from sources including paints, varnishes, solvents, and preservatives might be of particular importance (Jones, 1999; http://www.eea. europa.eu/signals /signals-2013/articles/indoor-air-quality).

In developing regions indoor unvented burning of biomass for cooking is the cause of at least 2,000,000 deaths a year (mainly women and children), and in the developed world IAQ is a main cause of allergies, other hypersensitivity reactions and airway infections (Jones, 1999). Most volatile organic compounds (VOCs) measured in both indoor and outdoor environments are derived from outdoor sources, probably motor vehicles. Benzene and other VOC concentrations are much higher during the winter months than the summer months. Note that a statistically significant association is found between indoor and outdoor levels of vehicle-related pollutants (Baek et al., 1997). Indoor air pollutants may also be formed by rearrangement of cleavage products or by metabolism. Compounds with C-bonds, like terpenes, undergo gas phase reactions with O_3, NO_x, OH and other reactive gases. Such products derived from indoor-related reactions may have a negative impact on indoor air quality due to their low odour threshold or health-related properties (Uhde and Salthammer, 2007). Chemical reactions between ozone and unsaturated organic compounds (VOC) (e.g. from citrus and pine oils) may produce strong eye and airway irritating species (Wolkoff and Nielsen, 2001). Diodou (2015) revealed that higher concentrations of aldehydes and ketones were found in rooms with new furniture compared to rooms with relatively old furniture, making new furniture a possible source of aldehydes and ketones.According to a tentative guideline for VOC's in non-industrial indoor environments, (1) the no-effect level seems to be about 0.2 $mg \cdot m^{-3}$, (2) multi-factorial exposure range may exist between 0.2 and 3 $mg \cdot m^{-3}$, while (3) above 3 $mg \cdot m^{-3}$ discomfort is expected (Mølhave, 1991).

Exposure to environmental tobacco smoke (ETS) is a major cause of lung cancer. The average contribution of environmental tobacco smoke (ETS) to total respirable suspended particulate matter (TRSPM) concentrations was estimated to range from 10 to 20% in Korean urban areas (Baek, et al., 1997; Autrup et al., 2007).

Furthermore, if the structure of a building begins to deteriorate, exposure to asbestos may be an important risk factor for the chronic respiratory disease mesothelioma (Jones, 1999). Malignant pleural mesothelioma (MPM) is an aggressive thoracic tumour type with limited treatment options and poor prognosis (Laszlo et al., 2018). Note that about 90% of deaths due to mesothelioma are due to exposure to asbestos in unmonitored settings. It is remarkable that e.g. in Great Britain, at least 3500 people die each year from mesothelioma and asbestos related lung cancer as a result of past exposure to asbestos. (Jones, 1999).

Of particular significance is radon, the radioactive gas that arises from outside, yet only presents a serious health risk when found inside buildings. Radon and its decay products are now recognised as important indoor pollutants, and their effects are explored. Radon is the second biggest cause of lung cancer after cigarette smoking. If someone breathes a lot of radon and smoke, their chance of getting lung cancer is very high. Unlike with other air pollutants, you won't have symptoms of radon poisoning right away. Instead, health problems from the exposure, such as lung cancer, show up after many years (Autrup et al., 2007; Zeeb and Shannoun, 2009). Concentrations of outdoor air pollutants and rates of infiltration affect the concentrations to which people are exposed indoors (Tsakas et al., 2011). Particles may behave as carriers for toxic substances into the lungs and that exposure to particulate matter may facilitate airway sensitization in susceptible individuals (Autrup, 2007).

Bucur et al. (2016) have conducted an experiment both indoor and outdoor (I/O): in an office, a smoking place and outside the building. The highest concentrations of particulate matter were found in outdoor air, 89.41 ± 40.44 $\mu g/m^3$; at the semi-opened smoking place the concentration was 70.89 ± 26.24 $\mu g/m^3$, and inside the office, 45.89 ± 19.65 $\mu g/m^3$. The average I/O ratio was 0.53, indicating a good isolation of the building against particulate matter infiltration from outdoor and the absence of indoor sources of particulatematter. The results indicated that smoking places can have a big impact on indoor air quality if they are not properly located in order to avoid the infiltration of PAHs inside offices.

II. RESULTS AND DISCUSSION

As the particles, especially those of very small dimensions, are real threat for the public health, special campaigns for detecting the particle concentrations were organized. The locations were a technological hall, and a packaging industrial hall, in which manual activity is occurring.

Fig. 1 presents the variation of different particle species, measured by a special Portable Laser Aerosolspectrometer and Dust Monitor (Model 1.108 instrument). It possesses an integrated gravimetric filter on which all particles are collected after the optical measurement and thus are available for further analysis (see Fig. 4). It was mounted at the level of a worker (see Fig.5a).

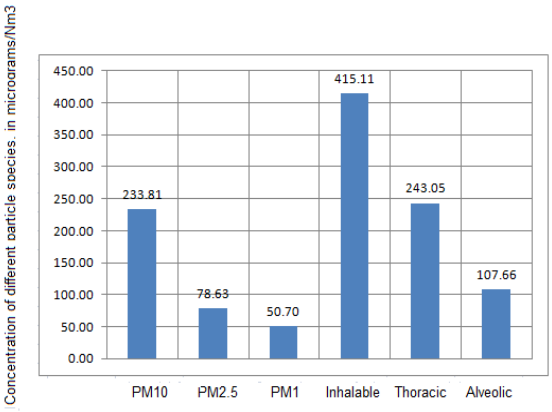

Fig. 1. Variation of the particle concentration, in a packaging industrial hall

Classic concentrations were measured by a standard gravimetric instrument – a Sven Leckel LSV3 monitor. The results are presented in Fig. 3. It is obvious that the more reduced the particles are, the concentration is higher, and effects upon human health can develop in time. Also, in some locations, the maximum admitted value (in Romania 10 mg/m^3_N according HG nr.1218/06.09.2006, H.G.nr.112012 9i HG 355/2).

a) b)

Fig. 2. Photos of the measurement campaigns for detecting particle concentration using the GRIMM dust monitor (a) in a technological production hall, and (b) a classic gravimetric instrument mounted in a packaging hall.

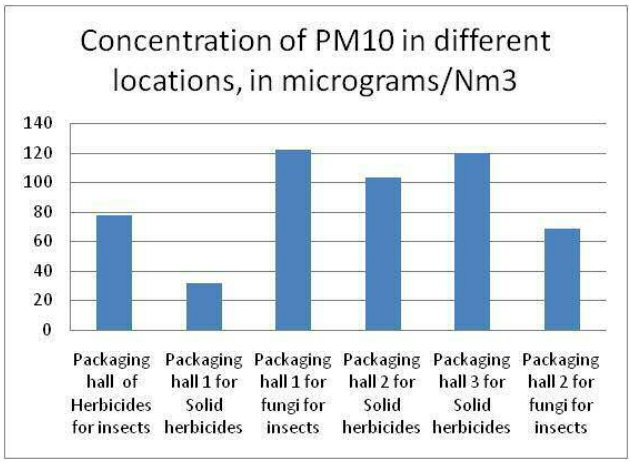

Fig. 3. Concentration of PM_{10} in different locations, in micrograms/Nm^3, in packaging halls

III. CONCLUSIONS AND RECOMMENDATIONS

The paper analyses three case studies concerning on line in door measurements for different species of pollutants. First a training lab was selected and the results for the VOCs indicate variations of concentrations and alteration of the air in time, when pollutant activity occurs in the area. The second example was related to an industrial activity (pesticide company), measurements being run in a production hall and in a packaging area. The third result is referring to an office, where mostly automatic printing and copying machines were working. In the latter case, ozone concentration was checked.

Depending on the technological process or activity in enclosed spaces, it is mandatory to check the IAQ, even the actual legislation is not, presently, such developed and applicable. This action must be taken as prevention,in order to reduce potential health risks upon humans. Acting in their homes, or schools and offices or industrial halls. Small actions, such as ventilating enclosed spaces, can help improve the quality of the airaround. Also, research must continue in order to depict also molds that produce spores that float in the air, land on damp surfaces and grow, most probable generating in time major risks for humans, and not only.

In order to avoid health problems, as presented by state of art literature, such as sore eyes, inflammations in the nose and throat, headaches, or fatigue, or worsen allergies, respiratory illnesses (such as asthma), heart disease, cancer and other serious long-term conditions, even death (carbon monoxide), a better legislation, with international effect must be developed, including measurement techniques and limits, similar to the outdoor air quality legislation.

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Social and Psychological Resilience in the Face of Disaster

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Abstract: **Starting with the 1970s the term resilience has made its way into such various domains as the environmental, social, political, as well as in psychology and psychopathology. Resilience describes the capability of people, societies and cultures to lead themselves or their environment in the face of challenges into new developmental pathways. Specifically, social resilience is the ability of groups or communities to cope with external stressors and disturbances as a result of environmental, social, and political change.One of the most relevant forms of the new concept is the psychological resilience after disaster, which constitutes the object of the present analysis. Disaster resilience focuses upon the strong points and not the impairments following a disaster. The available research evidence suggests that psychological resilience following disaster, or any traumatic event may be more prevalent than previously believed.**

This paper analyzes the indicators of psychological resilience, which can provide significant ante-factum relevance for disaster policies. Resilient outcomes, meaning a healthy functioning after disaster, is considered in line with data suggesting resilience is the result of multiple independent predictors. Taking into account research indicating that not all individuals develop psychopathology or impaired health after traumatic events, the present paper examines some of the underlying mechanisms that influence the development of stress-related resilience.

Keywords:social resilience, psychological resilience, coping, disaster

Starting with the 1970s the term resilience has made its way into various domains such as sociology, environmental studies, politics, as well as in psychology and psychopathology.

A simple search on Google, will reveal a myriad of definitions for resilience in very different fields, from ecology, technology and engineering to entertaining and social sciences. For the last ones, we distinguisha resilience in organizational terms, which refers to the ability of a system to withstand changes in its environment and to still function.

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More specifically, social resilience is the ability of groups or communities to cope with external stressors and disturbances caused by environmental, social, and political change.

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PSYCHOLOGICAL RESILIENCE

Psychological resilience is emerging as an important component of societal resilience. In psychology and especially in abnormal psychology, resilience has been one of the core topics over the last decades. After many years of carefully researching the meaning and the effects of stress, clinicians and psychology scholars observed that the same amount and quality of stressors do not lead to the same effects, as previously believed, in the 1960s and 1970s. Let us consider the well-known Holmes and Rahe *Social Readjustment Rating Scale (SRRS)* (1967)[16], which was designed based on the medical records of over 5,000 patients, as a way to determine whether stressful events might cause illness. Patients were asked to tally a list of 43 life events based on a relative score. Death of a spouse was arbitrarily rated as the most serious life event while minor violations of the law were rated as the least serious. The measure aimed to quantify the impact of a life event but did not account for individual differences and personal appraisals of the event.

The psychiatrists' Thomas Holmes and Richard Rahe presumption in the 1960s was that any given event might have the same impact upon an individual, an approach that nowadays would be difficult to sustain. Laboratory research that assessed physiological reactions to a series of stressors in

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different individuals proved that our biochemical and psychological reactivity to stress largely varies. Such findings gave rise to the question concerning the factors that may support our resistance in the face of stressful or traumatic life events, i.e. what may help us to be resilient.

The syntagma Coping with Stress became almost an obsession after the publication in 1984 of the volume *Stress, Appraisal and Coping (1984)*[17]by Arnold Lazarus and Suzan Folkman. It contains a detailed theory of psychological stress, built on the concepts of coping and cognitive appraisal. Coping means to invest one's own conscious effort to solve personal and interpersonal problems, in order to try to master, minimize or tolerate stress and conflict.[18] The term generally refers to reactive coping, i.e. the coping response which follows the stressor. Faced with stress, individuals can use a large variety of psychological mechanisms which may change over time. When using certain psychological mechanisms which do not lead to a positive outcome we label them as maladaptive coping mechanisms. Certain coping mechanisms may have an adaptive function in certain life situations and be less adaptive in some others, especially when dealing with our emotions. Coping strategies as releasing pent-up emotions, distracting oneself, and meditating may be helpful sometimes, but may be less useful when needing to act or to seek information for better managing significant stress.

This large variety of human reactions to stress is underpinned by personality traits, cultural environment and the nature, as well as by the significance (cognitive appraisal) of the stressor.

The question we are focusing on now is: when are significant stressors followed by a severe maladaptive reaction?

During quite the same period as the research on stress by Folkman and Lazarus, a medicine sociologist Aaron Antonovsky conducted a series of studies on stress and noted that exposure to important stressors did not invariably lead to a major stress reaction and illness. He then launched the term psychological resilience, defined as the ability to successfully cope with a crisis and to return to pre-crisis status quickly. A resilient person will use "mental processes and behaviors in promoting personal assets and protecting from the potential negative effects of stressors"[19]. Stressors of various kinds create immediate tension in an organism, but if the tension is resolved, it does not result in stress, which is the health-damaging condition one needs to avoid. A key approach in Antonovsky's theory concerns the question of how specific personal dispositions serve to make individuals more resilient to the stressors they encounter in daily life.[20] He considers three large groups of resources: (1) adaptability on the physiological, biochemical, psychological, cultural, and social levels; (2) profound ties to concrete, immediate others; and (3) commitment of and institutionalized ties between the individual and the total community. [21]

Resilience describes our resistance despite personal vulnerabilities (e.g. personality traits) and despite risk factors (e.g. significant negative life events). It is the process which helps us overcome difficulties, avoid adversity and be capable, after a crisis, to go on with our life in a healthy and serene manner. Resilience is a dynamic process sustained by protective factors, which are defined as competencies. When referring to competencies we usually think about any demonstrable characteristic that enables one to perform a well-defined task, but in the area of resilience it is about life competencies - how to better deal with life.

RESILIENCE TO TRAUMA AND DISASTER

Initial research on loss and potentially traumatic events has been dominated by either a psychopathological approach focused on the individual's dysfunction or an event approach emphasizing average differences between exposed and non-exposed groups. Recent research, however, has emphasized the heterogeneity of outcomes following aversive events, in the context of a multitude of factors that mediate human reactions to significant stress.

According to a series of findings, resilience is not the result of a few dominant factors, but rather there are multiple independent predictors of resilient outcomes. Bonnano et al. (2011) are categorizing sets of such independent factors which have emerged from different research areas: the individual's personality and positive emotions, the past and current stress, the individual's worldviews (his a priori beliefs) and meaning-making of an experience, but also the demographic variations (e.g. male gender, older age, and greater education). Beyond factors that pertain to the individual, proximal and distal exposure, social and economic resources also constitute independent factors[22].

Last decade research has specifically approached resilience to disasters, which are defined as events that may overwhelm the local capacities, often producing human losses, injury and damage to the affected communities. As climate hazards and disasters are likely to increase in frequency in the coming decades, strengthening the capacity of societies and of individuals to withstand these shocks and recover quickly becomes a central topic.

Disaster research indicates that the most typical pattern is for distress to be nearly universal in the first weeks or months post disaster, even though only a minority of participants

[2] R. S. Lazarus & S. Folkman, Stress, Appraisal, and Coping(1984) p.141. ISBN 0-8261-4191-9

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experience criterion-level psychopathology[23]. Most longitudinal disaster studies find that an event's adverse effects dissipate over time, leaving only a minority of communities and a minority of individuals within those communities chronically impaired. Most of the time - especially if the severity of the stressor has lessened and resources have been replenished - transient dysfunction is followed by a return to pre-disaster levels of functioning. The process that produces adapted outcomes is resilience; the more rapid the return to pre-event functioning, the greater the resilience. [24],[25]

Recent data indicate that strong social support received after a disaster is associated with an increased psychological resilience whereas a female gender is associated to a decrease in the likelihood of a resilient outcome. These results are consistent across disaster settings and cultures and are representative of approximately 13 million disaster-exposed civilians of adult age. An approach such as this, that collects and evaluates evidence will allow indicators of resilience to be much more revealing and useful in the future. They will provide a robust basis to prioritize indicators to act upon through intersectoral policies and post-disaster public health interventions.[26]

CONCLUSIONS

Last decades' research has involved large human samples for the investigation of disaster resilience. The core research has switched from focusing on the psychopathology associated to stress, to the question and analysis of sets of factors that might predict resilience, i.e. good outcomes. The positive conclusion for the available research evidence suggests that psychological resilience following disaster, or any traumatic event may be more prevalent than previously believed. Personality traits, core beliefs associated to social support and meaning-making of life in communities are all predicting higher resilience. On the other hand, efforts have been concentrated towards working out and better testing of prevention programs to help individuals to better face potential trauma.

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Evaluating the Fishery Production and Composition of Ismarida Lake (Thrace, Greece), Aiming to its Environmental Friendly Management

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Abstract: Ismarida Lake is located in Northern Greece (Thrace), 18 km from Komotini city. It is a lake in the "National Park of Eastern Macedonia-Thrace" and therefore protected by international and national legislation. Fishery production data elaborated in this paper covering 30 years (1979 to 2008), including total annual fishery production as well as the production of three commercially important fish species, as the common carps, eels and grey mullets (fam. Mugilidae) were presented in timeline charts and separated in decades and lustrums with a calculation of mean production, for each year. The composition of the fishery production was presented also through five and ten year's periods in percentage. During the decade of 70's the fishery production of the lake was high, but all over the 80s the lake was receiving municipal and industrial wastes, leading to its rapid hyper-eutrophication, and to a consecutive reduction of total fishery production which reduced from 45.009 kg (1980-1989) to 17.646 kg (2000-2009). The results presented prove the degradation of the fishery production of Ismarida Lake and help understand the ecological situation of the lake and to suggest and develop a conservational and environmental friendly fishery management.

Keywords: Environmental management and sustainable development (EM&SD), Ismarida Lake, fishery production, fishery composition, fishery management

XI. INTRODUCTION

The Ismarida or "Mitrikou" Lake is in the southern part of the of Rhodopi Regional Unit (Fig. 1), east of Vistonis Lake and 3 km away from N. Aegean sea. The lake is about 280 ha and is part of the National Park of Eastern Macedonia-Thrace, in NATURA 2000 network, while protected by the RAMSAR Treaty. The morphological characteristics of the lake are presented in Tab. 1. The lake contains fresh water and its characterized by low depths from 0,40 m to 1,5 m. Two rivers are discharge into this lake, Vosvozis and Fiouris Rivers [1]. Few years ago, the flow of the Vosvozis River extended to Thrace Sea, but the building of a dam and a lot of other technical measures at its discharge area were made to protect the fishery production [1, 2, 3]. Not long ago, the fisheries management was done by a Fishery Cooperative who also managed three other coastal lagoons in the area but during the last few years the management of the public Ismarida Lake changed and is carried out by different parts. Fishing is carried out principally with the 'fish catch devices' of the lake.

The major threats to the balance of the ecosystem of Ismarida Lake are the illegal pumping of lake waters for field irrigation and the pollution from pesticides and wastewaters. This study presents the changes in fishery production and the composition of catches in Ismarida Lake over a period of 30 years and aims using time series fishery production data to a sustainable management of lake.

XII. MATERIAL AND METHODS

The fishing data of the lake production used in this paper covers the period 1979 to 2008, have been recorded yearly by the Fisheries Department of Rodopi. Data include total annual fishery production for over 30 years and the analytical production of the 3 most representative fish species of the catch, as common carps (*Cyprinus carpio*), European eels (*Anguilla anguilla*) and grey mullets (fam. Mugilidae).

Table I. Landings and Productivity of Ismarida Lake (1979-2008)

Lagoons	Surface Area (ha)	Total Landings (kg/y)	Mean Productivity (kg/ha)	Mean annual catches (t)	Mean Productivity (t/km2)	Total Carps (kg)	Total Eels (kg)	Total Mullets (kg)
Ismarida	280	107.131	383	3,6	1,3	32.180	34.676	30.151

The data of grey mullets (Fam. Mugilidae) concern 5 different fish species as: *Mugil cephalus, Liza aurata, Liza Ramada, Liza saliens* and *Chelon labrosus*, are grouped as "mullets" (fam. Mugilidae).

From the data of the annual fishery production, calculations were made for the calculation of cumulative (total) fishery production and of the average production of Ismarida Lake for the entire period of the study.

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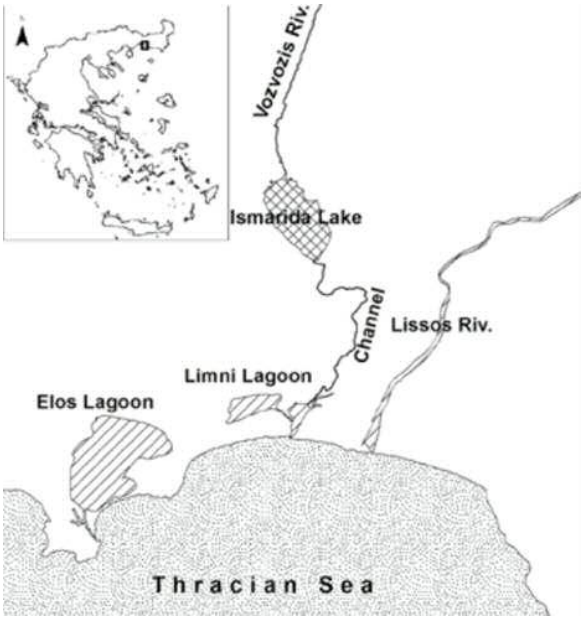


Fig. 1. Map of Greece and Ismarida Lake in Rhodopi Region

Moreover, the production of the lake was calculated and presented in diagrams illustrating the variations of the annual productions. The composition of the fishery production was also explored, and the total production has been assessed. These catch data have been grouped in decades and lustrums, yielding cumulative and average production at longer intervals, trying to make constructive conclusions and to prevent mistakes arising by the influence of environmental factors and/or management defects.

XIII. Results

The Ismarida Lake till recently communicated with the sea through channels and fish were entering during spring and throughout autumn, adult (mature) fishes tried to return to the sea for reproduction and caught with the permanent "fish capture" devices of the lake. Ismarida Lake starts from relatively high levels in the decade of 80's, but after intense fluctuations the fish catches has been deeply decreased due to the intense degradation from imported pollution and the reducing of water volume [4, 5].

The total production of Ismarida Lake for the considered period (1979-2008) was 107 tons (Fig. 5) and the contribution of the main species of fish to the total production of lake were: eels (*Anguilla anguilla*) with 34.7 tons was the dominant catch, followed by carps (*Cyprinus carpio*) with 32,2 tons, Mugilidae with 30,2 tons, while the other species caught were only 2,9 tons of total production of lake. At years 1985, 1991, 1996, 2002-03 and 2007 the production was from zero to low values (Fig. 2), on the contrary, during 1979, 1989, 1995, 1997 and 2004 the production reaches high numbers of catches. The highest total production of the lake during the study period was recorded in 1989 (Fig. 2). Throughout the 2000's the production was reduced even more and in 2008 the total production of lake was only 2,1 tons. As shown in Table 1, the percentage of the average production (mean landings, kg) for Ismarida Lake were 3,6 tons and mean productivity was 1,3 t/km2/year. These catches and productivities are significantly low, compared with other lagoons of the wider region, such as the four lagoons of Nestos River (10,8 t/km2/y) [6, 7].

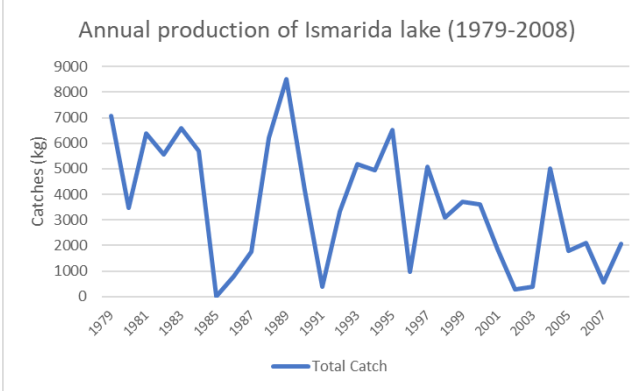


Fig. 2. Annually total catches for Ismarida Lake (1979-2008)

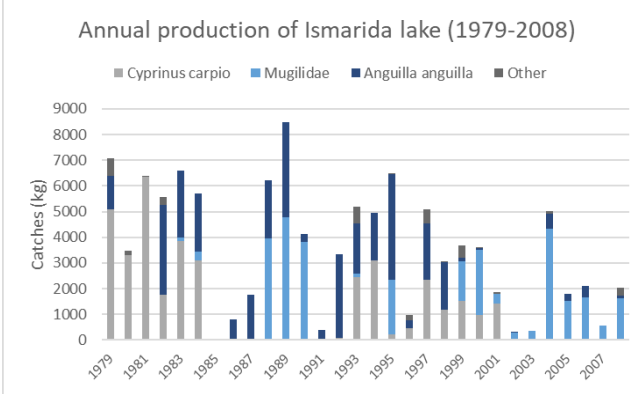


Fig. 3. Annual total productions of the main species of Ismarida L. (1979-08)

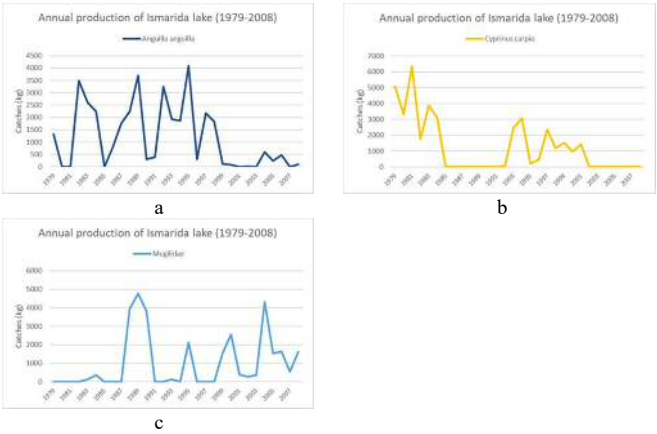
The annual production and the species composition of Ismarida Lake during the years 1979-2008 presented in Figure 3 shows the periods with high and minimum catches throughout the years and in Figure 4, are presented the fluctuations in the production of the main species of the lake. Eels were a key species and exhibits strong fluctuations in their fishery production during the years 1979-1998, but after 1999 the production was almost vanished. The carps during the years 1979-1984 had a production of 2-6.000 kg but after year 1985 there was a dead period in which the catches were null. After the 1993, the catches raised again until 2002 where carps 'catches vanished. The grey mullets (fam. Mugilidae) are also present a strong variation in their production (Fig. 3), starts after year 1988 and appeared in considerable catches during years 1988-1990, 1999-2000 and till the end of the study period (2004-08).

Species composition

Eels were the most important catch with 35%, during the all study period, the carps were the 32%, the Mugilidae 30% and the "Other" species were only the 3% of the cumulative catches (Fig. 5, 6, 7).

The production of eels exhibits vast fluctuations with high and low catches during the study period and in detail during

the years 1980-84, were the 30% of total catches and at next lustrum 1985-89 arrived to 49%. After the time period 2000-04 their contribution decreased to 6% and to 13% for the years 2005-09.



a b c

Fig. 4. Annual variations of fishery production of main species (a- Eels, b-carps, c- (Grey Mullets - Mugilidae) of Ismarida Lake.

It is well known that the failed eel fishing management across Europe has led to a sharp decline in their stocks and for this reason since 2010 the Eels has been incorporated into a special program for the management of its stocks by the EU under restrictive conditions.

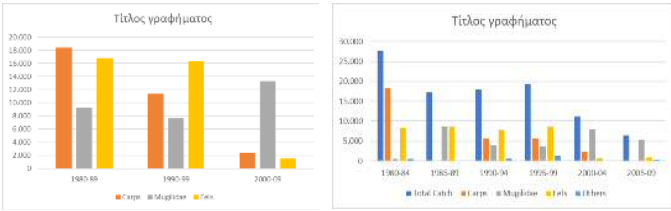


Fig. 5. Catch composition of lake Ismarida per decades and lustrums for the period 1979-2008

Carps exhibit high catches from the start of the study period and until 1984 were the most important species (1980-84: 66%). After a period (1985-92) that the species were almost disappeared (0%) rise again with catches from 1993 till 2001 (30-21%) and after this year they vanished (0%) (Figs. 5, 6, 7).

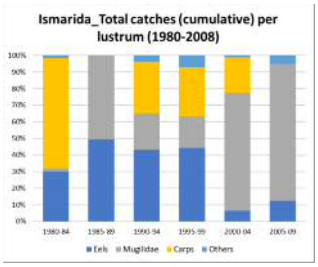


Fig. 6. Cumulative total fishery production of Ismarida L. (1979-2008).

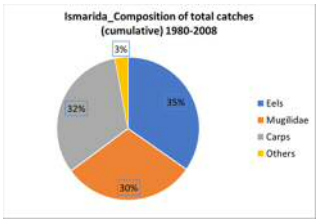


Fig. 7. Percentage of total catches (kg) of Ismarida L. (1979-2008).

The gray mullets (fam. Mugilidae) presented since 1983 and forwards and at year 1989 was their top in production with 4.8 tons (1985-89: 8,7 tons - 51%). Following, their catches ranged from low to medium prices until 2004 where a 2nd peak emerged and subsequently their production were the most important during the last years (2005-09: 5,4 tons - 82%).

XIV. Discussion and Conclusions

The time series of production in Ismarida Lake starts from fairly high levels in the 80's, but after intense fluctuations leading to zero production in recent years as massive deaths of fishes occurred due to the intense problems of water flowering of the lake. Therefore, the reduction of the contribution of the carps during 1985-89 is directly related to the increase in production of grey mullets in the same period. Based on the composition of the catches in the overall period of the study the contribution of the species was: carps 32%, Eels 35% and Mugilidae 30% (Fig. 7).

Analyzing the time series of total catches every five years of the lake (Fig. 5), significant fluctuations occurred: at the first lustrum (1980-84) was 28 tons and for the next 3 lustrums (1985-89, 1990-94, 1995-99), the production remains stable but lower than the first 5-years period (mean 18 tons) and from years 2000-04 gradually decreased to 11 tons and at the last lustrum (2005-09) the production was only 7 tons. In the lustrum 80-84 we have a very important domination of the carps and secondly of the Eels. However, Eels prevail in the period 85-90 and the percentage of carps decreases. In the lustrum 90-94, carps rise again, while for the first time a significant amount of the grey mullets emerged. Gray mullets gradually dominate in catches during lustrums 2000-04, 2005-09, while carps reduced from the production for the last lustrum 05-09 (Fig. 5).

The changes in the production of Eels during the years presented in Figure 4a can be addressed to many factors including the collapse of European stock. The production of carps in the decades of 80's and 90's was 18,4 tons and 11,4 tons respectively (Fig. 5), while during the 2000's the production was reduced even more (2,4 tons). The major decline in the fishery production of the carps are presented in Figure 4b. From the fishery production for the species it is anticipated that the production will remain in very low levels for the future. Finally, the production of Grey Mullets is presented in Figure 4c. The fluctuations of the production of these species during the last years shows an increased tendency in their catches.

The major threats faced by Ismarida Lake are sewage and chemical contamination (treated sewage of the city of Komotini and crude waste from manufacturing plants), the excessive hydrants, the expansion of agricultural crops and infrastructures [1, 2, 3, 4, 8]. The lake is characterized as hypereutrophic according to the Eutrofication classification of OECD [3]. However, in Ismarida Lake, there are routine eutrophic conditions with the fishing production being reset, while is repetitive the occurrence of water flowering phenomena. Although the fishery production of the lake was high in the 70's, throughout the 80's the lake was receiving municipal and industrial wastes, leading to its rapid hyper-eutrophication. The production of Ismarida Lake presents strongly reduced trends, resulting in great decline of fish catches in recent years due to the phenomena of eutrophication [2, 3, 4, 8]. Based on the catch data per decades there was a

gradually reduction in fish production of the lake: the total fishery production was reduced from 45.009 kg (1980-1989) to 17.646 kg (2000-2009) (Fig. 5). In the 1st decade (1980-89), carps accounted the 41% and eels the 37% of the total production, respectively while in 2nd decade (1990-99), there was a fall in the ecosystem (37.410 kg) and eels accounted the 44% and carps 30% of the total production. Through the late 80's, the lake stopped receiving wastes and increased its salinity and the production of carps was reduced from the 1st to 2nd decade (18.423 to 11.374 kg) and during the 3nd decade the carps catches collapsed (2.383 kg – 14%). The eels had a more stable production in the 1st and 2nd decade (16.841 and 16.314 kg respectively) and vanished in the last period 2000-09 (1.521 kg – 9%). Grey mullets (fam. Mugilidae) started with a production of 9.240 kg (1980-89) and during the 3rd decade (2000-09) overcame carps and eels, becoming the 75% of the total fishery composition. Several reasons are responsible for the decrease in fish production of lake, such as urban and rural pollution, climate change, extreme weather phenomena, excessive hydrants, expansion of agricultural crops and infrastructures etc. [1, 2, 3, 8].

The Ismarida Lake currently faces problems generated from the technical works of 1978 for the arrangement of the surface waters.

Unfortunately, the rivers that flow in the lake still receives industrial wastes and the lake can be characterized as hypertrophy [2, 3, 4, 5]. The lake used to communicate with the sea through a series of lagoons and a direct channel to the sea. Not long ago, this communication has been stopped due to decision taken by the stakeholders for the improvement of the fishery production of lake, as there was a critical decrease of fresh water since large quantities of seawater were arriving in the lake. Lately, the production of fish has been decreased due to the intense degradation from pollution brought by water and from the declining of water volume. During the last decade, the fishery production was degraded even more and today the lake exhibits low production yields making the management and rental of the lake not viable. The future forecasts [2] for Ismarida Lake are not positive, as production does not show any turnaround and continues to face strong problems due to the intense eutrophication of the lake.

The breakdown of the production of Ismarida Lake is a shocking situation not only for this lake as the problems of this lake seems to exist also to other lakes and coastal lagoons. The results of the work prove that the development of fishing production over a 30 years period in Ismarida Lake is a dramatic decrease of fish catches. The degradation of a natural environment such as the lake Ismarida which occurred during the last years due to various factors (over pumping water, pollution, ingress of salt water, extreme weather conditions) is hard to restore, no matter any technical interventions made [2, 3, 4]. There is a critical issue about the future management of this important ecosystem: if the current management continues, there isn't any potential to improve the production and return to the previous decade levels. These results can be a useful tool for local policy makers and stakeholders dealing with fishery and ecological management and protection of Ismarida Lake. A proposal might be the enrichment of the natural stocks of fishes with offspring as well as the dredging of locations that accept debris materials for better recycling of lake's water.

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Determination of pharmaceuticals in hospital and municipal wastewaters by using LC-LTQ Orbitrap mass spectrometry

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Abstract: **In this study, the occurrence of eleven pharmaceutical compounds in wastewaters was investigated. The compounds investigated include frequently used pharmaceuticals belonging to various therapeutic categories, i.e., the non-steroidal anti-inflammatory, NSAID's drugs salicylic acid, ibuprofen, paracetamol, naproxen and diclofenac, the antihyperlipidemics gemfibrozil and fenofibrate, the sychomotor stimulant caffeine, the anti-epileptical carbamazepine, the analgesic/antipyretic phenazone and the disinfectant triclosan. A monitoring program was carried out for the four seasons of one year. The selected areas of the study were the municipal and hospital wastewater treatment plants (WWTPs) of Ioannina city, located in Western Greece. Hybrid LTQ Orbitrap mass spectrometry was employed for the ultra-trace detection and quantification of target pesticides and finally was successfully applied to the analysis. The results of the monitoring study, showed the occurrence of all target compounds in the wastewater samples. Mean concentrations in the influent ranged between 86.34 and 0.85 µg/L and in the effluent ranged between 6.69 and 0.30 µg/L. Removal efficiencies ranged between 13.8 % and 98.0 % for the WWTP of the city, and between 20.0 % and 92.2 % for the WWTP of the hospital. Removal efficiencies were higher in the WWTP of the city than in the WWTP of the hospital.**

Keywords: Environmental pollution, pharmaceuticals, WWTPs, LTQ Orbitrap mass spectrometry.

INTRODUCTION

Pharmaceuticals are chemical substances used in the treatment, cure, prevention, or diagnosis of disease or used to otherwise enhance physical or mental well-being. The growing use of pharmaceutical products is becoming a new environmental problem [1,2,3,4]. Besides other micropollutants, drug residues have become a notable contaminant of surface water during recent years. The excretion of drugs and their metabolites together with improper waste disposal have led to considerable concentrations of various compounds. High concentrations of pharmaceutical products reach wastewater treatment plants (WWTP), via human urinary or fecal excretion and from pharmaceutical manufacturing discharges. WWTP input constituents have to deal with complex mixture of various organic and inorganic substances and detailed information on potential wastewater composition is often scarce. Even the processing of communal wastewater in sewage treatment plants cannot avoid the entry of drugs into surface water because of the high stability of some drugs or their metabolites against biological degradation. Finally, these compounds may enter groundwater as well as drinking water produced from groundwater and induce adverse effects in terrestrial and aquatic organisms. The most common sample isolation and pre-concentration technique for pharmaceuticals, is solid phase extraction (SPE) where as well as isolation and pre-concentration, the matrix-solvent (wastewater) is exchanged with a more volatile organic solvent suitable for liquid chormatography (LC) [5,6,7]. Hybrid LTQ Orbitrap mass spectrometry was employed for the ultra-trace detection and quantification of target pesticides and finally was successfully applied to the analysis The use of Orbitrap MS for detection gives a better second dimension of information, which can be used to confirm the identity of the targeted compound through its mass spectrum as compared to the GC-MS systems used in a previous work [1]. Nonetheless, pharmaceuticals include a broad range of molecules of differing polarity and functionality, and hence pose a significant analytical challenge.

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EXPERIMENTAL SECTION

A. Reagents and standards

Pharmaceuticals were supplied from Promochem (Wesel, Germany). Methanol (MeOH), and water HPLC supplied from Fisher Scientific (Leicestershire, UK). Oasis MCX (150 mg, 6 cm3) cartridgeswere purchased fromWaters Corporation (Milford, MA, U.S.A.).

B. Sample collection and preparation

Wastewater samples used in this study were collected from the municipal and hospital wastewater treatment plants (WWTP) of Ioannina city located in Western Greece. The municipal plant is connected to a sewage system servicing a municipal area with~ 100.000 inhabitants. The plant applies a pre-treatment for solid removal (grit chamber), a primary and secondary treatment carried out in circular sedimentation tanks, a tertiary-biological aeration treatment, an activated sludge biological treatment and a final clarification. The hospital plant has a capacity of 800 beds and applies a pretreatment (grit-removal), a mix tank, and a biological secondary treatment concluding with disinfection. During the study, a monitoring program was carried out for the four seasons over 1-year monitoring period. Thirty two influent and effluent wastewater samples were collected during the sampling period from both WWTPs. Samples have been taken from sewage pipes from hospital inlet and outlet leading to the treatment plant, as well as at the inlet, the outlet, and between different treatment steps within the municipal WWTP, giving additional and useful information on the effects of the different treatment steps on the removal of PPCPs. All samples were collected in 1 L amber clean glass bottles and kept cooled during the transportation to the laboratory, where they were stored at 4 ◦C until analysis. The sample holding time was less than 48 h. The samples were filtrated and acidified to pH 3 to enhance trapping of the acidic compounds on the solid-phase extraction (SPE) sorbent.

C. Solid Phase Extraction (SPE)

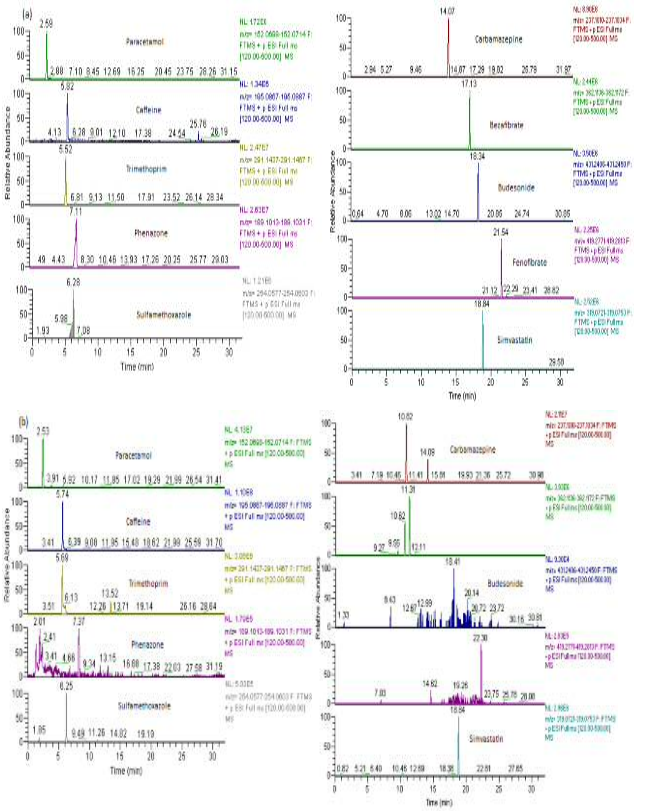
Isolation of the pharmaceuticals from the water samples were performed off-line using a standard SPE-system from Supelco (Bellefonte, PA, USA) connected to a vacuum pump. The cartridges were preconditioned with 5 mL of methanol and 5 mL of HPLC-grade water. After the conditioning step sample aliquots of 400 mL were loaded into the cartridge at a flow rate of 10 mL/min and finally washed with 5 mL of HPLC-grade water prior to the elution, in order to remove interfering compounds. Next the cartridges were dried under vacuum for 10 min. The analytes were eluted with 2 × 5 mL of methanol at 1 mL/min. The extracts were dried over anhydrous sodium sulfate and then under a gentle stream of nitrogen until dryness. The samples were then reconstituted with 0.5 mL of methanol:water, 50:50 (v/v) and stored at−20 °C until being analyzed.

D. LC Orbitrpap MS analysis

An ultra-high pressure liquid chromatography (UHPLC) system (Thermo Scientific Accela TM, Thermo Fisher Scientific, Bremen, Germany) coupled to one LC-full-scan MS configuration (Exactive High performance LC Orbitrap MS) was used. The resolution during all the analysis was set at 60000 FWHM while the scan acquisition range was performed over a range of 250-500. An ESI ion source was operated in positive ion mode. Ultra-high performance liquid chromatography (UHPLC) was employed and chromatographic separation was achieved on a Hypersil Gold column (50 × 2,1 mm, 1,9μm). The identification of the positive findings is accomplished with the data from accurate masses of the target ions, based on the full-scan exact mass measurement of $[M+H]^+$ ions, along with retention time data and characteristic fragment ions. The advantage of this hybrid instrument is that fragmentation can be carried out either in the linear trap or the HCD cell. The same applies to resulting fragments that can be measured either with the linear ion trap or the orbitrap detector. In the case of the orbitrap detector a high resolution mode was applied to obtain MS and MS/MS with high accuracy (Figure 1).

RESULTS AND DISCUSSION

The target analytes were investigated attempting to evaluate their occurrence and fate in municipal and hospital wastewater



treatment plants (WWTP) of Ioannina city, located in Western Greece. Generally, the frequency of quantification in the influents of the two WWTPs was above 50% for the majority of the target PPCPs. Salicylic acid, ibuprofen, caffeine, paracetamol and gemfibrozil were detected in 100% of the analyzed samples for both WWTPs. Mean dissolved concentrations in the influent range from 0.3 μg/L for phenazone (quantified in 6% of the influent samples) to 86.8 μg/L for salicylic acid (quantified in 100% of the influent samples) in the case of municipal WWTP and from 0.6 μg/L for fenofibrate (quantified in 6% of the influent samples) to 45.3 μg/L for salicylic acid (quantified in 100% of the influent samples) in the case of hospital WWTP. These influent concentrations depend mainly on the degree of prescription and human metabolization.

For naproxen, hospital influent concentrations (mean 11.6 μg/L) were significantly higher than in the influent (mean 1.5 μg/L) of the municipal WWTP. For gemfibrozil, diclofenac and carbamazepine hospital influent concentrations were

higher or ranged in the same order as for municipal influent concentrations. Comparison of influent concentrations of both WWTP demonstrate that for salicylic acid, ibuprofen, paracetamol and caffeine the municipal influent concentrations were higher than those of hospital influent concentrations indicate that municipal WWTP, a large wastewater plant serving over 100,000 inhabitants, receives sewage with higher loads of these PPCPs than hospital WWTP.

Salicylic acid, paracetamol and ibuprofen presented the highest concentrations in the influents, with mean concentrations of 86.8, 20.6 and 12.5 μg/L, respectively for municipal WWTP and 45.3, 9.3 and 7.8 μg/L, respectively for hospital WWTP. Paracetamol is excreted mainly as conjugates which can undergo hydrolysis during wastewater treatment resulting in the release of the parent compound.

Another compound also identified as a major constituent in influents is the stimulant caffeine with the highest concentration level of 74.9 and 25.8μg/L, for municipal and hospital WWTP, respective

The limit of detection (LOD) and limit of quantification (LOQ) were determined by the injection of spiked water samples (n = 3) and calculated as the minimum detectable amount of analyte with a signal-to noise ratio of 3:1 and 10:1, respectively. Any peak above the LOQ was quantified. LODs in distilled water ranged between 1.8 and 70.7 ng/L, in influent wastewaters between 2.9 and 112.9 ng/L and in effluent wastewaters between 2.0 and 78.3 ng/L.

Precision of the chromatographic method, determined as relative standard deviation (RSD), was obtained from the repeated injections (n = 5) of a spiked extract during the same day (repeatability) and in different days (reproducibility). Recovery studies (n = 3) were carried out by spiking samples at two concentration levels of 0.2 and 2 μg/L. Recoveries were determined for distilled water and wastewaters. The recoveries were calculated by using influent and effluent wastewaters spiked with the analytes at concentrations of 0.2 and 2 μg/L. Mean recoveries in distilled water ranged from 49.4 to 101.4% in 0.2 μg/L and from 58.6 to 100.8% in 2 μg/L. In the influents, recoveries varied from 43.3 to 99.3% and from 52.7 to 112.1%, in 0.2 and 2 μg/L, respectively. In the effluents, recoveries varied from 45.5 to 121.4% and from 49.8 to 126.5%, in 0.2 and 2 μg/L, respectively.

Matrix effects such as signal suppression/enhancement are a substantial concern in liquid chromatography. Ion suppression or enhancement were evaluated by comparing the peak areas of spiked influent and effluent wastewater extracts (area matrix), after subtracting the peak areas corresponding to native analytes present in the sample (area blank), with the peak areas from solvent (methanol–water 50:50, v/v) spiked at the same level (area solvent). When signal suppression or enhancement occurs the signal intensity of the analytes decreases or increases, respectively.

CONCLUSION

In this work we have identified and traced 11 most-detected compounds, all of which were present in all influent and effluent water samples from both WWTPs investigated. This group includes some of the most often used and environmentally persistent PPCPs in Greece. A method including SPE and Orbitrap analysis is proposed for simultaneous determination of different classes of pharmaceutical compounds in hospital and municipal wastewaters. The compounds investigated include frequently used pharmaceuticals belonging to various therapeutic categories. The application of the proposed method has allowed a simple, rapid and reliable evaluation of the reported compounds at mean concentration levels ranged from 0.3 to 164.4 μg/L in the influent and from 0.5 to 14.6 μg/L in the effluent. The removal efficiencies of the WWTPs for these compounds varied from 9% (diclofenac) to 97% (paracetamol). The highest removal rate was achieved during biological treatment, which was satisfactory except for diclofenac and carbamazepine.

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Mapping stakeholders' perception of the main vulnerabilities, limitations and opportunities generated by land-sea interactions in the Danube Delta - Black Sea coastal zone

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Abstract: This paper is an outline of the main activities the National Institute for Marine Research and Development "Grigore Antipa" is undertaking in the frame of the COASTAL project (Collaborative Land-Sea Integration Platform), funded by the European Union's Horizon 2020. By combining local knowledge and scientific expertise in a co-creation process, the COASTAL project engages actors and stakeholders at all levels to improve coastal-rural interdependence and collaboration by identifying problems and setting up evidence-based business roadmaps and policy solutions, focusing on economic growth, marine spatial planning, and environmental protection, including inland water quality. COASTAL will contribute to integrated coastal-rural planning and coastal-rural synergy in the case study regions and the wider EU territory, develop a durable, online platform for knowledge exchange about coastal-rural synergy with concrete examples and tools for supporting land-sea collaboration.

Keywords: COASTAL Platform, mind maps, coastal zone, multi actor laboratory, Danube Delta

BACKGROUND

Rural development in coastal areas of the EU is increasingly affected by changing market developments, decreasing population densities, urban sprawl, lack of employment, desertification and other environmental, economic and social pressures. Moreover, coastal areas provide interesting business opportunities, but are also influenced by economic activities in the hinterland [1]. In the frame of the COASTAL Project, Multi-Actor Approaches are combined with System Dynamics to analyze the environmental, economic, and social interactions of rural and coastal areas in a holistic manner. The underlying feedback structures governing the dynamics, vulnerabilities, limitations, and business opportunities of the land-sea system are identified and analyzed, taking into consideration the regulatory frameworks, stakeholder priorities and social-economic conditions at the local, regional and macro-regional scale levels. Multi-Actor Labs using qualitative and quantitative tools are set up to support the co-creation exchanges between scientific experts, stakeholders, business entrepreneurs, sector- and administrative representatives (Fig. 1).

National Institute for Marine Research and Development "Grigore Antipa", Constanta, Romania

Fig. 1. COASTAL structure and work-flow.

MATERIAL AND METHODS

The project is organized around six interacting, complementary Multi-Actor Labs (MALs) spread over the EU, exchanging their tools and expertise and connected through a Collaborative Knowledge Exchange Platform, to be further exploited and developed beyond the project life time (Fig. 2). The Romanian case study covers the Danube Mouths and Black Sea coastal zone.

Due to the semi-enclosed location and size of the contributing catchment area, the Black Sea is vulnerable to anthropogenic pressures and pollution sources. Even today the Black Sea catchment is still under pressure from excess nutrients and contaminants due to emissions from agriculture,

tourism, industry and urbanization in the Danube basin. The increased rates of eutrophication, pollution and bioaccumulation affect both the biodiversity and fishing sectors. Mass tourism is also an important growth sector for the Black Sea and eco-tourism is becoming more important in the region. Approximately 65% of the Romanian coastline is located in the Danube Delta Biosphere Reserve and subject to tourism regulations, resulting in conflicts between nature conservation and economic development [2]. Failing to resolve these conflicts has economic and political impacts, which calls for urgent co-creation actions among all the stakeholders involved [3].

In order to accurately map all these pressing issues and the interactions between them, mind mapping exercises were organized in the frame of three workshops focused on Blue Growth, Tourism and Fisheries & Aquaculture. Stakeholders from these sectors attended, and they developed mind maps starting from 8 common drivers: water, policy, climate change, demography, environment, infrastructure, business development and well-being. Mind-maps were initially drawn on a white board, and eventually transposed into a digital format using the VENSIM software [4].

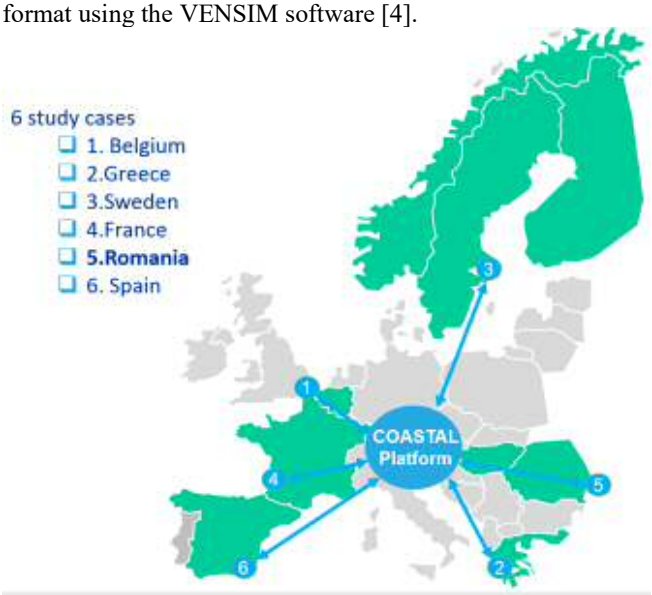

Fig. 2. COASTAL Platform and case study distribution.

RESULTS

Local actors and experts from the Danube Delta and Black Sea coastal zone participated in collaborative exercises to analyze problems, the underlying causes, propose and discuss solutions, and validate and interpret the impacts of simulated business and policy decisions. Three interactive workshops were organized on 30 and 31 October 2018, focusing on Blue Growth (industry, transport and administration), Tourism and Fisheries & Aquaculture, attended by local stakeholders from the Constanta and Tulcea counties.

Qualitative and quantitative techniques were combined in this co-creation process supported by graphical tools to gain in-depth understanding of the systemic transitions underlying the land-sea interactions in each specific domain.

During the three workshops, stakeholders were actively involved in identifying the main connections between the 8 drivers, specifically tailored for the activity sectors. For Blue Growth, representatives from public administration, policy makers, industry and transportation were present, while for Tourism and Fisheries & Aquaculture - operators, investors and control authorities attended (Fig. 2).

Fig. 2. Workshop debates with local stakeholders from the Constanta and Tulcea counties.

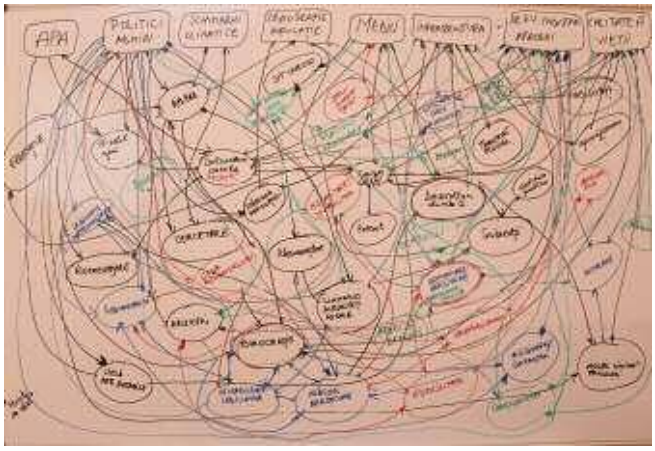

Fig. 3. Example of a mind map for TOURISM.

For all three activity fields, it resulted that the most significant driver is represented by *policy*, as it can influence all activities by regulating them (Fig. 3).

All these identified interactions between drivers were further introduced into the VENSIM software, in order to graphically represent the cause-effects relationships (Fig. 4).

These systemic transitions will further be synthesized and analyzed with system dynamic models to produce multiple transition scenarios for key business and policy indicators, in a process of fostering co-creation as a must-have approach of current environmental and societal issues [5].

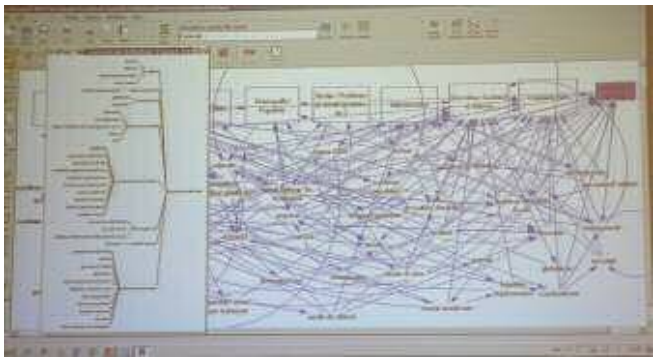

Fig. 4. Causal trees built using the VENSIM software.

CONCLUSION

The novel approach of the COASTAL project will allow for a joint co-creation effort between scientists and stakeholders acting the in Romanian Black Sea coastal zone - Danube Delta area.

The multi-actor approach applied for analyzing the social-environmental and economic land-sea interactions will highlight potential cross-sectoral interactions and innovation that could emerge from greater cooperation between sea-based and land-based businesses or organizations, while also considering the short-, mid- and long-term impacts of decision making and feedback mechanisms on coastal and rural development.

The next steps in the project include:

- Qualitative and quantitative techniques are combined in this co-creation process supported by graphical tools to gain in-depth understanding of the systemic transitions underlying the land-sea interactions (final VENSIM charts).
- These systemic transitions will be synthesized and analyzed with system dynamic models to produce multiple transition scenarios for key business and policy indicators.
- From these mind maps, practical business roadmaps and policy solutions are derived, which are easily updated in the models used to support the analyses.

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Land Consolidation and Sustainable Development

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Abstract: Land consolidation as a tool for land management produces positive effects for multiple and various dimensions of agricultural development including societal and economic parameters as well. Land consolidation as a process which requires engagement of experts of various scientific fields and certain period of time for its realization produces costs which must be smaller than its positive economic effects. Land consolidation costs, in that sense, shall be treated as an investment in agriculture production development while its other positive effects are difficult for precise determination. This paper aims to consider, analyze and discuss land consolidation effects from aspect of sustainable development in the sense defined by United Nations. Methodology for land consolidation effects determination is based on simplified mathematical models. The consideration in this paper are predominantly theoretical and represent the effort for global model formulation.

Keywords: Land consolidation, societal development, sustainable development, economic growth.

INTRODUCTION

Land consolidation is a term which denotes a various operations with land and has taken different meanings during its history. Study the practice and development of land consolidation it may be concluded that its role changed during according to development of society and according to the consciousness about the human influence on the environment. From the starting idea to grouping fragmented land ownership the land consolidation evolved to the significant tool for land management. Numerous theoretical considerations as well as practical solutions showed that land consolidation based on land ownership rearrangement and parcel reallocation could have positive effects not only n economic but also in societal and environmental dimensions.

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Sustainable development is an approach which encourages development of current human generation at the level which does not jeopardize the development of future generations.

"The first consolidation initiatives of Denmark in the 1750s were part of a profound social reform to free people from obligations to noble landlords by establishing privately-owned family farms. The consolidation of fragmented holdings did result in improved agricultural productivity but this was not the only objective of these reforms." [1]. The same literature highlights that land consolidation has always been regarded as an instrument or entry point for rural development and is sometimes incorrectly interpreted to be only the simple reallocation of parcels to remove effects of land ownership fragmentation. The definitions of land consolidation which could be finding in literature encompass broader area of activities and aims. For example: "Generally, land consolidation (LC) is a tool for ensuring the effective and rational cultivation of farmland." [2]. This definition highlights the effective farming as a main aim of land consolidation, but does not stress the period of time in which effective shall last. In this paper we will assume that effective farming shall last in infinite period of time because the sustainable development is related both for current and future generations. Second implicit assumption is that the demand for food will last as long as humanity.

The sustainable development is a consequence of the matter of fact that available resources on the planet Earth for satisfying peoples' needs are limited and that aspiration for developing is unlimited. World Commission on Environment and Development in its report stated that „Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs." [3] This approach could be explicated as a need for rational utilization of available resources in order to minimize their degradation ensuring, at the same time, the development of humanity. Utilizing this principle on the arable land which is the main source for food supply it could be concluded that, on the one side is necessary to provide enough food (bearing in mind the increasing world population the pressure is on increasing productivity per unit area of arable land), while on the other side it is necessary to conserve the existing and limited arable land. At the same time the economy could not be neglected. As the other market of goods, the food market also functioning

according to supply-demand law i.e. the farmers shall to make some profit.

Summarizing the previous considerations it is possible to conclude that sustainable development should encompass three indispensable factors: Society, environment and economy. These related factors are called common three-ring

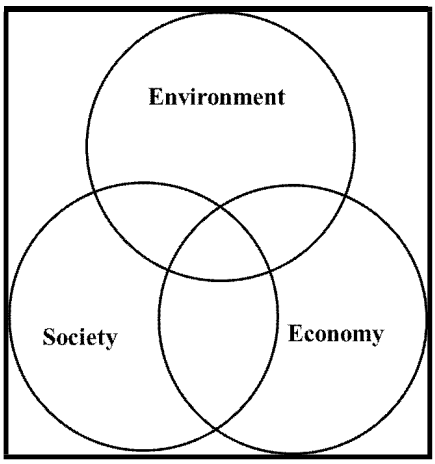

Fig. 1. Common three-ring sector view of sustainable development [4]

sector view of sustainable development showed on fig. 1. [4]. Utilizing land consolidation from aspect of this approach it is necessary to ensure that aims of land consolidation shall belong to the intersection of all three rings.

METHODOLOGY

Methodology of analysis is based on the general approach because detailed analysis shall encompass numerous parameters and it is almost impossible to include all of them in analysis.

The basic assumption is that rearrangement and reallocation of parcels (as a toll for land consolidation realization) is possible in huge number of ways but optimal reallocation could be obtained only according to the previously defined aim. If we consider every ring sector as a set of parameters (Society, Environment and Economy) and denote them as S, En and Ec respectively we can say that the sustainable development (SD) exists in the intersection of those sets:

$$SD \in S \cap En \cap Ec \tag{1}$$

If land consolidation (LC) tends to support sustainable development what could be written in following way:

$$SD = SD(LC) \tag{2}$$

then aims of land consolidation (A_{LC}) should belong to the set $\{SD\}$. The environmental function is, by default, decreasing with increase of human activity i.e. limitations means to preserve the capacity of environment. This means that aims of land consolidation shall not include only the effective and rationale farming but also societal and environmental parameters. Societal and economic aims predominantly mean maximization of development and economic growth respectively, while the environmental parameters predominantly represent limitations.

Previous principles could be represented by following formulae:

$$SD = f(S, En, Ec) \tag{3}$$

$$SD = f[S(A_{LC}), En(A_{LC}), Ec(A_{LC})] \tag{4}$$

In order to fulfill the condition of sustainable development the aims of land consolidation shall be formulated in way which ensure increasing function of societal development and economic growth and, at the same time, limits degradation of environment.

It could be written as follows:

$$\left(\frac{\partial f}{\partial S} > 0\right) \wedge \left(\frac{\partial f}{\partial Ec} > 0\right) \wedge \left(\frac{\partial f}{\partial En} = 0\right) \tag{5}$$

Bearing in mind that last condition in formulae (5) is not possible it could be defined as:

$$\left(\frac{\partial f}{\partial En} \leq q\right) \tag{6}$$

where q is the maximal value of environment deterioration which is acceptable in order to consider development "sustainable".

Further development of model (4) leads to following formulae:

$$\left(\frac{\partial f}{\partial S}\frac{\partial S}{\partial A_{LC}} > 0\right) \wedge \left(\frac{\partial f}{\partial Ec}\frac{\partial Ec}{\partial A_{LC}} > 0\right) \wedge \left(\frac{\partial f}{\partial En}\frac{\partial S}{\partial A_{LC}} \leq q\right) \tag{7}$$

The formula (7) highlights the role of proper formulations of land consolidation aims in order to contribute to sustainable development.

RESULTS AND DISCUSSION

The considered model for contribution of land consolidation to sustainable development includes the societal development, economic growth and environment preservation in phase of aims of land consolidation definition. Societal development and economic growth are function which intends to grow while the environment must not be deteriorated over the value which compromises the future generations' chance for development. This is very difficult task because the limit of deterioration (q) cannot be determined in advance, and even it is determined the only way to be kept in defined interval is by regulation. The land consolidation is a method which could contribute to solution of minimizing the arable land and environment deterioration by reallocation and rearrangement of land ownership. To ensure contribution of land consolidation to sustainable development it is necessary to include sustainable development criteria in the phase of aims of land consolidation formulation and checking them in

relation to all the three-sector aims.

CONCLUSION

This paper consider the model for analyze of potential contribution of and consolidation to sustainable development. The considerations are predominantly of theoretical approach.

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Environmental impact of hybrid electric vehicle passenger cars in urban areas

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Abstract: The scientific study will reveal the environmental impact of hybrid electric vehicle passenger cars emissions for two configurations of hybrid-electric propulsion systems simulated on four consecutive ECE-15 and one EUDC emissions test cycle with Advance Vehicle Simulator software - ADVISOR. Further, the initial conditions – temperature of the propulsion systems - will be considered for cold and hot scenario while assessing the autonomy of the two-vehicle configurations.

Keywords: Hybrid, passage cars, ECE-15, EUDC, ADVISOR.

INTRODUCTION

Urban emissions mitigations of passage cars it's a continuous fight of both manufactures and administrations. Considering the actual trend and future prognosis of the ambient emissions of passage cars in urban areas, a mitigation solution of them is the migration of the actual propulsion system to more environmentally friendly solutions.

The concept of hybrid electric propulsion is not new, from the beginning of the XX century electric motor was connected to a vehicle that could carry passages and more. Nowadays the technology and materials are capable to offer reliable solutions in terms of alternative propulsion for passenger cars. Several hybrid propulsion system concepts emerged during the rise/increasing demand of the alternative propulsion system for passenger cars. One hybrid electric configuration is **serial,** when the internal combustion engine is connected to the drive axel through electric generator, energy storage system (battery pack) and electric motor, and the other concept is **parallel** configuration when the internal combustion engine and the electric motor are connected directly to the drive axel [1,2]. Both systems in principle propels the vehicle in the same alternative way, either electrical or with internal combustion engine, trying to save conventional fuel and lower the ambient emissions while in operation. The difference between the systems are in mater of concept and/or propulsion management.

EXPERIMENTAL SETUP AND RESULTS

For the propose study the Advance Vehicle Simulator Software will be used to highlight the difference between the two-hybrid electric vehicles architecture while are driven on the NEDC cycle (Fig. 1). NEDC cycle was established in 1997 by designed to evaluate the emission levels and fuel economy of conventional internal combustions engines of passenger cars, excluding the light trucks and commercial vehicles. In scientific literature it can be found also as MVEG cycle (Motor Vehicle Emissions Group).

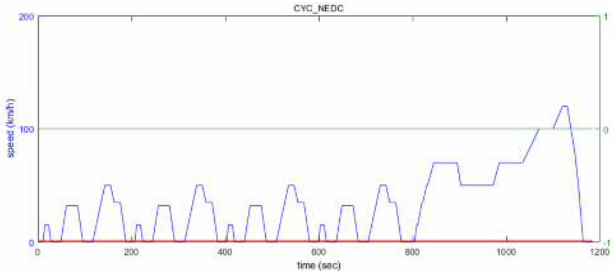

Fig. 1. New European Driving Cycle

Constantly the NEDC, which presumes to reveal the typical usage of a car in Europe, was criticized for delivering fuel economy-figures which are unachievable in real conditions. The NEDC cycle consists of four repeated ECE-15 urban driving cycles (UDC) and one Extra-Urban driving cycle (EUDC) [3]. In detail the NEDC cycle has a length of 10.93 km, perused by the vehicle in 1184 seconds. Maximum speed achieved by the vehicle is 120 km/h, and the average speed is 33.21 km/h. Maximum acceleration of the tested vehicle is 1.06 m/s^{-1} (average 0.54 m/s^{-1}), maximum deceleration -1.39 m/s^{-1} (average -0.79 m/s^{-1}).

The test procedure for CO_2 measurements and fuel consumption and/or the measurement of electric energy consumption and electric range in hybrid and fully electric M1 and N1 vehicles is defined by UNECE R101[4], and UNECE R83[5] for the measurement of emission of pollutants of M, N1 and M2 type vehicles. It is highlighted by the UNECE World Forum for Harmonization of Vehicle Regulations (WP.29),[6] which is valid for its successor, the Worldwide harmonized Light vehicles Test Procedures (WLTP) [7].

The Advance Vehicle Simulator Software was developed by NREL in 1997, and since then, the open source support is continuously offered. The software is developed under the Matlab - Simulink platform with guided user interface interaction. The principle operation of the Advance Vehicle Simulator Software is approximation of the behavior of the vehicle continuously in a **series of discrete steps during each of witch the components are assumed to be at steady state**. In other words, **at each time step**, **the** effects of current changing, voltage, torque, and RPM are neglected. In this way

for example the software can use to relate the power demands of the components at each time step with the efficiency or power loss tables determined through testing of a component from the drivetrain [8].

ADVISOR simulation is driven by the input driving profiles. From the statement above, after the input profiles ware loaded, it works backwards form the required vehicle and wheel speeds, to required torques and speed of each component between the extreme limits (wheel - energy storage system) [8].

The first step in evaluation of the environmental impact and autonomy of the hybrid electric vehicle is establishing the initial condition for each architecture of them. The model from ADVISOR used for hybrid-electric vehicle in series configuration is presented in Fig. 2.

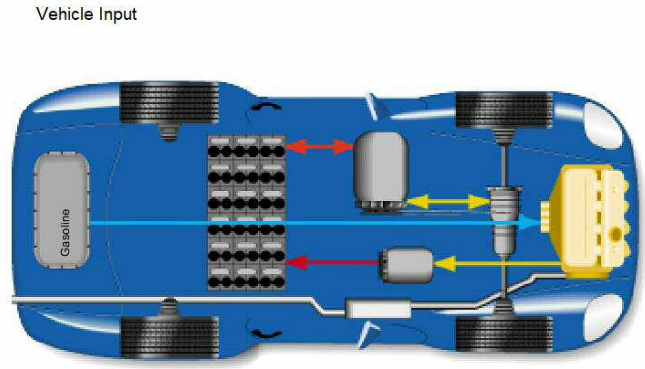

Fig. 2. Hybrid electrical vehicle – Series configuration.

The overall mass including the energy storage system of the series model is 1373 kg. The sub models used for the study consist for the internal combustion engine FC_SI41_emis (3-cylinder GEO 41 kW engine) with aftertreatment and a peak efficiency of 34 %. The energy storage system consists a pack of lead acid batteries ESS_PB25 with a nominal voltage of 308V. For electric propulsion the MC_AC75 (P_{max} =75 kW) asynchronous electric motor model was used. All the subsystems were connected to a one-speed manual transmission (TX_1SPD) with front wheel drive.

After the cycle run is selected, the initial conditions are the next input variable that will suffer alteration. The first evaluation test is when the initial conditions of the vehicle in terms of temperature are set to ambient values (Fig. 3). The initial condition refers whether the vehicle is cold or wormed up for driving. The cold and hot state of the vehicle has a major impact on ambient emissions of the internal combustion engines. Regarding the batteries used for vehicle propulsion the temperature also plays an important role. In our case the batteries are led acid, and the temperature can influence the chemical reactions inside it. One aspect that must be highlighted form the initial conditions is that the state of charge (SOC) of the energy storage system was set to 0.7, which means 70% charge. In laboratory conditions the maximum charging capacity obtained is circa 80%.

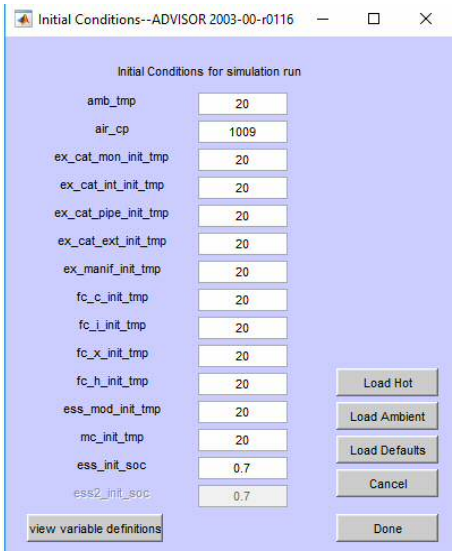

Fig. 3. Initial conditions – Series configuration ***cold setup***.

Preliminary results of the Hybrid electrical vehicle – series configuration tested on 1 NEDC cycle are presented in Fig. 4.

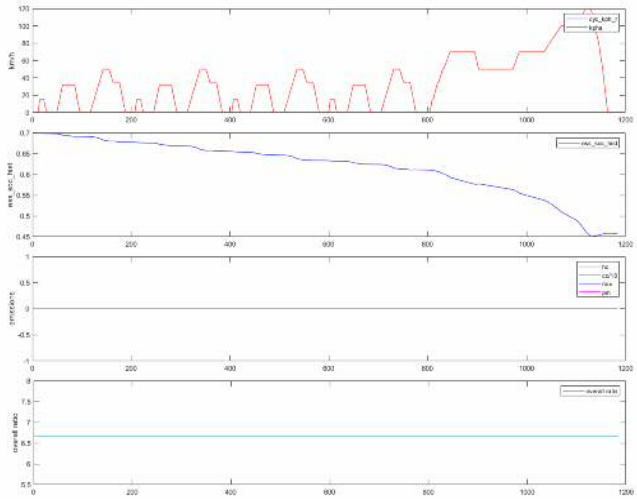

Fig. 4. 1 NEDC cycle – Series configuration ***cold setup***.

From the preliminary results one conclusion emerges: the vehicle was operated on the NEDC cycle only with electrical propulsion. Therefore, emissions of the internal combustion engines are 0. During the NEDC cycle, the series configuration hybrid vehicle operates in electric mode and the SOC dropped from 70% to 45%. In average in a medium size urban area, per day an urban family vehicle is operated between 30 – 50 km, therefore, it is necessary to have a view of the hybrid vehicle behavior while it is driven on several complete NEDC cycles – 54.7 km. In this way 5 consecutive NEDC cycles were chosen, and the results are presented in Fig. 5.

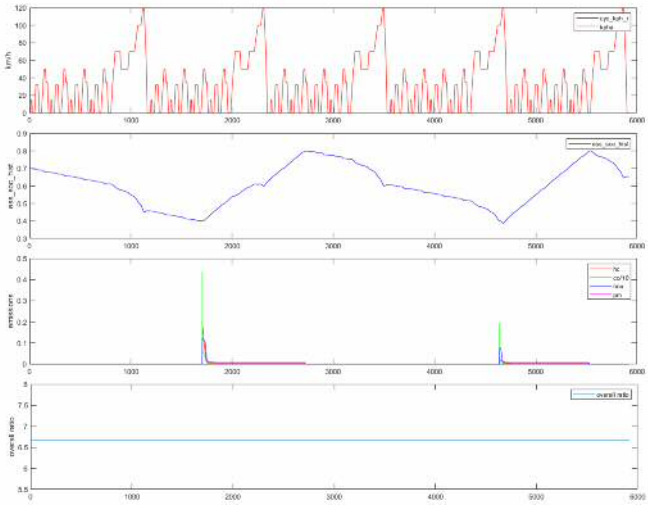

Fig. 5. 5 NEDC consecutive cycles – Series configuration ***cold setup***.

In this case the internal combustion engine started to operate, therefore emissions are present: HC = 19.3 gr/100 km, CO = 84.4 gr/100 km and NO_x = 36.6 gr/100 km. The fuel economy accomplished was 6.7 l/100 km, therefore for a small compact size vehicle the average fuel tank is 60 liters, thus in urban driving resulting an autonomy of 895.5 km.

There results were obtained when the state of the hybrid electric vehicle was cold.

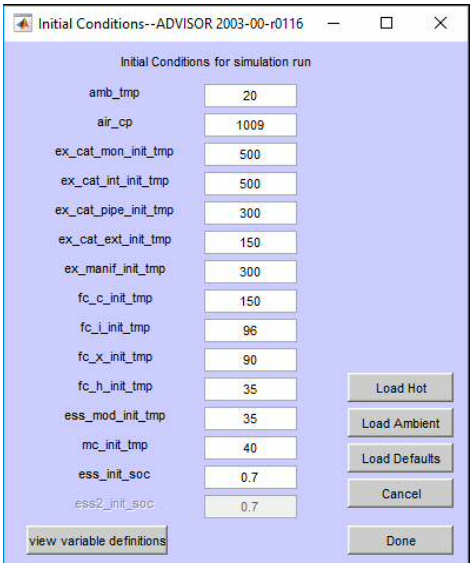

Fig. 6. Initial conditions – Series configuration ***hot setup***.

An interesting observation will be when we consider that the vehicle is wormed up and ready to fulfil our needs. In this consideration from the ADVISOR software the in initial condition variables pane the hot values were loaded (Fig. 6).

In this case the hybrid vehicle is warmed, only the ambient temperature remained the same at 20 °C. Results of the hybrid electric vehicle behavior for 5 consecutive NEDC cycles – 54.7 km with ***hot initial*** conditions are presented in Fig. 7.

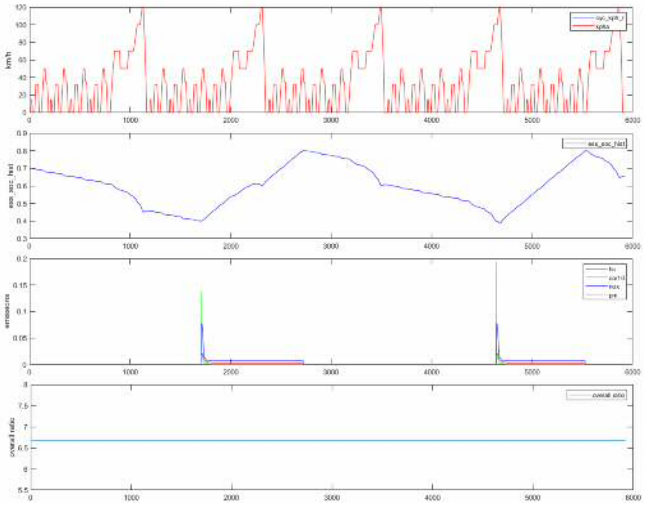

Fig. 7. 5 NEDC consecutive cycles – Series configuration ***hot setup***.

In this care the operation of the internal combustion engine revealed emissions of: HC = 12.9 gr/100 km, CO = 54.9 gr/100 km and NO_x = 31.8 gr/100 km. The fuel economy experienced in this case remained the same 6.7 l/100 km, therefore the autonomy of 895.5 km in urban driving for a 60-liters fuel tank remained the same.

The second hybrid electric vehicle architecture is the parallel configuration, presented in Fig. 8.

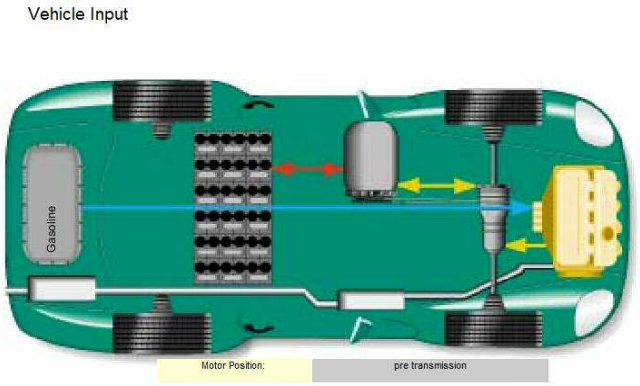

Fig. 8. Hybrid electrical vehicle – Parallel configuration.

The parallel configuration hybrid electric vehicle model used from ADVISOR database presented in Fig. 8, has several particularities. From the beginning it can be observed that it is lighter with 23 kg. To have a fare comparison the weight of the second hybrid electric vehicle must be increased (with 23 kg). Another aspect that must be taken into consideration is that of the transmission the 1 speed transmission doesn't fit in this architecture because the internal combustion engine can be coupled direct to the drive axel through the transmission and accordingly to the operational principle of the internal combustion engine the transmission must be divided in gears. The sub model chosen further on is the TX_5SPD, a transmission that has the same weight as for the first case. All other input variables were kept the same to have a fair comparison.

The first preliminary results for *cold setup* and 1 NEDC cycle run of the hybrid electric vehicle – parallel configurations are presented in Fig. 9.

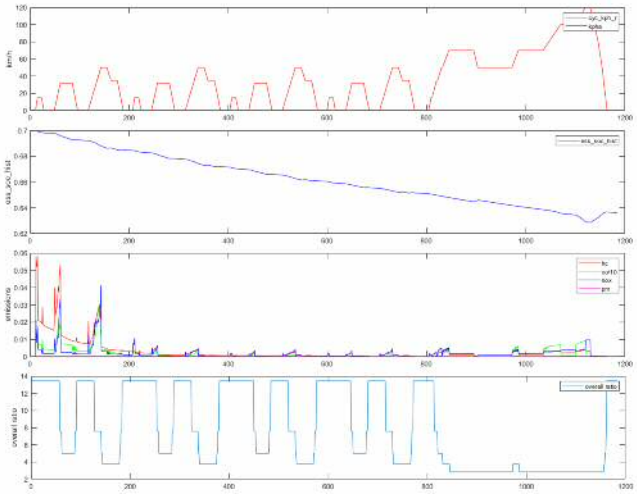

Fig. 9. 1 NEDC cycle – Parallel configuration ***cold setup***.

Another conclusion is that the parallel configuration vehicle started to move the vehicle from the beginning with both engines, thus resulting from the beginning emissions. Computed, the emission results are: HC = 34.4 gr/100 km, CO = 181.4 gr/100 km and NO_x = 19.5 gr/100 km and the remaining SOC was 62 %. From the first run ADVISOR computed the fuel consumption at 6 l/100 km. Results for 5 NEDC consecutive runs are presented in Fig. 10.

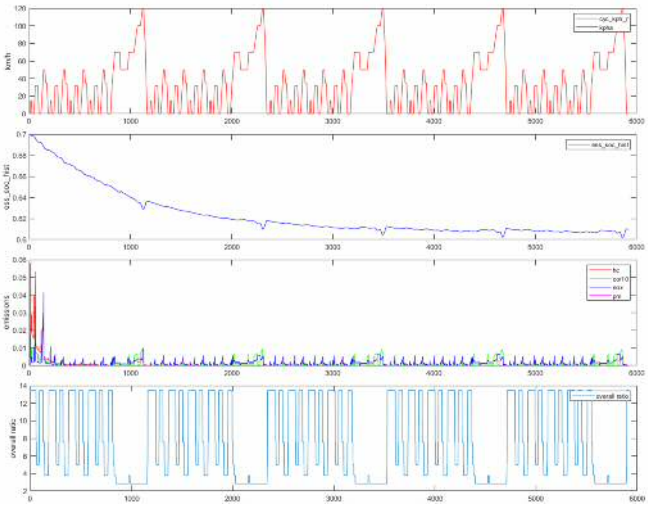

Fig. 10. 5 NEDC consecutive cycles – Parallel configuration ***cold setup***.

The results show a reduction for emission of HC = 15.8 gr/100 km, CO = 99.5 gr/100 km and NO_x = 15.4 gr/100 km, but an increase of the fuel consumption is experienced 6.8 l/100 km, and for a 60 liters fuel tank the autonomy of the vehicle is 882.3 km in urban driving.

Analysis of the behavior and results for the ***hot setup*** and 5 NEDC consecutive cycles runs are presented in Fig. 11

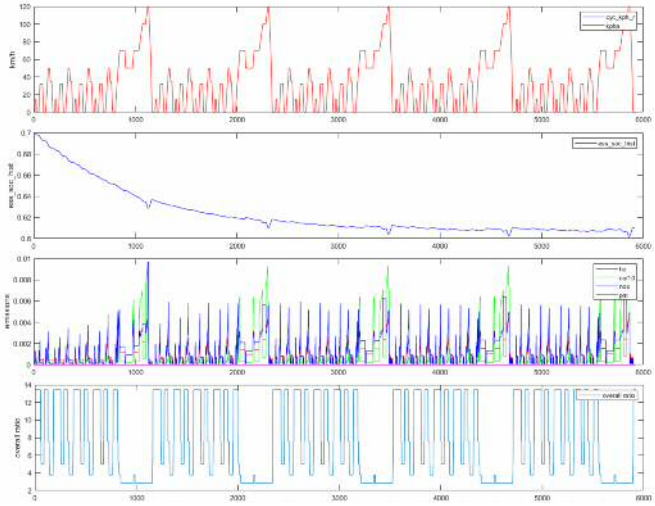

Fig. 11. 5 NEDC consecutive cycles – Parallel configuration ***hot setup***.

The same decreasing trend in the emissions is experienced: HC = 10.7 gr/100 km, CO = 76.1 gr/100 km and NO_x = 13.5 gr/100 km. It can be noted that when the parallel configuration hybrid electric vehicle is used when is wormed up and in the same conditions, the fuel consumption is equal to the serial configuration, 6.7l/100 km, experiencing the same 895.5 km in urban driving, for 60-liter fuel tank, autonomy.

CONCLUSION

For short distances in NEDC cycle the simulation revealed that the energy management system is more efficient in terms of environmental impact for the hybrid electric vehicle in serial configuration. In cold setup the environmental impact is slightly increased for the serial configuration hybrid electric vehicle for the HC and NO_x emission while the CO emission was lower.

The fuel consumption for cold setup was higher for the parallel configuration hybrid vehicle with 0.1 l/100 km.

The situation turned in favor of the parallel hybrid vehicle configuration when the vehicle was tested while the propulsion system was wormed up during five NEDC consecutive cycles. The emissions counted for the serial configuration were: HC 10.7 gr/100 km, CO = 76.1 gr/100 km and NO_x = 13.5 gr/100 km while for the serial configuration were: HC = 12.9 gr/100 km, CO = 54.9 gr/100 km and NO_x = 31.8 gr/100 km. Only for carbon monoxide emissions higher values were experienced.

The fuel consumption was conserved putting both configurations to 895.5 km autonomy in urban driving for a 60-liters fuel tank.

Although the serial configuration hybrid electric vehicle has a better energy management for short distances, has more disadvantages then the parallel configuration. One major is the cost since has more components in the drive chain, thus a lower overall efficiency in terms of energy transformations. The odds are balanced in favor of the parallel configuration case.

Acknowledgment

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Micro-elements solubilization in soils, depending on different environment conditions 1

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Abstract: Some micro-elements and heavy metals (zinc, copper, iron, manganese, lead, and cadmium) solubilization degree in soils was studied, represented by the mobile form percentage out of the total one, in five areas of the Country: three agricultural sites, located in South-Eastern Romania, unaffected by anthropic impact or natural handicaps, an area generally occupied by pastures, located on the Călmățui and Buzău rivers valleys, on Solonchaks and Solonetz , and an area affected by major anthropic impact, around Baia Mare Municipality.

The degree in which these soil micro-elements and heavy metals pass in soil solution was linked to the soil general agrochemical properties, to the existence or not of anthropic impact or natural handicap and to the vegetation type. Different micro-elements and heavy metals solubilization models were outlined in the five researched areas and the highest values were registered in the polluted and acidified soils from around the Baia Mare Municipality. Also, there are important differences as regards the solubilization degree of each element. The iron stands out, with extremely low relative values. It's followed by manganese, zinc, lead, copper, and cadmium, in an increasing order, not always the same.

Keywords: environmental pollution, micro-elements, solubilization degree, natural handicap.

INTRODUCTION

Micro-elements and heavy metals, whether mobile forms important to plant nutrition or total forms with significance in pollution phenomena, have long been studied, in our country and all over the world. Data referring to their contents in soils are largely variable, depending on soil genesis, parent not last – anthropic impacts and their nature. Studies have been developed regarding different microelements and heavy metals flow in the soil-(water)-plant system in various regions, such as a vineyard [1] or an area subject to strong anthropic impact [2]. Other authors studied the retention of major elements and trace metals within the sludge deposits particles and the influence of extreme pH conditions on their potential release [3]. Special attention has been given to heavy metals behavior in soils after ecologic accidents [4] from the point of view of their environmental impact. Previous studies have stated that micro-elements/heavy metals solubilization increases, sometimes very much, in acid soils, and the solubilization degree increases with the acidity [5] [6] [7] [8]. Redox conditions have also been considered in the heavy metals mobilization process and it has been found that pH and redox conditions are master variables controlling the potential release of stored pollutants to the aqueous phase and therefore their dispersion in the environment and their availability to biota [9]. The dissolved organic matter has also been found to influence the mobilization of heavy metals in polluted wetland soils but not in in soils with a low soil pH (< 4.5) [10].

The present study takes into account some general agrochemical soil properties in relation to the solubilization degree of some micro-elements and heavy metals.

MATERIAL AND METHODS

Five areas of the Country were considered for the study of some micro-elements and heavy metals (zinc, copper, iron, manganese, lead, and cadmium) solubilization degree in soils: three agricultural sites, located in South-Eastern Romania, unaffected by anthropic impact or natural handicaps, an area generally occupied by pastures, located on the Călmățui and Buzău rivers valleys, on Solonchaks and Solonetz[27], and an area affected by major anthropic impact, around Baia Mare Municipality.

Total contents of microelements and heavy metals were determined by atomic absorption spectrometry after sample digestion with a mixture of hydrochloric acid (HCl), nitric acid (HNO_3), and hydrogen peroxide (H_2O_2) [11]. Mobile forms of microelements and heavy metals were extracted in an ammonium acetate (CH_3COONH_4)-EDTA solution at pH 7 [12] and determined by atomic absorption spectrometry too.

The solubilization degree was computed as the mobile form

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[27] WRB-SR 2014

percentage out of the total one.

The micro-elements solubilization degrees were correlated with the soil general agrochemical properties: reaction (pH_{H_2O}), organic matter (humus), total nitrogen and mobile phosphorus and potassium contents.

RESULTS AND DISCUSSIONS

The values of micro-elements solubilization vary very much, not only between regions, vegetation cover, or the existence or not of some natural handicap or anthropic impact, but also inside the same region, in similar conditions. It can be seen in the adjacent tables (Table I) that the values of the statistical parameters are very scattered which suggests that there are multiple factors that influence the micro-elements solubilization in soils.

Table I. Micro-elements solubilization values (mobile forms out of total ones, %) in the upper horizon (0-20 cm) of soils from:

a) Central and South Dobruja

Statistical parameters	Cu	Zn	Cd	Mn	Fe
n	26	26	26	26	**26**
x_{min}	12,7	1,6	18,1	0,2	**0,00025**
x_{max}	35,3	12,0	29,8	1,3	**0,01778**
$\bar{x}$	17,1	3,1	23,8	0,7	**0,00552**
σ	5,0	2,2	3,0	0,3	**0,00316**
cv (%)	29	71	13	43	**57**
Me	15,1	2,2	24,2	0,7	**0,00490**
Mo	**15,1**	**2,6**	**24,6**	**0,5**	**0,00187**

b) South-Eastern Romanian Plain

Statistical parameters	Cu	Zn	Cd	Mn	Fe
n	23	23	23	23	**26**
x_{min}	11,2	1,5	16,6	0,2	**0,00314**
x_{max}	23,0	5,7	92,2	1,6	**0,02408**
$\bar{x}$	14,0	2,6	31,7	0,7	**0,00743**
σ	2,3	0,9	16,4	0,4	**0,00515**
cv (%)	16	35	52	57	**69**
Me	16,7	2,4	28,0	0,5	**0,00555**
Mo	**14,0**	**2,2**	**24,8**	**0,4**	**0,00516**

c) Central Bărăgan – Slobozia – Radu Vodă area

Statistical parameters	Cu	Zn	Pb	Cd	Mn	Fe
n	34	34	34	33	34	**34**
x_{min}	6,5	0,5	4,4	25,9	0,1	**0,00562**
x_{max}	24,9	4,6	23,8	80,3	4,8	**0,11066**
$\bar{x}$	10,9	1,3	9,5	49,6	1,8	**0,03272**
σ	3,7	1,0	4,4	14,3	1,2	**0,02443**
cv (%)	34	77	46	29	67	**75**
Me	9,9	0,9	8,3	46,9	1,8	**0,02820**
Mo	**10,3**	**0,9**	**7,6**	**39,4**	**0,6**	**0,01735**

The values for lead in Central and Southern Dobrogea and in the South-Eastern Romanian Plain have not been presented as most of them are below the detection limit of the analytical method.

d) Călmățui and Buzău rivers valleys – Solonchaks and Solonetz

Statistical parameters	Cu	Zn	Pb	Cd	Mn	Fe
n	55	55	43	28	55	**55**
x_{min}	6,8	0,0	0,8	20,1	0,5	**0,00000**
x_{max}	32,8	69,6	80,5	90,7	19,3	**0,73516**
$\bar{x}$	15,5	3,7	28,6	57,3	4,6	**0,08714**
σ	5,1	9,5	20,5	21,7	3,9	**0,14785**
cv (%)	33	257	72	38	85	**170**
Me	13,5	1,7	27,1	58,9	3,0	**0,02978**
Mo	**12,9**	**5,1**	**9,8**	**73,9**	**2,2**	**0,05405**

e) Călmățui and Buzău rivers valleys – Solonchaks and Solonetz

Statistical parameters	Cu	Zn	Pb	Cd	Mn	Fe
n	30	32	27	30	28	**32**
x_{min}	5,5	6,6	14,8	6,6	1,4	**0,06432**
x_{max}	69,8	51,7	78,2	93,2	81,2	**3,14607**
$\bar{x}$	35,1	17,7	49,7	37,2	14,5	**0,95900**
σ	17,0	11,4	17,1	22,3	19,3	**0,80925**
cv (%)	48	64	34	60	133	**84**
Me	31,8	14,0	49,8	37,5	8,4	**0,71284**
Mo	**22,8**	**11,3**	**47,8**	**42,3**	**8,8**	**0,37162**

The cadmium solubilization values appear to be the biggest and they tend to increase in the areas with natural handicap (Buzău and Călmățui Rivers Valleys – Solonchaks and Solonetz) or affected by anthropic impact (Baia Mare area – heavy metals pollution). This tendency is also manifested by the other micro-elements, in a smaller degree. According to researches carried out for a long time in heavy metals polluted areas, the solubilization of these elements is directly and positively influenced by acidity [5] [6] [7] [8].

Table II. Correlation tables depicting the relations between micro-elements solubilization degrees and general soil agrochemical properties:

a) Central and South Dobruja (n = 26)

	Cu	Zn	Cd	Mn	Fe
pH_{H_2O}	0,21	0,08	- 0,50**	- 0,36	**- 0,44***
Humus	- 0,29	0,02	0,41*	0,01	**- 0,10**
Nt	- 0,24	0,05	0,49*	0,10	**0,001**
PAL	0,10	0,30	0,06	- 0,29	**- 0,30**
KAL	**0,36**	**0,37**	**0,13**	**- 0,07**	**- 0,23**

The iron solubilization values stand out as extremely low. They increase seven and more times in the Solonchaks and Solonetz area as compared to the unaffected regions from Southern Romania, and even more in the area affected by heavy metals pollution. This is because heavy metals pollution is often associated with soil acidification and particularly in the Baia Mare area soils are natively acid. Even so, iron solubilization remains extremely low as compared to the other micro-elements.

b) South-Eastern Romanian Plain (n = 34)

	Cu	Zn	Cd	Mn	Fe
pH_{H_2O}	- 0,13	0,11	- 0,69**	- 0,56**	**- 0,63****
Humus	0,33	0,47*	0,23	0,32	**0,24**
Nt	0,44*	0,43*	0,03	0,38	**0,14**
PAL	0,24	0,55**	- 0,004	0,05	**0,06**
KAL	**0,55****	**0,52***	**- 0,04**	**0,47***	**0,40**

c) Central Bărăgan – Slobozia – Radu Vodă area (n = 23)

	Cu	Zn	Pb	Cd	Mn	Fe
pH_{H_2O}	- 0,16	0,24	- 0,03	- 0,14	- 0,75**	**- 0,53**
Humus	- 0,06	- 0,01	0,35	- 0,24	0,06	**0,26**
Nt	0,28	0,32	- 0,01	- 0,003	- 0,29	**0,14**
PAL	0,43*	0,71**	0,53**	- 0, 6	- 0,29	**0,37***
KAL	**0,19**	**0,67****	**0,29**	**- 0,16**	**- 0,31**	**0,14**

d) Călmățui and Buzău rivers valleys – Solonchaks and Solonetz

	Cu	Zn	Pb	Cd	Mn	Fe
n	53	53	41	26	53	**53**
pH_{H_2O}	0,04	- 0,04	0,31	- 0,41*	- 0,06	**- 0,24**
Humus	- 0,55**	- 0,06	0,01	0,32*	- 0,58**	**- 0,48****
Nt	- 0,53**	0,29	0,19	0,36*	- 0,43**	**- 0,35***
PAL	- 0,10	0,42**	0,43**	0,05	- 0,27	**- 0,22**
KAL	**- 0,34***	**0,15**	**0,31**	**0,09**	**- 0,22**	**- 0,24**

e) Călmățui and Buzău rivers valleys – Solonchaks and Solonetz

	Cu	Zn	Pb	Cd	Mn	Fe
n	30	32	27	30	28	**32**
pH_{H_2O}	- 0,24	- 0,12	- 0,14	0,30	0,52**	**- 0,39***
Humus	0,50**	0,21	0,35	0,32	0,14	**0,33**
PAL	0,32	0,33	0,32	0,45*	0,68**	**0,20**
KAL	**0,11**	**0,42***	**0,03**	**0,66****	**0,29**	**- 0,09**

CONCLUSION

As the correlations tables show, there are no specific patterns to describe the micro-elements solubilization dependence on soil properties. Soil acidity clearly and directly influences the solubilization values, but nor always significantly. There is also an important exception to notice: the manganese solubilization values in the Baia Mare area decrease with soil acidity, which needs to be explained further. And, certainly, other factors have to be taken into account.

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Applying simulation techniques for proper treatment method, plant design and economics for some food industrial waster

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Abstract: (**The energy saving from recycling of food industrial waste is really the difference between the energy required to manufacture a new product minus all of the energy required to transport and reprocess the product in the recycling phase. If that difference is greater than the energy that would be realized from combusting that product and recovering the energy then recycling is indeed the best option.**

In this work we have considered the proper treatment of some food industrial waste such as cheese whey from dairy industry, wastes from slaughterhouses and meat processing plants in Albania, corn Stover from agricultural cultivation waste, glycerin wastes from biodiesel production, spent grains from bier production etc., in order not only to avoid environmental problems, but also to profit some useful product with economic and social interest.

Firstly we have done characterization of these wastes, and have performed some experimental tests, for their treatment aiming to profit some energetic values (biogas test), and obtaining some chemicals such as Ethanol, Xylitol, Polylactic Acids, etc.

On the other hand it was drawn process flow sheets, using the engineering software so called Super Pro Designer, and also we have also performed the computer simulation procedure aiming to have the optimal value for the biogas (methane) capacity production, economic cost, and optimal expenditures during production. We have used also the ASPEN PLUS vs. 10 for the process scaling up and anaerobic reactor design and was designed the treatment plants for each of abovementioned food industrial waste by those engineering computer software.

Keywords: simulation techniques, treatment method, plant design, food industrial wastes

INTRODUCTION

In the food industrial practice there is one of most importance of the waste management issue, due to the two fold impact to the societal activity, contaminating the environment and secondly due to the fact that within the food wastes there are a lot of useful compounds and products that can be recovered during their carrefully treated. This requires the best available technics in the practice and adopting the most suitable technology and engineering parameters to reach always the most feasible process to be applied efficiency [1].

In general the food processing discharges different wastes in a solid, liquid and gaseous state. In this work we have dealt with wastewaters discharged from the slaughetryhouse, wastes from the beer industry, (brewer's spent grains), in order to produce possibly on of the following compounds: Xylitol, Lactic Acid, and /or Ethanol, strongly depended from the process conditions [2-4]. On the other hand, we have tried to find a suitable process through engineering simulation [5-8] and experiments for producing Ethanol from cheese whey from dairy industry in Albania, but also we have made complex simulation also for establishing better conditions for producing bioethanol from food agricultural waste, such corn stover [9-12], and at the same way to transform glycerol as by product from other industrial activity, to produce biofuels [13-15] etc.

There is almost the same preliminary treatment of most of the food wastes and food industrial by products, which includes the following preliminary treatment systems with unit operations such as :

a) Screens which is carried out for the removal of the large objects such as rags, paper, plastics, metals, and the like. these objects , if not removed may damage the pumping and sludge-removal equipment, hangover wires, and block valves, thus creating serious plant operation and maintenance problems.

b) Aerated Grit treatment in special basins to remove dust, bone chips, and other materials in wastewater and higher than organic matter.

c) Primary Treatment is including primary sedimentation with the purpose to remove the settle able organic solids. Normally a primary sedimentation will remove 50-70 percent total suspended solids and 30-40 percent BOD*R*5*R*.

d) Biological Treatment (Secondary Treatment) with the purpose to remove the soluble organics that escape the primary treatment and although it does not remove significant amount of nitrogen, phosphor heavy metals, no degradable organics, bacteria and viruses. These pollutants may require further removal (advanced one).

e) Advanced treatment which is an additional treatment process, such as filtration, carbon adsorption, and chemical precipitation of phosphorus, to remove those constituents that are not adequately removed in the secondary treatment plant. The provide further removal of suspended solids include nitrogen, phosphorus, and other soluble organic and inorganic compounds

MATERIALS AND METHODS

One important track of this work was to decide on:

- ✓ whether biomass materials or crude glycerol is a better feed material for a conversion process obtaining bio fuels,
- ✓ Develop a process to convert biomass or glycerol to hydrocarbon fuels, and
- ✓ Evaluate the economic feasibility of the design.

From this work being performed from our simulation there were reached some deliverables such as:

- Material Balance and Computer-Drawn Block Flow Diagram
- Detailed Equipment Design for Key Process Unit
- Major Equipment Design
- Completed Finances
- Written Report, etc.

With exploration in biomass as a source of energy, biodiesel has become a popular fuel source product. In the biodiesel process, the major by-product formed is glycerol, also known as glycerin [10]. The third direction of our work has been to find a suitable characterization and process parameter estimation for the brewer's spent grain to use it as a valuable by-product of the brewing process. It is a solid residue that results from the production of malt after grains are soaked in water, germinated, and dried. Spent grain is collected during lautering at the end of the mashing process. It is generally constituted by lignin, cellulose, hemicelluloses, and protein, though its composition variability depends on the type of grain used, processing conditions, and preservation method [5]. Alternative applications of spent grain such as bio fuel and bio product production can be a viable and cost effective option for breweries. The process was designed to optimize total production of the product. The main steps outlined in the process include an acid or alkaline pretreatment to remove lignin, an enzymatic hydrolysis to extract the fermentable sugars, fermentation of sugars using different microorganisms, separations, and additional processing to a final packaged commercial product form.

With this work, we seek to adopt and present a desirable and suitable process for converting brewers spent grain into two value-added products: the alternative sweetener, xylitol, and a biodegradable plastic, polylactic acid. This particular process is based on uses the spent grain from surrounding breweries and microbreweries as its input.

The process consists of collection, universal pretreatment, then a split to feed one of two continuous fermenters. A highly acidophilic strain of the yeast *Candida tropicalis* ferments xylose into xylitol, which can then be purified. *Lactobacillus delbrueckii* bacteria ferments glucose into lactic acid, which during simulation could be polymerized to form polylactic acid of the desired molecular weight. This polymer could then be purified and be processed for marketing.

This product profile is optimal, as it incorporates both of the major constituents of the grain–cellulose and hemicelluloses. We estimated through computer simulation, a possible return on investment through process simulation showing a profit of up to 43.3%, with an internal rate of return of 28.4% and a net present value. However, if the price of polylactic acid were to rise, as market patterns suggest it may, this process would quickly become even more profitable. We therefore commented pursuing the proposed process, and possibly expanding to other densely populated areas.

A number of assumptions were made in order to simulate the process in Aspen Plus simulation software.

One of these products is biodiesel. The production of this bio fuel is known to have progressive growth, and consequently the wastes obtained from the development of this process are of high levels. Given this fact, the need for their processing is present, not only for environmental reasons, but also for utilizing one element and for doing so in a form that affects people. In the biodiesel industry, glycerol is produced as a secondary product.

One alternative method for glycerol processing is through fermentation. This is a very efficient method because the products obtained by the development of the reaction are different. One of them is also the succinic acid, another component that has many uses in the industry. The realization of this task in the practical aspect consists in the realization of three important processes. The cycle begins with the preparation of feed stream for the fermentation of glucose glycerol, develops after anaerobic fermentation of glycerol in ethanol and succinic acid, in fermentation tanks and the process closes with the separation of fermenting products to obtain ethanol and succinic acid. Ethanol thus produced is denatured with gasoline and has a purity of about 99.5% by weight. The process is simulated in Aspen Plus in which the analysis of material balance, energy and economic evaluation is also done.

RESULTS AND DISCUSSION

After studying and experimentally characterizing analytically all the types of the wastes from food industry taken into consideration, we have performed the process simulation, knowing in details all the chemical compounds taking place into reactions and interactions, thermodynamic data taken from the databases, through applying computer programs as follows: *Pro/II; SuperPro Designer; Aspen Hysys; Design II for Windows; Aspen Plus; ChemCad etc.*

***Simulation in Super Pro Designer and in Aspen Plus**:*

Based on the optimized schemes for the treatment of the industrial discharged water we construct the process scheme as is shown in fig.1. Red streams represent the sludge stream while the blue streams represent the water stream. Discharges come from impurities derived from meat processing and contain detergents used for cleaning plant equipment. The discharges are initially subjected to a prior treatment in which large solid waste is removed and then passed to a clarifier. From the first cleaner, the largest sludge that contains blood,

fats, proteins and biomass is the biggest removal. The sludge passes down while the previously cleaned water passes into a vessel where aerobic bio oxidation occurs, a process that requires air.

The water then passes to a second purifier where again a treatment occur to removal the sludge. From this stage the water is disinfected and is free to flow into rivers, seas or even for irrigation. The sludge that comes from the second cleaner has very high water content and it has to pass through a thickness leaving most of the moisture and returning to the initial stream to retreat. In anaerobic digestion, reactions to biogas production occur, which is the main product for economic benefit from this plant. The residual sludge from the digester passes to a belt filter and then dries and can be used as organic fertilizer for plants.

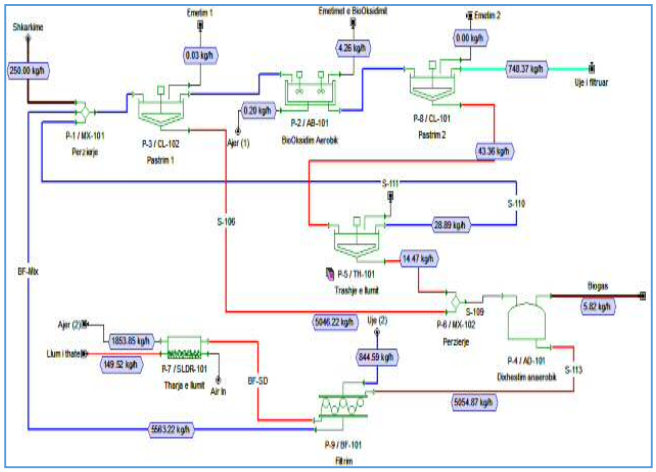

Fig.1. Flow diagram for treatment of waste water from slaughterhouses, Super Pro Designer

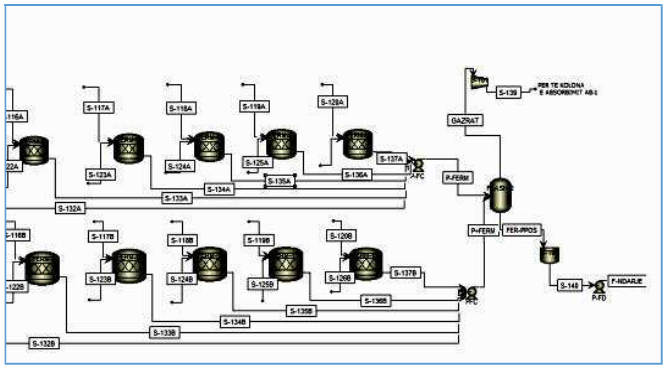

Fig.2. Flow diagram for treatment of waste in Aspen Plus

CONCLUSIONS

From the simulation results we make a comparison of the parameters and the see that we have a significant reduction of BOD and COD in the effluent stream.

The biological demand for oxygen in the initial discharge stream is 1398 mg/L and after treatment it is reduced to 3.3 mg /L. The chemical oxygen demand is reduced from 3179 mg/L to 157.8 mg/L. We also see a substantial elimination of solid substances. The effluent water after treatment is not dangerous to the environment because it is within the limits of the regulation and can be streamed to rivers or seas.

From the simulation results after anaerobic digestion we have 5.82kg/h biogas production which should be cleaned from other impurities and obtain pure methane which can be used as fuel or for heating purposes.

Water after treatment it is not environmentally hazardous because it is within the limits of regulation and can be streamed to rivers or seas. The discharged waters are cleaned from the solid contents of suspended matter, other solids and fatty substances. While in the discharge stream, there is a high proportion of biomass that can be used as fertilizer for agriculture.

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Soil Improvement Study Using Colloidal Silica Injection

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Abstract:Soil liquefaction and its surface manifestations cause substantial damage to buildings and other structures. This fact has been proven many times by past earthquakes occurred close to urban areas. In some cases, the damages could be attributed primarily to soil liquefaction such as the situation in Christchurch City following the 2011 Christchurch earthquake. Soil improvement is one of the options that can be utilized to prevent or avoid the liquefaction related damages from future earthquakes. One such soil improvement method is injection of substances into the soil to improve its engineering properties. In this study, effects of colloidal silica injection into the soil in terms of soil strength and rigidity are studied. Soil samples were analyzed and found to have a grain size distribution falling into the range of liquefiable soils. To produce improvements, colloidal silica injected into samples of 7 cm diameter and 14 cm height using pressure. Samples were prepared with different relative densities and curing days.After carrying out clean sand experiments, static and dynamic triaxial tests were performed on improved sand samples. Results are presented and compared for improvements observed in strength and rigidity values.

Keywords:Colloidal Silica, earthquake, soil improvement, liquefaction.

I. INTRODUCTION

Land may not always have the required soil properties suitable to support buildings and other structures. For instance, one of the most powerful phenomenon that can occur in the ground during an earthquake is liquefaction. This has been proven by earthquakes – especially those occurring near urban areas in recent years – such as Christchurch, New Zealand in 2011 and Kocaeli (İzmit), Turkey in 1999. Soil liquefaction causes significant effects on the ground surface and in structures [1-3]. These include the surface eruption of sand and water, large settlements, large amplitude ground movements, a reduction in the bearing capacity, damage to retaining walls, soil flows affecting houses, permanent horizontal deformations – called spreading – on the ground and damage to underground structures. Soil improvement practices can be applied, or structural measures can be taken, to reduce or eliminate the effects of liquefaction. Otherwise, infrastructures and superstructures can be subjected to severe damage during earthquakes [4-13]. The improvement of soil properties still remains within acceptable economic limits if compared to the serious damage suffered by buildings during an earthquake. Among several factors, the choice of the method to be used for the soil improvement is directly related to the soil properties of the area. Soil improvement methods aim to increase the resistance of soils to liquefaction and/or prevent excess pore water pressure formation during an earthquake. Consequently,different methodshave beenproposed to increase the soil density, introduce bonding (cohesion) between grains or drain the water in the ground.

One of the soil improvement methods is injection of chemicals into the ground. Suitability of chemical material for applicability and effectiveness against liquefaction is important. The injection material to be applied must be suitable for the structure of the ground and not react reversibly with the chemical structure. Colloidal silica, as an injection substance, has ability to reach the smallest pores that only water can reach because its density is close to water. When a mixture of colloidal silica that has a fixed gelation time is poured into a container filled with sand, it can penetrate into the gaps between all grains, reaching the bottom of the container. The fact that the gelation time can be adjusted with an accelerator material provides ease of application. The cost can be reduced by lowering the amount of colloidal silica, and low concentration values do not cause too much loss in strength. A number of studies have been carried out using colloidal silica as an injection material in soil improvement works to improve the soil against liquefaction [14-18].

The strengths of the treated or untreated soils can be determined in a laboratory by using various tests carried out on samples. This study prefers triaxial tests (Fig. 1) as they resemble better the field conditions. The purpose of this study is to study the properties of clean sand samples after injecting colloidal silica and to determine the level of improvements. The results of the experimental study were presented and

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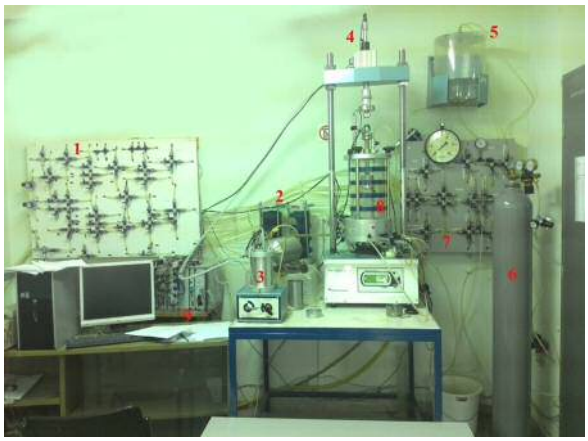


(a) Dynamic Test Apparatus

(b) Static Test Apparatus

Fig. 1. Static and dynamic triaxial test apparatus used in the experiments

discussed.

III. MATERIALS AND EXPERIMENTAL METHOD

Sand samples were obtained from various quarries around Denizli to determine the sand to be used in this study. Sieve analyses were carried out on differently graded sand samples and it was verified that the sample was within the range of liquefiable soils. Clean sand samples and improved samples with colloidal silica were subjected to static and dynamic triaxial tests. Samples were prepared with relative densities of 40%, 60% and 80%, and static triaxial pressure tests were carried out at 100 kPa and 300 kPa cell pressures. In dynamic triaxial tests, relative densities of 40% and 60% were used and samples were tested under only a 100 kPa cell pressure because of the capability of the test equipment. For static tests, static triaxial test equipment was used in the soil mechanics laboratory of the Civil Engineering Department of Pamukkale University (Fig. 1b), while for dynamic testing; dynamic triaxial test equipment belonging to DokuzEylül University (Fig. 1a) was used. Dynamic triaxial tests were performed by gradually increasing loads according to ASTM D 3999 (Load Controlled Modulus and Damping Test) standard [19]. Liquefaction tests were done on clean sand samples and improved sand samples were loaded for 1000 cycles but no distortion was observed. Fig. 2 shows the static triaxial cell and the sample inside (Fig. 2b) and the sample after the failure Fig. 2a). Not all details of the sample preparation and testings can be presented herein as they can be found at another publication by [20].

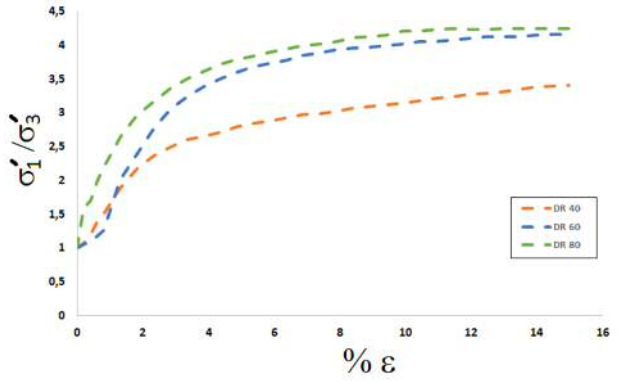
II. TEST RESULTS AND CONCLUSIONS

Figure 3a shows the test results of clean sand samples

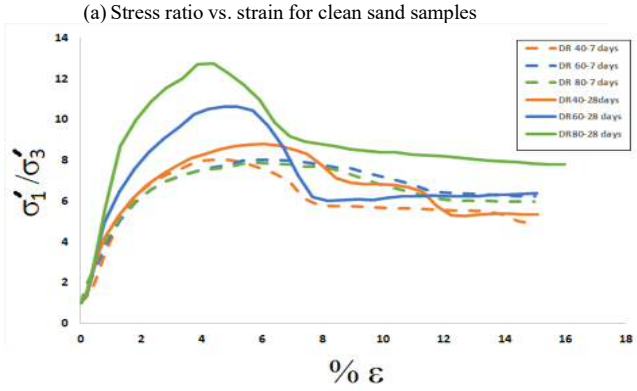
Fig. 2. Treated sand sample with the relative density 60% in the triaxial test cell (right), the sample after the failure (left)

at a confining pressure of 100 kPa. As seen from the Figure, the sand sample with 40% relative density had the lowest strength. Figure 3b shows the test results of improved sand samples at a cell pressure of 100 kPa. Comparing Figures 3a and 3b, significant increases in the strength can be observed in either 7-day or 28-day cured samples.The increase in the strength was the highestfor 28-day-cured samples.Because of the space limitation, not all the test results could be presented herein. However, they can be found in another publication by [20].

The JGS 0542-2000 standard (Japanese Geotechnical Society, 2000) [21] was used to evaluate the dynamic test results. Young's modulus and the hysteresis damping ratio was calculated by using 5 cycles and 10 cycles of data. Because calculations were very close to each other, the values calculated for 10 cycles were used in the curves. Figures 4a shows the calculation of Young's modulus $E_{eq}(MN/m^2)$ from the hysteresis loop. Figure 4b shows how to determine the stored energy per cycle, W, and the damped energy per cycle, ΔW, to be used to calculate the hysteretic damping ratio: $h\{= (1/2\pi)\ x\ \Delta W/W\}$.If the hysteresis loop is not closed, $1W$ can be the sum of an area gbh on the compression side and an area hdf on the extension side (see Fig. 4c). The W-value may be determined in a test with uniform amplitude of cyclic axial load:



(a) Stress ratio vs. strain for clean sand samples



(b) Stress ratio vs. strain for treated sand samples

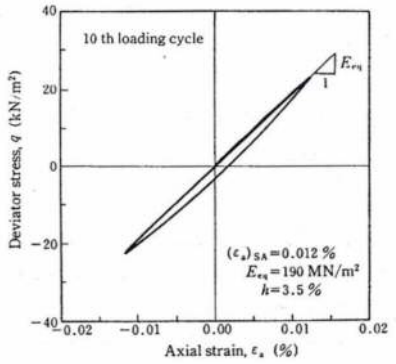
Fig. 3. (σ_1'/σ_3') – Ɛ curves for untreated and treated soil samples at a cell pressure of 100 kPa

$$W = \frac{1}{4}\Delta P.\Delta L \qquad (1)$$

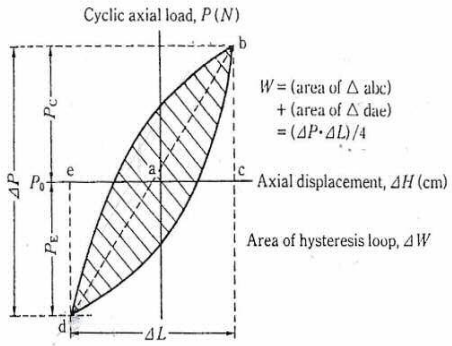
where
ΔP = the axial load measured
ΔL = the axial displacement corrected by the method.

In dynamic triaxial tests, the relative density values of 40% and 60% were used and the module tests were performed under a 100 kPa cell pressure. Significant increases were observed in the elastic modulus values of the samples improved with colloidal silica. Decreases were seen in the hysteretic damping ratio ratios of the improved samples, but they were not significant. The results were in agreement with other studies found in published literature using different methods [e.g., 22].

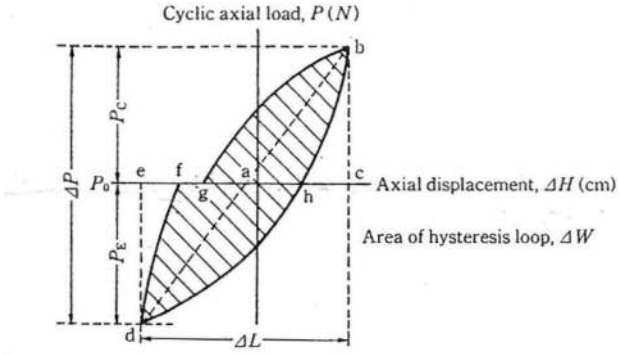
The soil injection study using colloidal silica on clean sand samples obtained from a quarry near Denizlishowed significant increases in the strength and elastic modulus of the samples with small decreases in damping ratio values. The ease of use of this material was observed because of its rapid penetration characteristic and adjustable gelation time. Considering static and dynamic triaxial test results herein, it can be stated that colloidal silica as a soil injection material was effective against liquefaction.



(a) Typical hysteresis loop



(b) Hysteretic damping ratio when the hysteretic loop is closed



(c) Hysteretic damping ratio when the hysteretic loop is not closed

Fig. 4. Calculation of Young's modulus and the hysteresis damping ratio according to JGS 0542-2000 standard [21]

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Soil heavy metal status from Maramureș County, România

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*corresponding author

Abstract: (One of the main area rich in metalliferous ores (gold-silver ores, polymetalliferous ores, copper mineralizations, iron and manganese ores) is the Maramures County, with a long history of mining of non-ferrous ores. Moreover, in the Baia Mare area were two nonferrous metal smelting factories, Romplumb (lead smelter) and Phoenix (copper smelter) wich have been major sources of environmental pollution.

Field studies were made across the Maramures County. The soil samples were taken from agricultural and forest sites according to a regular network part of Romanian soil quality monitoring system. On whole county, the concentration values range were as follows: 5.6-48 mg/kg (Cu), 31-243 mg/kg (Zn), 17-639 mg/kg (Pb), 0.1-2.0 mg/kg (Cd), 45-1265 mg/kg (Co), 0.1-31 mg/kg (Cr), 1.6-86 mg/kg (Ni), and, respectively 0.2-100 mg/kg (Mn).

The mean concentration of the heavy metals decreased in the order of Mn > Zn > Pb > Cr > Ni > Cu > Co > Cd.

The coefficient of variation (Cv) of investigated heavy metals decreased in the order of Pb (141%) > Ni (71%) > Cr (57%) > Cu (51%) > Mn (50%) > Co(48%) > Cd (47%) > Zn (41%).

This study allowed the identification of the sites with high values of heavy metals content that shows a risk to the trophic chain, where remediation efforts and monitoring should be focused.

Keywords: heavy metals, monitoring, Maramureș county

INTRODUCTION

Some heavy metals are essential for both plants and animals (Cu, Zn, Co, Mn), others only for animals (Cr, Ni), and others have no known being essential neither in plants or animals (Pb, Cd, etc.) [1], but all heavy metals are toxic at high contents.

The mining and metal processing industry are known as important sources of heavy metal pollution for the environment [1]. There are many studies which have shown that soils surrounding mining areas and metal smelting industries are seriously affected by heavy metals pollution [2].

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In Romania, one of the main area rich in metalliferous ores (gold-silver ores, polymetalliferous ores, copper mineralizations, iron and manganese ores) is the Maramures County which has a long history of mining exploitation of non-ferrous ores [3] [4]. Moreover, in the Baia Mare area there were two nonferrous metal smelting factories, Romplumb (lead smelter) and Phoenix (copper smelter) wich has been very important sources of environmental pollution.

During the smelting activity, Baia Mare was identifued as environmental hot spot. From these plants large amounts of sulphur dioxide emission (SO_2) and particles riched in heavy metals (Cadmium, Lead) were released into the air. High frequency of exceeding the maximum admitted concentration were recorded for SO2, Pb and Cd. Also, in this area, the mining and smelting activities have caused serious environmental issues by generating high volume of mining waste and tailing waste, drainage water, nowday, sources of soil pollution being tailings dumps, mine waste, mine waters [5]. According to [6], 18 tailings ponds and 300 tailings dumps were identified and 60 mil t of waste were generated [4]. The accumulation of heavy metals in soil is of increasing concern due their non-biodegradability and cumulative nature, their toxicity even in very small amounts to the food safety issues and potential health risks [7] [8]. Studies carried out in this area highlighted the high values of heavy metals (Pb, Cd, Cu, Zn) in soils [9] [10]. Previous studies have paid attention to soil contamination around Baia Mare area, but have focused less on heavy metal pollution of soils across the county.

The objectives of this research were to analyze the total concentration of several heavy metals (Pb, Zn, Cu, Cd, Co, Cr, Ni, MN) in soils and to determine the distribution of these metals across the whole county.

METHODOLOGY

The studied area is located in west-north part of Romania. It covers a surface of 6304 km^2 and has around 461.290 inhabitants.

Field studies were made across the Maramures County. In order to cover the whole county, samples were taken after a regular network sampling, part of Romanian soil quality monitoring system, according to the methodological specifications presented in Order MADR 278/2011 [11]. Within the field stage, 72 soil profiles have been studied.

Location of sites was done according to the geographic (latitude, longitude) coordinates using a Global Positioning

System (GPS). Sampling location maps were produced with ArcGis Software (fig. 1).

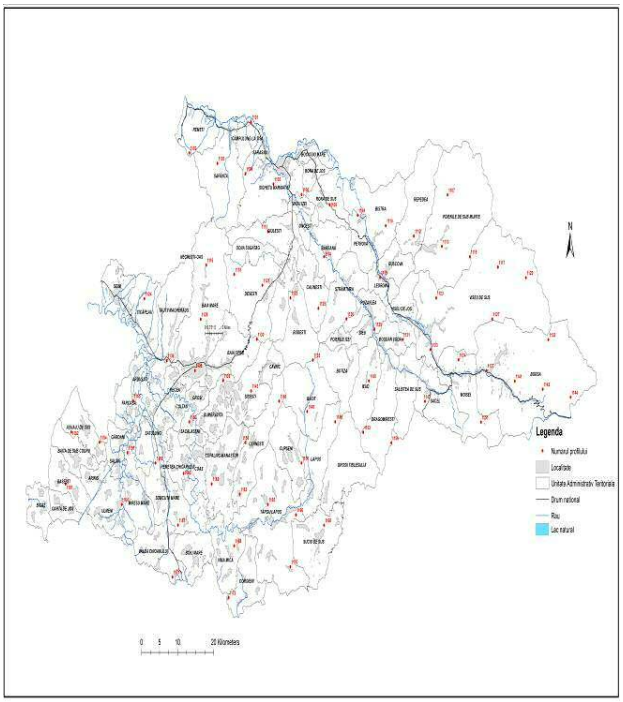

Figure 1. Location of soil sample plots

In case of agricultural sites, a composite soil sample was collected within an area of 400 m^2 (20x20 m) around the soil profile, from 0-20 cm deep for crop sites and from 0-10 cm and 10-20 cm deep for grassland. At forest sites, samples were taken from A horizon. .

The sampling was performed with stainless-steel materials to avoid contamination of the samples. The samples were stored in tightly sealed plastic bags and properly numbered.

All soil samples were air-dried, milled and sieved to 2 mm fractions to remove stones and other coarse fragments.

The pseudo-total concentrations of Cd, Cu, Pb and Zn were determined in the soil samples using atomic absorption spectrometry after extraction by the *aqua regia* ($HCl:HNO_3$ – 3:1) – microwave digestion method.

Microwave digestion was performed using 10 mL of *aqua regia* at 140°C for 30 min. A certified soil reference material (ERM–CC141) was used to ensure the accuracy of the analytical data.

Descriptive statistics including mean, maximum, minimum, median, coefficient of variation (CV) were calculated for soil samples.

RESULTS AND DISCUSSIONS

The distribution of sites in the 8x8 km network highlighted the predominance of agricultural sites (62.5%) compared to forest sites (37.5%). For the agricultural land, most plots are found on arable land (6 sites), followed by grassland (14 sites), meadows (24 sites) and orchards (1 site).

In order to assess the soil pollution, the values of heavy metals were compared with soil thresholds [12] from Order no 756/1997 of the Minister of Water, Forest and Environment, Romania (table 1).

Table I. The statistical parameters of heavy metals (Cu, Zn, Pb, Cd, Co, Cr, Ni, Mn) in topsoil of soil sample plots, Maramures county (mg/kg)

	Cu	Zn	Pb	Cd	Mn	Co	Ni	Cr
Minimum	5.6	31	16.5	0.11	45	0.1	1.6	0.2
Median	17	75	34	0.73	541	11	19	23
Mean	20	78	57	0.75	554	11	22	23
Maximum	48	243	639	2.03	1265	31	86	100
Standard deviation	10	32	80	0.35	277	5	15	13
Variation coefficient	51	41	141	47	50	48	71	56
Normal values	20	100	20	1	900	15	20	30
Alert threshold	100	300	50	3	1500	30	75	100
Intervention threshold	200	600	100	5	2500	50	150	300
Average agricultural Romanian soil [15]	26.1		21.3	0.43	531	13	34.5	-
Median European soil [16]	13	52	22.6	0.145	-	7.8	18	60

On the whole county, the concentration values range were as follows: 5.6-48 mg/kg (Cu), 31-243 mg/kg (Zn), 17-639 mg/kg (Pb), 0.1-2.0 mg/kg (Cd), 45-1265 mg/kg (Co), 0.1-31 mg/kg (Cr), 1.6-86 mg/kg (Ni), and, respectively 0.2-100 mg/kg (Mn), with mean values of 20 mg/kg (Cu), 78 mg/kg (Zn), 57 mg/kg (Pb), 0.75 mg/kg (Cd), 544 mg/kg (Co), 11 mg/kg (Cr), 22 mg/kg (Ni), and, respectively 23 mg/kg (Mn).

The total Cu content for the investigated area varied between 5.6 and 48 mg/kg, the median (17 mg/kg) being higher than the mean value reported by [14] for European soil (13 mg/kg). The range, mean and median values are below than recorded values in Romanian monitoring agricultural sites [13].

As regarding land use, the average content values decrease in order: orchard > grassland > arable > meadows > forest (fig. 2).

High values of Cu were found in crop land compared with forest land [15].

Total Lead content. Total lead content varied between 17 and 639 mg/kg, the average of 57 mg/kg being higher than the average value (25 mg/kg), reported by [16] or 20 mg/kg reported by [1] Adriano (2001). The maximum value exceeds the threshold of intervention for sensitive use (100 mg/kg).

As regarding land use, the average lead content varies between 40 mg/kg in meadows and 84 mg/kg in pasture. Most of the lead in topsoil has anthropogenic origin [15].

Total Zinc content in the studied samples varies between 31 and 243 mg/kg, with an average of 78 mg/kg.

As regarding land use, average content varies between 73 mg/kg in forest lands and 86 mg/kg in pasture.

Total Cadmium content of studied sites vary from 0.11 to 2.0 mg/kg and the average is 0.75 mg/kg. The range, mean and median values are higher than recorded values in Romanian agricultural sites [13].

The median Cd content (0.73 mg/kg) in studied soil is higher than Cd median in European soil (0.15 ppm) [14].

As regarding land use, the average values ranged between 0.6 – 0.8 mg/kg.

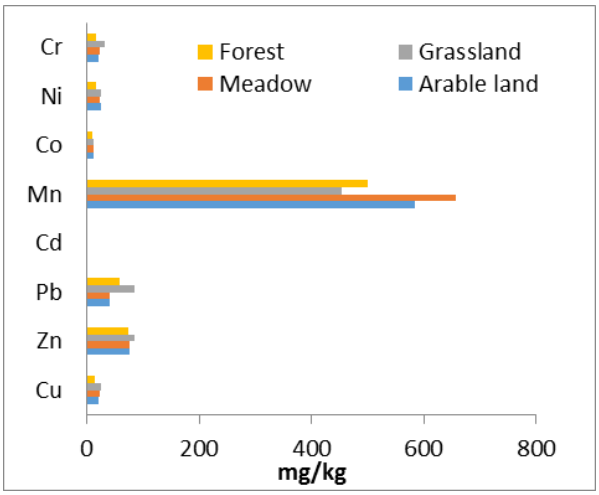

Fig. 2. The average content of heavy metals from soil sample plots according to land uses (mg/kg)

Total Cobalt content varies between 0.10 and 30.5 mg/kg, with a mean of 11 mg/kg. The range, mean and median values are comparable to the recorded values in Romanian agricultural sites [13]. As regarding land use, average values of total Co content varies between 10 mg/kg in forest soil and 12 mg/kg in arable land.

Total Crom content varies between 0.21 and 100 mg/kg, with a mean value of 23 mg/kg. In studied area, median and mean of Cr values are below the values reported for European soil [14].

As regarding land use, average values of Cr content vary between 17 mg/kg (forest) and 32 mg/kg for pastures.

Total Nickel content, in the investigated soil, varies between 1.6 and 86 mg/kg, with a mean value of 22 mg/kg.

As regarding land use, average values of Ni content vary between 17 mg/kg (forest) and 26 mg/kg for grassland.

The total Mn content varies between 45 and 1265 mg/kg, with an average value of 553 mg/kg in the normal class.

As regarding land use, average values of Mn content ranges from 455 mg/kg (grassland) and 657 mg/kg (meadows).

In historical mining and smelting areas were displayed elevated contents of heavy metals, which exceed permissible standards in soils [17] [2].

The mean concentration of the heavy metals decreased in the order of Mn > Zn > Pb > Cr > Ni > Cu > Co > Cd.

Median levels of Cu, Pb, Zn, As, Mn and Cd in agricultural soils were higher than corresponding values determined for the reference soils.

The coefficient of variations (Cv) of investigated heavy metals decreased in the order of Pb (141%) > Ni (71%) > Cr (57%) > Cu (51%) > Mn (50%) > Co (48%) > Cd (47%) > Zn (41%).

CONCLUSIONS

The major of heavy metals contents had higher values grass land compared with arable land and forest soil.

This study shows high variability of contents of heavy metals, closely correlated to anthropogenic activities (smelting and mining practices).

The contents of studied heavy metals in some of the soil samples exceed the Romanian soil standards for sensitive and, in some sites, even for less sensitive land use.

This study allowed the identification of the sites with high values of heavy metals content that shows a risk to the trophic chain, where remediation efforts and monitoring should be focused.

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Sustainable Industrial Growth with the Reduction of Environmental Emission in China: The Evidence of Employment Variety

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Abstract: The increase in environmental emission is usually the challenge to the industrial growth, which attracts much attention by the design for the country industrial structure. In current work, the development of industry with the reduction of environmental emission in China was analyzed in 2003-2015. The discharge of 4 pollutant factors (chemical oxygen demand, dust, SO_2, and heavy metal) was collected in 4 industrial sectors (Manufacture, Mining, Construction, Supply). The significant increase in the product value of these industrial fields was recorded. Despite, the discharge of pollutant was changed as the function of time. In 2003-2006, the amount of pollutant discharge was increased with industry development while it was reduced to 50% or more in 2007-2015 with industrial scale growing 3-4 times. This was supported by the result of hierarchical clustering analysis (HCA) and principal component analysis (PCA), which conducted the cluster analysis of the time-dependent changing of environmental emission with the quantity of employment, industrial-scale. Moreover, more industrial employee in manufactory and supply industry than that in other industry fields. This supposed that the resource-consumed industrial structure changing and industrial technology upgrade happened in China in recent decade, which was probably responsible for the environment improvement. It illustrated that the Porter Effect (PE) worked in the industry growth in China after 2011 as the decrease in pollution even with the constant industry scale and the employment quality increasing. Accordingly, our results proposed that the productivity was the satisfied indicator to indicate the relationship between industry growth and pollution reduction. Therefore, an insight into the relationship of industrial growth with environmental emission was provided, which was a new approach to assess the sustainable industry growing in developing country.

Keywords: sustainability, industrial growth, emissions, pollution reduction

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I INTRODUCTION

The strict discharge standard and policy for pollution reduction is the common environmental strategy executed in most countries. This resulted in the improvement of environmental with the growth of industry, which has been predicted by Environmental Kuznets Curve (EKC) (Grossman and Krueger, 2000; Panayotou, 1997; Dinda, 2004; Agras and Chapman, 1999). Despite, the driven force for this situation was described by different reasons. Among them, there are two “effects” to provide the reasonable explanation on the relationship between environment improvement and industry structure changing. One is the Pollution Haven Effect (PHE), which supposed that the moving or shutdown of the pollution-intensive industries improved the local environment (Dechezleprêtre and Sato, 2017; Levinson and Taylor, 2010).

II STUDY AIMS

This developed the acceleration of industry structure changing in China. Moreover, it is noting that the growth of industry kept a rapid trend at about 8% of the increasing rate. The regulation of environment is supposed to have less effect on the decrease in industry growth (Khanna and Kumar, 2011; Hettige et al., 2000). Thus, the Porter effect was used to explain this situation. Many evaluations of PE were lodged, which has been composed of factors population, urbanization, gross domestic product, wage, etc (Cohen and Tubb, 2015; Ambec et al., 2013; Porter and Vander Linde, 1996). However, the impact from the industry structure changing was not excluded in such way of evaluation, which led to the enlargement of PE on the sustainable growth of industry. Therefore, the way to identify the PE and PHE in industry growth with environment improvement is essential.

In this study, the relationship between structure changing of industry and contaminant discharge was investigated. The quantity of employment (QOE) and output of four industrial sectors of Manufacture (MaI), Mining (MiI), Construction (CI) and Supply (SI) were selected as investigated objects and chemical oxygen demand (COD), dust, SO_2, waste water (WW) and heavy metal were chosen as the main pollutant factors. The statistical construction of dataset was investigated using principal component analysis (PCA) and hierarchical clustering analysis (HCA) to evaluate the relationship between growth and environmental emission in China. Our result provides the insight into the sustainable growth of industry with environmental improvement.

III. METODOLOGY

The PCA method was applied to analyze the correlation matrix. PCA is a method for statistical dimension reduction and can simplified the dataset by reducing the variables into several non-correlated components called Principal Components (PCs). The data structure could be accessed by this way. The Kaiser-Meyer-Olkin (KMO) test was applied to evaluate the appropriateness of conducting PCA (Durmusoglu and Yilmaz, 2006).

Combining with PCA, hierarchical clustering analysis (HCA) was conducted to reveal the variety of development mode in the time period in China. Euclidean Distance was selected as the statistical distance and calculated after normalizing in this HCA.

RESULTS AND CONCLUSIONS

The study had collected the data of QOE and output of four industrial sectors (Manufacture, Mining, Construction, Supply) and of the four pollutants discharge (COD, SO_2, dust and heavy metal) from 2003 to 2015. After 2006~2007, the discharge amount of pollutants decreased and the economic developed constantly. The cluster analysis of the time-dependent changing of environmental emission with the quantity of employment, industrial-scale was used to access the relationship between industry growth and pollutant emission. The result indicates that (1) Porter Effect worked in the industry growth in China after 2011 as the decrease in pollution even with the constant industry scale. (2) the productivity was the satisfied indicator to indicate the relationship between industry growth and pollution reduction, which suggests the technology innovation led to the improvement of environment; (3) there is the limitation of pollution reduction at the productivity over 35-40% as further technology innovation demand. Therefore, our result reveals that Porter Effect works on the industry growth with environment improvement in China, which was indexed by the profiles of the productivity increasing with pollution reduction. This provides an insight into the pathway of sustainable industry growth.

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Research regarding on pollution monitoring with the help of benctonic macroinvertebrates at Bega river near Timisoara

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Abstract: An important role in the monitoring of the water quality is represented by the benthic macro invertebrates. They are a key component in the transfer of matter and energy in the aquatic ecosystems.

From February 2014 to September 2016, 20 quantitative seasonal samples of benthic macro invertebrates were collected at different seasons in the Bega River water. Samples were collected from the upstream, middle and downstream of Timisoara city.

The aim of this paper is to identify the changes that occur in the structure of benthic macro invertebrates communities due to anthropogenic activities.

Once the identification of saprobionte organisms has done, it have been performed the density, abundance and frequency of the sample. Based on these values, we can say that the upstream segment waters falls into the category of superior quality compared to the waters of the central segment, especially in the downstream segment.

Keywords: macro invertebrates, Bega River, polluation

I. INTRODUCTION

Starting with the last century, an important step in biomonitoring of surface waters are nsidered the benthic macro invertebrates. Their great importance is based on trophic base for the fish and the role that they serve as biological indicators, they offer clues to the environmental conditions were they are living (Badea *et. al.,* 2010, 2.Kubosova *et. al.,* 2010, Ogbeibu and Oribhabor, 2002).

They have a relatively short life cycle and are living in direct contact with the substrate and for this reason the benthic macroinvertebrates can characterize the condition of an ecosystem and reveal the natural or anthropic changes (Blandin, 1986, Rosenberg, 1993).)

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Most species have a complex life cycle of one year or more. Sensitive life stages will respond quickly to stress; the overall community will respond more slowly (Moldoveanu and Rîşnoveanu, 2010).

The aim of this paper is to identify the changes that occur in the structure of benthic macro invertebrates communities due to anthropogenic and natural activities.

II. MATERIALS AND METHODS

From February 2014 to September 2016, 20 quantitative seasonal samples of benthic macroinvertebrates were collected at different seasons in the Bega River water. Samples were collected from the upstream, middle and downstream of Timisoara city.

Samples were collected from the upstream, middle and downstream of Timisoara city. The benthic samples were collected with Ekman-sampler with a surface of 225 cm^2 and were subsequently washed with benthic nets (meshes of 250 µm) and stored in 8% formaldehyde (LIxandru, 2006, Marin *et al.,* 2014, Péterfi and Sinitean, 2002, Petrovici, 2009).

The collecting stations (S) were located as follows (figure 1):

S1 is located upstream of Timisoara city, near Ghiroda village, upstream of potable water treatment station.

S2 is located upstream of sewage water treatment station of Timisoara.

S3 is located near Sânmihaiu Roman village from Timis County and downstream of sewage water treatment station of Timisoara.

S4 is located near Otelec village, before the border line with Serbia Country. There have been calculated the density (Di = ni / Sp), the abundance (A= (ni / N)*100) and the frequency (F = Ni*100/Np), where ni represents the total number of individuals for the i series, Sp the total researched area, N the total number of individuals belonging to all species (from the sample or the studied samples), Ni the number of stations within which been identified the subjected species, Np the total number of stations (Sîrbu and Benedek, 2004, Stan, G, 1995).

Figure 1. The location of the sample collecting stations on Bega River water)

III. Results and Discussion

Once the identification of saprobionte organisms has done, it have been identified ten groups of benthic macro invertebrates: *Oligochaeta* subclass, *Hirudin* class, *Nematoda* phylum, *Diptera* order (larve of the families *Chironomidae, Ceratopogonidae* and *Tipulidae*), *Isopoda* order, *Trichoptera* order, *Odonata*, order, *Coleoptera* order (table 1). After the density was performed we can say that at the first stations the density of individual's that belong to the *Oligochaeta* subclass and *Chironomidae* order have a density which is smaller than the density of individual's that belong to the *Gastropoda* class, which means that the degree of impurification at this station is very small (fig. 2).

Some groups like *Oligochaeta* subclass and *Chironomidae* order are known for that they live in environments where the contamination level is high (Benbow, 2009, Collier *et al*., 2010, Courtney and Merritt, 2009, Marchese *et al*., 2008) and other groups as *Lamelibranchiata* class, *Gastropoda* class, *Odonata* order are considered indicators of unpolluted water (Lorenz, 2003).

At the second station (figure 2) we can notice an increase of the density values of groups which are classified as indicators of unpolluted water (*Lamelibranchiata* class, *Gastropoda* class). At this station we can notice the highest density values of sensitive groups to the pollution.

At station three (figure 2) the situation was changing, we see an increase of the density values at groups that have a high tolerance to the impurification.

At the last station we can see a decrease of the density values of individual's that belong to the *Oligochaeta* subclass and *Chironomidae* order and appear the individual's that belong to the *Gastropoda* class. Also at this station are identified individual's than belong to the Trichoptera order, macro invertebrates who are considered indicators of the indicators of unpolluted water (Lorenz, 2003).

Regarding to the numerical abundance we can notice that is in correlation with the density, if the values of density grow up, then the numerical abundance shows increased values (figure 3).

Table I. Groups of saprobionţi in relation with the collection stations

Groups	Station 1 (S1)	Station 2 (S2)	Station 3 (S3)	Station 4 (S4)
Oligochaeta	x	x	x	x
Hirudinea			x	
Lamelibranchiata	x	x		
Gastropoda	x	x		x
Nematoda	x	x		x
Chironomidae	x	x	x	x
Ceratopogonidae	x	x		x
Tipulidae			x	x
Isopodae			x	
Trichoptera				x
Odonata	x			
Coleoptera	x			

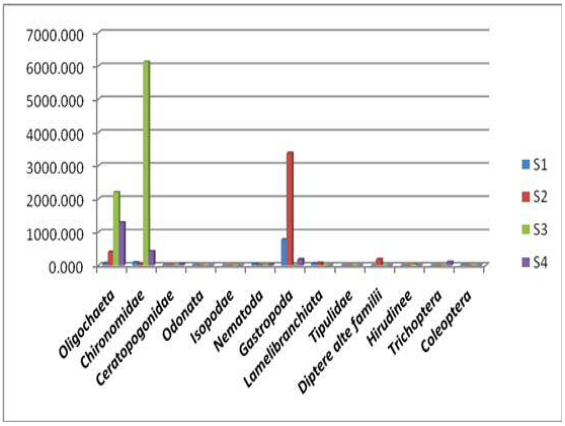
Analysing the frequency (figure 4), individual's belong to the *Diptera* order (larvae of the *Chironomidae* families) show a 60 % frequency at the first station, a 80 % frequency at the second station and a 100% frequency at the three and the last station individual's belong to the *Oligochaeta* subclass show a 80 % frequency at the first station, a 60 % frequency at the second station and a 100% frequency at the three and the last station.

Macro invertebrates belong to the *Gastropoda* class show a 100 % frequency at the first station, a 80 % frequency at the second station and a 20 % frequency at the last station (fig. 4). Individual's belong to the *Lamelibranchiata* class has show a 100 % frequency at the first station, a 80 % frequency at the second station and at station 3 and 4 the this invertebrates disappear.

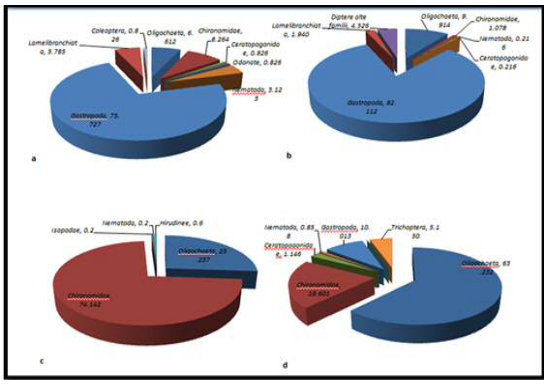
Individual's belong to the *Trichoptera* order has a 40 % frequency at the last station. Macro invertebrates belong to the *Nematoda* phylum show a 20 % frequency at the first and the second station, individual's belong to the *Hirudin* class has a 60 % frequency at the station three and individual's belong to the *Isopoda* order has a 20 % frequency at the same station (fig. 4).

Individual's belong to the *Odonata* order show a 20 % frequency at station 1. Analysing the frequency (fig. 4), iIndividual's belong to the *Diptera* order (larvae of the *Chironomidae* families) show a 60 % frequency at the first station, a 80 % frequency at the second station and a 100% frequency at the three and the last station individual's belong to the *Oligochaeta* subclass show a 80 % frequency at the first station, a 60 % frequency at the second station and a 100% frequency at the three and the last station.

Macro invertebrates belong to the *Gastropoda* class show a 100 % frequency at the first station, a 80 % frequency at the second station and a 20 % frequency at the last station (fig. 4). Individual's belong to the *Lamelibranchiata* class has show a 100 % frequency at the first station, a 80 % frequency at the second station and at station 3 and 4 the this invertebrates disappear.



(Figure 2. Macro invertebrate's density (individual's m^2) from Bega River)



(Figure 3. Numerical abundance of the invertebrates group at: a- first station, b- station 2, c- station 3, d- station 4)

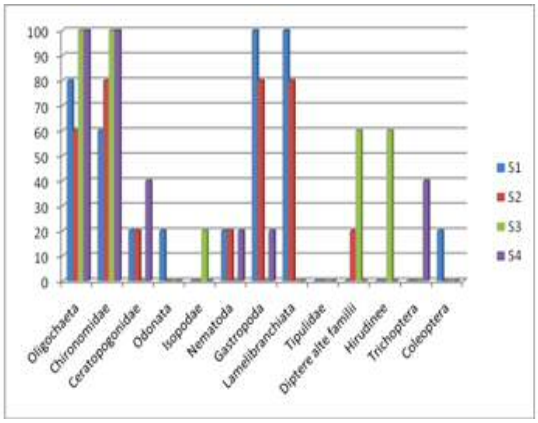


Figure 4. Macro invertebrate's frequency in the Bega River (%).

Individual's belong to the *Trichoptera* order has a 40 % frequency at the last station.

Macro invertebrates belong to the *Nematoda* phylum show a 20 % frequency at the first and the second station, individual's belong to the *Hirudin* class has a 60 % frequency at the station three and individual's belong to the *Isopoda* order has a 20 % frequency at the same station (figure 4).

Individual's belong to the *Odonata* order show a 20 % frequency at station 1.

IV. CONCLUSSION

In conclusions we can say that have been identified ten groups of benthic macro invertebrates: *Oligochaeta* subclass *Hirudin* class, *Lamelibranchiata* class, *Gastropoda* class, *Nematoda* phylum, *Diptera* order (larvae of the families *Chironomidae, Ceratopogonidae* and *Tipulidae*), *Isopoda* order, *Trichoptera* order, *Odonata* order, *Coleoptera* order and:

- at the first and the second station has been identified groups who have a high sensitivity to pollutionare and they are considered indicators of unpolluted water (*Lamelibranchiata* class, *Gastropoda* class, *Odonata* order), and at the three station this groups disappear,
- at the three station was notice the highest density values to the groups who have a high tolerance to the pollution (*Oligochaeta* subclass, *Diptera* order),
- at the last station appear macro invertebrates who are considered indicators of the indicators of unpolluted water.

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Societal and Economic Effects of Land Consolidation

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Abstract: Land consolidation is primarily introduced with the aim to group fragmented land ownership, to reduce costs and increase the agricultural production. But achieving this aims the concomitant positive effects appears in sense of economic and societal parameters. The analysis of societal effects in this paper is based on analysis on migration of the population while the economic analysis is based on agricultural production of wheat and corn. For research of societal and economic analysis of land consolidation effects the linear regression method is used. The case study is based on available data for Vojvodina, Republic of Serbia.

Keywords: Land consolidation, Economy, Society.

INTRODUCTION

Land fragmentation is a well-known problem in literature and practice. Efficiency and effectiveness of land utilization in case of fragmented land ownership is lower in performances than in case when parcels are optimally sized and distributed. Optimal size and distribution of land parcels which are the personal land ownership: decrease costs, increase the effects of agricultural production and consequently create the conditions for better land utilization. In case of extreme land ownership fragmentation it could be treated as a form of land degradation [1].

Starting from the assumptions that agricultural land is limited resource, that enhancement of food production per unit of agricultural land area is limited, that agricultural land decrease it characteristics with time and that need for food will increase in the future immediately follows that available land shall be treated with maximal care. It means that land degradation and any decrease in its characteristics shall be minimized or eliminated. On the other side small fragmented farms are not competitive in the globalized economy [2]. Global economic aspect of small and fragmented farms low agricultural production competitiveness, even though of high importance, reflects the global trend and may be one of causes for increasing urbanization and migration from rural to urban areas. From this perspective, increasing efficiency of small farms agricultural productivity could improve not only economy of rural areas but also could have positive social effects. The social effects of land consolidation projects have been taken into consideration more recently than the economic effects [3]. The reasons are based on the difficulties with data gathering as well as the selected criteria. The main criteria for allotment were parcels concentrating and reducing the mean distance between farmhouse and parcels. This goals are predominantly and essentially of economic character. But it must be kept in mind that not only economic values lead farmers' behavior, but also: pride of ownership, contentment, dowry and family tradition are of high significance [4]. According to literature [5] research based on long period of time showed that land consolidation, in general, made a positive contribution to slowing rural depopulation in Galicia.

The research in this paper is based on the methodology of linear regression which is also used in quoted literature. The same model of linear regression is used both for societal and economic analysis but the data were (responsive and explanatory variables) selected in different way. The responsive variable in societal analysis is changes in population in municipality consisting Vojvodina while in economic analysis the responsive variable is amount of produced wheat and corn per hectare averaged on ten years period of time. The explanatory variable is level of land consolidated agricultural land in municipality.

METHODOLOGY

The general equation which describes linear regression is:

$$Y_i = a x_j + b \quad (1)$$

where:
- Y_i – responsive variable;
- x_i – explanatory variable and
- a, b – unknown parameters.

In case of societal analysis the equation (1) reads:

$$\Delta P_i = a * LC_j + b \quad (2)$$

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while in case of economic analysis the equation (1) reads:

$$Wheat_i = c * LC_j + d \quad (3)$$

$$Corn_i = e * LC_i + f \quad (3)$$

where:
- ΔP_i – changes in population;
- LC_i – the level of land consolidated land;
- $Wheat_i$ – wheat production and
- $Corn_i$ – corn production.

RESULTS AND DISCUSSION

For analysis were used data about migration and average production of wheat and corn for ten years (from the year 2004 to the year 2013) for 35 municipalities in Vojvodina.

For available data the following values for unknown parameters were obtained and the forms of equations (1), (2) and (3) become as follows:

$$\Delta P = 0.04 * LC + 5.99 \quad (4)$$

where the all dimensions are percentage [%].

$$Wheat = 2.72 * LC + 5258 \quad (5)$$

$$Corn = 3.61 * LC + 5314 \quad (6)$$

where the parameters are given in kilograms [kg] and LC is the level of land consolidated land in percentage [%].

Utilization of equations (1), (2) and (3) based on the available data resulted as shown in table I.

Table I. Significance of Land Consolidation

Response	LC significance	Coefficient of determination
Migration	**Ha**	0.14
Wheat	**Ho**	0.03
Corn	Ho	0.03

The obtained results are quite paradoxical: the one-dimensional regression model resulted with null hypothesis about migration rejected and with null hypotheses about influence of land consolidation on wheat and corn production.

On the other side the coefficients of determination are quite low which means that the chosen model of one-dimensional regression does not explain the complexity of land consolidation and the extended analysis is necessary. The extended analysis shall encompass hydro meteorological conditions and the investments in roads and agricultural infrastructure.

CONCLUSION

Obtained results based on the one dimensional regression are quite paradoxical and show that the agricultural production does not depend on the level of land consolidated agricultural land. But the coefficient of determination shows that only small part of complex phenomenon is explained. This indicates further research which shall include additional explanation variables such as hydro meteorological parameters and other variables which influence agricultural production as well as additional variables which explain social behavior and trends in industry.

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Assessment of colonial waterbirds in the Danube Delta Biosfere reserve (Romania) during 2015 - 2018

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Abstract: We present the research results on all identified colonies of waterbirds in the Danube Delta Biosphere Reserve - Romania (not including pelicans) from 2015 to 2018. The largest number of total breeding pairs (bp) for all colonial waterbirds was recorded in 2016 (51,457 bp). Between 2015 and 2018, the highest (average) numbers of breeding pairs were of *Chlidonias hybrida* (11,042 bp), *Phalacrocorax carbo* (7,209 bp) and *Microcarbo pygmaeus* (3,846 bp), while the lowest were recorded for *Bubulcus ibis* (14.75 bp), *Chlidonias leucopterus* (10.5 bp) and *Sternula albifrons* (2.5 bp). Most of the species showed relatively high variation in breeding population size over the years. This could be attributed to diverse factors such as weather during the nesting period, fluctuating water levels or increasing disturbance by human activities. The most stable population across the 4-year study, according to the coefficient of variation, was that of the Eurasian Spoonbill (*Platalea leucorodia*, CV= 0.13). However, tern and gull populations showed the highest degree of variability both during our study and compared with previous ones. The *Sternula albifrons* population has decreased by 96.15 % since 2001, *Thalasseus sandvicensis* by 89.54% and *Larus melanocephalus* by 78.75%, while *Chlidonias niger* and *Chlidonias hybrida* populations have increased.

INTRODUCTION

The Danube Delta is an extensive wetland complex with an important role in a wide variety of bird species' breeding sites. In the rest of Europe natural wetlands have suffered due to human intervention and now can be found as isolated areas, but the Danube Delta complex marshlands still represent a stronghold for these species, not only as breeding grounds but also for food supply [1, 2, 3]. It represents the breeding ground of approximately 165 species of birds [4] and plays an important role in maintaining healthy European populations, especially in the case of colonial waterbirds. The area was studied intensively in the past, starting with the 19th century [5, 6] with some of the studies focusing on colonial water birds [3, 7, 8, 9, 10, 11, 12, 13, 14]. However, there has been no long-term assessment of the colonies. For this reason we conducted a four-year monitoring of the colonies of breeding waterbirds in the Danube Delta. We also compared our findings with those from studies made in the past.

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MATERIAL AND METHODS

We visited all known waterbird colonies on the territory of the Danube Delta Biosphere Reserve. The colonies were identified each year by navigating through canals and lakes using motorboats, covering much of the Danube Delta Biosphere Reserve territory. The pelican species (*Pelecanus sp.*) colonies were excluded from the analysis. Observations were carried out starting with March and ending in the month of July from 2015 to 2018. All the colonies were visited at least 2 times in every year. The number of breeding pairs (bp) of each species represents absolute values for Danube Delta Biosphere Reserve. In order to better evaluate the variation in population size across years, we calculated the Coefficient of Variation (CV), which is defined as the ratio between Standard Deviation (SD, σ) and Mean ($\bar{x}$) of the population for each species:

$$CV = \sigma / \bar{x}$$

A large CV represents greater variability of breeding pairs between years, while a smaller CV is translated as low variability [15].

RESULTS AND DISCUSSION

In total, we evaluated 24 separate waterbird species (Table I) breeding both in polyspecific and monospecific colonies.

The largest monospecific colony was one of Great Cormorants (*Phalacrocorax carbo*), with 2,000 breeding pairs. In the case of mixed colonies, the largest one was formed by 4,000 breeding pairs belonging to 9 species of birds.

Regarding the number of total breeding pairs of the species that make up our study subject, there was great fluctuation over the years. Thus, the largest number of total breeding pairs for all colonial waterbirds was recorded in 2016 (N = 51,457

bp), while the lowest in 2017 (N = 32,704 bp). The species with the largest population among the studied colonies was the Whiskered Tern (*Chlidonias hybrida)* in 2015 and 2016, with 14,035 bp and 17560 bp, respectively, while in 2017 and 2018 it was the Great Cormorant (*Phalacrocorax carbo*) with 8,157 bp and 7,524 bp, respectively. The Little Tern (*Sternula albifrons*) had the smallest breeding population in the colonies, nesting only in 2016 and 2017 with 4 and 6 bp, respectively.

Table I: Waterbird species nesting in colonies in the period 2015 - 2018, mean of the population, standard deviation (all expressed in breeding pairs) and Coefficient of Variation for these populations

No.	Species	Mean of the population ($\bar{x}$)	Standard Deviation (σ)	Coefficient of Variation (CV)
1	*Phalacrocorax carbo*	7209	1183.53	0.164
2	*Microcarbo pygmeus*	3846.25	1671.42	0.434
3	*Ardea cinerea*	254.75	75.76	0.297
4	*Ardea purpurea*	306.5	315.08	1.028
5	*Ardea alba*	175.75	100.32	0.570
6	*Bubulcus ibis*	14.75	8.22	0.557
7	*Egretta garzetta*	2058.75	577	0.280
8	*Ardeolla ralloides*	1968.75	945.83	0.480
9	*Nycticorax nycticorax*	2193.75	1010.16	0.460
10	*Platalea leucorodia*	221.75	28.86	0.130
11	*Plegadis falcinellus*	1006.25	381.08	0.378
12	*Recurvirostra avosetta*	135.5	62.63	0.462
13	*Himantopus himantopus*	487.5	318.32	0.652
14	*Glareola pratincola*	201	104.69	0.520
15	*Larus cachinnans*	2395	1109.39	0.463
16	*Larus ridibundus*	1437.25	633.251	0.440
17	*Larus ichthyaetus*	60	54.77	0.912
18	*Larus melanocephalus*	42.5	23.62	0.555
19	*Sterna hirundo*	3009	1903.32	0.632
20	*Thalasseus sandvicensis*	282.5	311.80	1.103
21	*Sternula albifrons*	2.5	3	1.2
22	*Chlidonias hybrida*	11042.25	5689.57	0.515
23	*Chlidonias leucopterus*	10,5	6.40	0.609
24	*Chlidonias niger*	214	214.06	1

Herons (*Ardeidae*) are well represented colonial breeding waterbirds in the area. We found 7 species. Most of the breeding pairs were Black-crowned Heron (*Nycticorax nycticorax*), with 2,975 bp in 2018. The rarest heron recorded breeding in the Danube Delta Biosphere Reserve was the Cattle Egret (*Bubulcus ibis*). The highest number of breeding pairs for this species was recorded in 2017 – 27 bp., while the lowest in 2016 and 2018 – 10 pairs. The Danube Delta is the northern limit of its breeding area in Eastern Europe [16]. The first proof of breeding for the Cattle Egret in the area and in Romania was recorded two decades ago [17, 18].

The Eurasian Spoonbill population was relatively stable during the study period ($\bar{x}$ = 221.75 bp, σ =28.86 bp, CV = 0.13) (Table I), with a low in 2015 – 191 bp., and a high in 2018 – 259 bp.

Gulls and terns (*Laridae*) have the largest number of species that breeds in colonies in Danube Delta Biosphere Reserve – 10 species in total. The Whiskered Tern was the species with the largest population over the years, with a maximum of 17,560 bp in 2016. The Mediteranean Gull (Larus *melanocephalus*) and Little Tern (*Sternula albifrons*) showed an inconsistency in breeding in colonies in our study period.

By comparison with a previous evaluation done in 2001 that covered medium and large colonial breeding waterbirds on Romanian territory of DDBR [3], we found 2 new breeding species: Pallas'sGull (*Larus ichthyaetus*) and White-winged Tern (*Chlidonias leucopterus*). However, we could not find, as a breeding species, the Gull–billed Tern (*Gelochelidon nilotica*). Between 2001 and our study period, the populations of 12 species decreased. The largest decrease was for Little Tern (*Sternula albifrons*), with 95.15%, Sandwich Tern (*Thalasseus sandvicensis*) with 89.5 % and Mediteranean Gull (*Larus melanocephalus*) with 78.75%. The populations of 7 species have increased since 2001. Black Tern (*Chlidonias niger*) had the largest increase in breeding pairs, followed by Whiskered Tern (*Chlidonias hybrida*) and Black-winged Stilt (*Himantopus himantopus*). The most stable populations were those of the European Spoonbill (CV = 0.01), Black-crowned Heron (CV=0.01) and Little Egret (CV=0.02).

We presume that large fluctuation in population size for some species, as seen from the Coefficient of Variation (Table I) shows that the colonies have a high degree of dynamicity over the years. This can be caused by natural and/or anthropogenic factors. The natural phenomenon's that influence the annual dynamics of colonial waterbirds are: adverse weather and hydrological conditions, food availability, diseases and predation. Often during the winter, due to heavy winds and other weather conditions, some trees in which nests are built break and topple. Extreme weather conditions and water levels of a particular year may pose significant risks for some species and/or particular locations. Heavy rain or low temperatures in the breeding season could negatively affect the breeding population of herons and other species [19, 20]. Also, high fluctuation of water levels during the breeding season has the same effect on gull and tern populations [21, 22]. Food availability may play an important role especially in relation with water level, temperature and habitats dynamics. In some cases, especially in the case of colonies formed on islands, the dropping in water levels causes the possibility for predators like jackals and foxes to reach the nesting birds, causing them to leave the colonies. Diseases, such as episodic outbreaks of Avian Influenza (H1N1 Virus) can be a factor of high variability in colonial bird population sizes. The Danube Delta was affected by

Avian Influenza in 2015, killing a total of 108 Dalmatian Pelicans [23], though we had no proof that populations of other colonial breeding species were affected.

Beside the natural factors mentioned above, human disturbance and human induced landscape change, specifically habitat loss and modification are recorded and may have a significant impact on colonial waterbird populations in Danube Delta Biosphere Reserve. Disturbance is produced by direct intervention such as entering colonies, usually by motorboats, some as the result of poorly managed tourism, other belonging to local fishermen or anglers. Domestic animals could also play an important role in population dynamics of nesting birds. It is the case of cattle and horses that could disturb the nesting of gulls, terns, avocets or stilts. As result of these perturbations, especially in the case of heron and cormorant colonies, the adult birds left their nests, exposing their eggs and young chicks to opportunistic predators such as crows (*Corvidae*). In other extreme cases chicks, still unable to fly, jumped from the nests into the water and drowned. Reed burning has a devastating effect by directly destroying the nests, as does the cutting down of trees in which nests are built. Another threat for colonial breeding birds that was observed in the study area is represented by the direct destruction of nests, especially in the case of ground-breeding species and cormorants, though these extreme cases are relatively rare.

For a better understanding of these effects on the population of colonial breeding birds, a complex data-gathering protocol has to be implemented over a long period of time.

CONCLUSIONS

During the 4 years of study we found a high variability in annual populations of most of the 24 studied species, caused by multiple natural and anthropogenic factors. Compared with 2001, we identified 2 more species that breed in DDBR, whereas for one species the breeding was not recorded anymore. The populations of 12 of the species have decreased since 2001, while 7 have increased. The study highlights the importance of continuous monitoring of colonial waterbird species in the Danube Delta Biosphere Reserve.

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- "Monitorizarea coloniilor speciilor de păsări acvatice respectiv a speciilor de păsări pentru care s-au desemnat SPA-uri în Rezervația Biosferei Delta Dunării / Monitoring of the waterbird colonies and bird species for which SPA sites have been designated in the Danube Delta Biosphere Reserve" - PN 09 26 04 07 - financed by the Romanian National Research program Nucleus (2015).
- "Starea actuala a coloniilor de păsări acvatice si a speciilor de păsări pentru care s-au desemnat situri NATURA 2000 în Rezervația Biosferei Delta Dunării / The current status of waterbird colonies and bird species for which Natura 2000 sites have been designated in the Danube Delta Biosphere Reserve" - PN 16 28 01 10 - financed by the Romanian National Research program Nucleus (2016-2017).
- "Conservarea biodiversității și exploatarea sustenabilă a resurselor naturale pentru armonizarea sistemelor socio-economice cu capitalul natural din Rezervația Biosferei Delta Dunării / The conservation of biodiversity and sustainable exploitation of natural resources for the harmonization of socio-economic systems with the natural capital of the Danube Delta Biosphere Reserve" - PN 18 14 01 01 - financed by the Romanian National Research program Nucleus, Romanian Ministry of Research and Innovation (2018).
- "Cercetări privind bolile infecțioase și parazitozele cu caracter zoonotic la animale sălbatice și domestice din Rezervația Biosferei Delta Dunării / Research on infectious diseases and zoonotic parasitoses in wild and domestic animals of the Danube Delta Biosphere Reserve" - PN 18 14 03 02 - financed by the Romanian National Research program Nucleus, Romanian Ministry of Research and Innovation (2018).
- Contract 4PS/2017 "Cercetări în sprijinul dezvoltării capacității de monitorizare, evaluare și valorificare a resurselor naturale oferite de zonele umede de importanță internațională din România și zona costieră a Mării Negre / "Investigations regarding the development of monitoring, assessment and capitalization capacity of natural resources provided by Romanian wetlands of international importance and the Black Sea coastal area" financed by the Romanian Ministry of Research and Innovation (2018)

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Studies and researches of protecting the hunting biodiversity in the region of Banat

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Abstract: **The paper presents the link between the number of species of hunting interest and changes in the anthropic ecological systems. Timis County there are 86 hunting funds. On these funds is complementary feeding of game, especially in winter. The feed rules are calculated according to the relief, the game species and the allowances for quotas. Quotas are mandatory. The wild boar (*Sus scrofa ferus*) has been particularly popular in the plains area in large numbers approx. 3700 in 2018. The existence of large grain farms offers very good conditions for food, water and tranquility. Boar brings damage not only to agriculture but also to other hunting species: Roe deer (*Capreolus caprelolus*), pheasant (*Phasianus cholchicus*), hares (*Lepus europeus*). The number of hares for 2018 are about 20000 and are continuously decreasing. The fallow deer (*Dama dama*) and mouflon (*Ovis aries musimon*) is particularly in the Complex for Hunting Pischia and sporadically in other areas of the county. A numerical decrease is also recorded for roe deer cca. 4200 exemplares in 2018. The important cause to decreased the number of partridges is related to the introductionof the pheasant.**

Keywords: cynegetic biodiversity, bioindicators, agro-silvo-pastoral ecosystem

INTRODUCTION

Unlike other countries in Western Europe, which managed to bring to extinction a large number of wild animal species through bad management, Romania still has a great venatorial potential. Nevertheless, the exact number of wild species on Romanian territory remains to be determined, as well as the interaction between species pertaining to a certain ecosystem. The extinction of a certain species may lead to a state of unbalance in the ecosystem and to the apparition of another species, a fact which usually has negative effects.
When trying to preserve the gene banks, one usually employs two methods: the *in-situ* and the *exsitu* ones.

The in-situ method refers to taking immediate and necessary measures in order to protect the living animals in an environment which is as similar as possible to their natural one, or even their natural habitat if this is possible. The ex-situ method uses conservation *in vivo*, where, unlike the former method, animals are kept in a different habitat than their natural one, as well as conservation *in vitro*, which means preserving seminal cells, embryos or tissues.

MATERIALS AND METHODS

This study was conducted on the hunting funds in Timis county, and the data came from the County Association of Hunters and Fishermen (CAHF) Timis [1], the Timis Forestry Department (DST) [2] and the Transilvanian Rare Breeds Association (TRB) [3]. The evaluation of the flocks was done on sample areas, which were randomly chosen, representing a percentage of the size of the hunting funds area, during the spring breeding when there were counted how many pairs there were, and in winter guiding after the snow tracks.

Hunting species that live in the beautiful landscape of the Timiș county are an excellent bioindicator of the existence or the lack of ecological balance. In the Timis county, there are 86 hunting funds. Within these funds, the hunting fauna is varied and specifically vigorous, due to the existence of various agro-silvo-pastoral ecosystems.

The damage, caused by the conventional intensification of agriculture to the environment and nature, made finding new solutions necessary.

In this work, the evolution of the main hunting species in the Timis county is presented, over the last decade, including climate changes and the introduction of intensive agriculture on a large scale. It is known that climate changes bring along changes,especially in the way the wild flora adapts itself.

RESULTS AND DISCUSSIONS

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All the information from this scientific work, comes from the Timis Sporting Fishermen'and Hunters' Association, the Timisoara Forest District and the Transilvanian Rare Breeds Association, gathered by the „Monitoring Protocol for the Specific Species of the various Agro-silvo-pastoral ecosystems". In the Timis county, the wild boar entered, in large numbers, in the plains, especially in the hundreds of hectares of crops. Inside these plains, it found food, water, quiet and it is very difficult to remove. The wild boar enters the forests only during hard winters, and when its food is scarce. There are farmers who, from the lack of storage places, leave the corn crops in the fields during winter, and thus, a great number of wild boars is attracted, getting plenty of food to eat.

The wild boar produces damages not only in agriculture, but also to the rest of the hunting species. The places where it entered, it destroyed the Roe deer, the pheasant and the hare. Some hunters say that the boar acts like having a „radar in its snout", finding the bunnies, the pheasants and catches the young deer. The Timis Sporting Fishermen'and Hunters' Association gathered about 480 specimens wild boar in the year 2017. During 2018, there can be gathered 583 specimens, mainly because of the swine fever. In figure no.1, we find the evolution of the number of wild boars illustrated, in the Timis county, during 1995-2018.

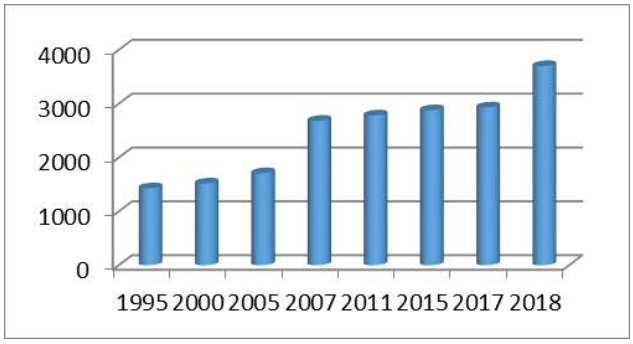

Fig. 1. The evolution of the number of wild boars in Timis county in period 1995-2018.

The Roe deer decreases its number, because of poaching, the agriculture with pesticides and the golden jackal *(Canis aureus*). There have been cases when, due to some poisonous substances, placed in the field crops, hundreds of roe deer died. In fig.2, we notice the evolution of roe deer in the Timis county, during 2000-2018.

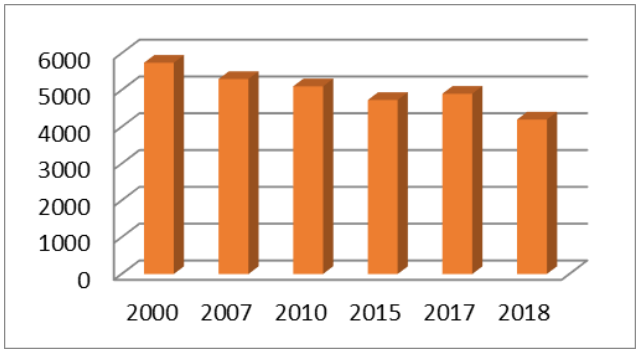

Fig. 2. The Evolution of roe deer in the Timis county, during 2000-2018.

The year 2000 is considered the year of spreading the superintensive agriculture in the West of Romania. In fig.3, we notice that the number of hares decreased substantially, due to chemicals used in agriculture, the golden jackal, the foxes (*Vulpes vulpes*), the wild boars and mostly due to poaching.

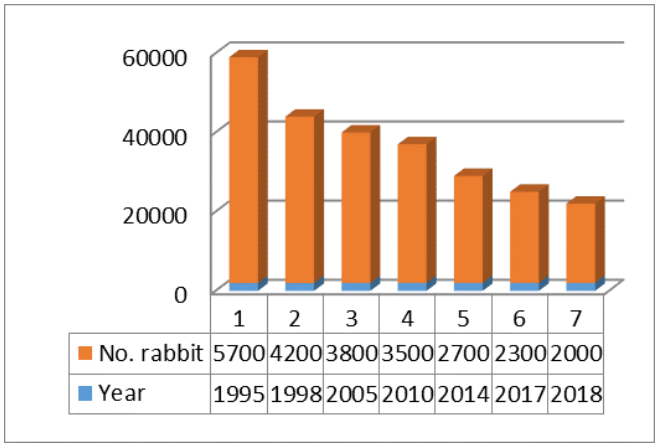

Fig.3 The evolution of the number of hares in the Timis county, during 1995-2018

The Fallow deer and the mouflon can be found in the Pischia Hunting Complex.

The common quail (*Coturnix coturnix*) has got three passage paths in Romania, one being in Banat. Every year, the number of quails is according to the path they choose. In fig. 4 there is the evolution of the number of partridges in Romania during 1937-2016.

Fig. 4 The evolution of the number of partridges in Romania during 1937-2016. (Matiuti et all, 2016)[4]

For that period one can calculate an average of 110,309.36 ± 22549.13 birds; their distribution suggests the existence of three peaks: in 1937 (273 000 units), 1971 (300,000 units) and 1998 (132,000 units).

The chemical treatment of the seeds has led to the sharp decline of the entomofauna which forms the basis of the offspring in the first 10 days of life, "because at this time they do not have the necessary enzymes to digest cellulose" [5].

From the observations that have been made, the authors of this study believe that another important cause that has decreased the number of partridges in the western area of Romania is related to the introduction of the pheasant. *"The pheasant is more resistant to cold and lack of food"* [6].

In the past 10 years there has been a relative comeback of the number of partridges and this can be linked to a better control of the chemical substances used, combating poaching, reducing large monoculture of fields. There are good conditions for the existence of partridges in the uncultivated hills of Banat due to the higher slopes. The Pischia pheasant farm where there are approx. 3000 specimens annually for populating the hunting partridge funds do not solve the problem of their number, as the specimens bred here lose their instinct to hatch when they are released at the rate of 62-71%.

On the hunting grounds/funds, the supplementary game feeding is done, mostly during winter. The quantities are estimated according to the forms of relief (mountains, hills, plains), the hunting species and the number of specimens. The numbers are reported by the respective ministry, and are compulsory. When these numbers are not fulfilled, the management contract of the funds is suspended. The hunting numbers represent the gathering of animal excess, in comparison with the best number of animals, determined by some marking points.

CONCLUSIONS

In order to maintain a certain normal biological balance between the hunting species and the agro-silvo-pastoral ecosystems, some urgent measures are to be taken:

- Rational use and control of chemicals;
- making agriculture ecological;
- Encouraging animal breeding in a pastoral system. Pastoral practices take into account entomofauna as an indicator for grazing;
- Combating poaching and stray dogs and cats;

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Ethnozootechny, a science of the history of animal breeds

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Abstract: Etnozootechny deals the relation between man-animal-environment in past and present societies and their transformations determined by animal breeding evolution. The purpose of this paper is to present the importance of animal genetic resources in Intra-Carpathian area. The existence of local livestock breeds is important for keeping genes, which gives them certain qualities, such as rusticity or products obtained for traditional recipes to which is added the beauty of a landscape through their existence. The purpose of Transilvanian Rare Breeds Association is the identification and preserving the breeds which are on the verge of extinction. The owners of local breeds are supported logistically by the association through university extension and this breeds are verrry important for the bioeconomy.

Keywords: ethnozootechny, landscape, biodiversity, local breed

INTRODUCTION

This scientific paper was presented to the 42nd Congress of the American Romanian Academy of Art and Sciences, 23-26 May, 2018, Babes-Bolyai University, Cluj-Napoca, Romania [1]. "Economic intelligence promotes solutions for maintaining domestic biodiversity by providing tools necessary for obtaining the information that allows farmers to anticipate and defend their economic interests" [2].

MATERIAL AND METHOD

The purpose of this paper is to present the importance of animal genetic resources in Intra-Carpathian area. The method used was strategic planning.

Throughout the years at conferences and symposiums in the country and abroad, Transilvanian Rare Breeds Association presented the creation of local communities in Banat and Transylvania in the field of animal husbandry, promoting the local breeds (their creation), their monitoring and the ways of protecting the national zoological patrimony. These works have been published in prestigious journals [3 - 13]. Much of the information is from the Transilvanian Rare Breeds Database.

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RESULTS

This scientific paper advances a possible solution for the creation of a Biocultural Protocol for the rural communities of Banat region maintaining or reviving rural vivacity.

The bioeconomy covers land and marine ecosystems and the services they provide. The Banat county bioeconomy needs to have sustainability and circularity at its heart.

The scheme 1 shows the proposed strategy for maintaining zoogenetic diversity in the Euroregion Banat for the period 2016-2030. This strategy is in line with the Bioeconomy development strategy for the period 2014-2030 developed by the European Union. The scheme is also based on the work of two reserchers from France [14].

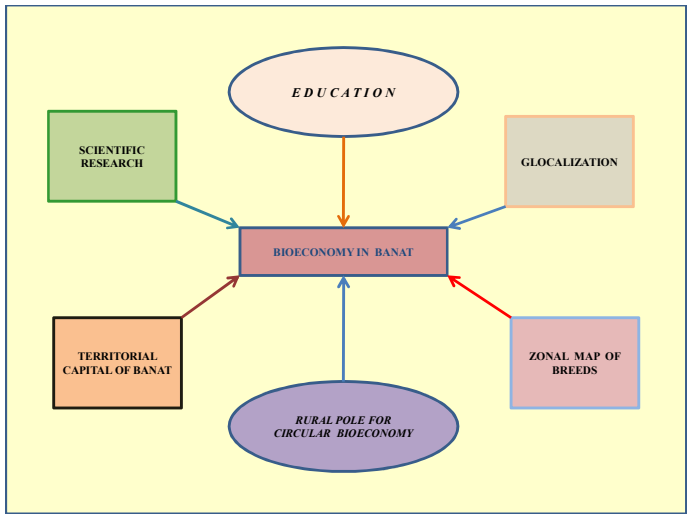

fig. 1

History and tradition in technology

"Ethnozootecny studies the relation between man-animal-environment in past and present societies and their transformations determined by animal breeding evolution "[14].

"For all the Banat areas the dwelling is characteristic" [15]. This is basically the equivalent of the American ranch. If a comparison is made between the nineteenth-century and the

2018-type of dwellings, there is a great resemblance. The house was built in the middle of the land owned by the family and was made up of a dwelling for the people and separately the shelters for the animals, for the agricultural machinery and tools and the room for the preparation of the products. Most of the lodges were equipped with a brandy boiler. The existence of the dwellings makes the work of the field easier, representing a form of integration of plant culture and animal breeding. Breeding animals at a dwelling also had the role of isolating them from epizootics. Including for people, it was the place of refuge in the case of plague.

"The destruction of the zoogenetic biodiversity means destroying a lifestyle, a civilisation" [2]. Genetic diversity is a basis for food security and rural development.

"By traditions point a view the local animals breeds are part of the *Cultural Intelligence* of rural communities in Romania" [16]. They show the intelligence, work and creativity of the people of this communities. "Preserving local animals breeds means respect for the community that created them and for the work involved in this process" [17].

Diversified ethnogastronomy and rural economy/turism.

Ethnogastronomy have a large number of recipes. Products made from recipes are verified over the course of time. Each community in Banat borrowed from one another what was best. The knowledge acquired by each ethnic community of Banat represents sample of the material life of different generations. Much of ethnogastronomy of Banat has been lost because the recipes used to be transmitted orally from generation to generation or through grandmother's notebook from the drawer of the kitchen cupboard. There is the possibility of organizing tourist routes on the "map" Banat following places with different traditional dishes, associated with various hiking that highlight the picturesque Banat.

"Marketing products from local breeds has two advantages: traditional technical processing - production or manufacturing clothing with a characteristic design" [16].

Bioeconomy and rural pole development and circular economy

It is important for Banat bioeconomy to facilitate the rapid implementation of technical and technological innovations such as eco, nature-friendly technologies. One example for bioeconomic competitiveness is the *rural pole of local development* – several projects intentions are ongoing. National Group of Professional Initiative for applied Bioeconomics in Romania (GNIBA) is promoting a complex sustainable rural development project that brings together a large number of business opportunities in Romania and other countries.

The project *"**Pilot Project for Integrateg Park based on Bioeconomy**"* is based on current conditions in Romania and offers state-of-the-art solutions to the stringent problems facing the rural communities. In so doing, it puts in place the first bases for the poles of competitiveness in rural Romania, where the vegetal and animal production as well as that of their derivatives benefit from very good geo-climatic conditions and are supported by traditions, relevant schools and others. "Implementing the project will not only spell a new dimension for the rural economy and society, but also provide jobs with the rural agro-industrial park, the business centre and the units processing vegetal and animal raw materials" [18], [19].

The project equally contributes to increasing the incomes of the local authorities as it offers a chance to diminish the effort represented by aid provided to the pauper and the socially-assisted, and by developing the business travel, consequently by increasing the national and international visibility of the area in question.

The multi-purpose areas in the park allow for creating banking, sanitary, veterinary and educational units in the rural world. There continuous learning can be done to continue crafts specific to the respective area; an entrepreneurial, associative and competitive spirit can be created while different pieces of equipment, technologies, valuable breeds and strains are presented to the farmers. It is again here that a trade area or the sale of household appliances will be developed.

Interested companies and people in the food industry may become involved into processing vegetal raw materials into daily food, bakery, pastry and sweets, as well as in breeding and processing poultry, pigs, goats, sheep and cattle in areas close to the park. The project may also generate a profit for the manufacturers of equipment for use in slaughter houses, meat-processing units, the diary industry, in processing fruit and vegetables.

CONCLUSION

In the perspective, the Banat should have the Resilience force, meaning the ability to resist bio-economically or economically through the multitude of existing knowledge. The territorial capital of Banat Euroregion is not enough known. "When a territorial capital will be established, correct decisions can be made and the *territorial economic intelligence* may be determined "[20].

Based on all these analyzes and information, a Biocultural Protocol of Banat could be created.

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Effects on lon term fertilization with NP on soil fertility

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Abstract: The paper presents results obtained from a long term field (1967-2018) experiment located within Agricultural Research and Development Station - (SCDA Lovrin). The experiment is located on a Chernozem. The experiment has two factors: first one is nitrogen with 5 graduations (N0, N50, N100, N150, N200 kg/ha), the second one is phosphorus with 5 graduations ((P0, P40, P80, P120, P160 kg/ha). The soil samples were taken on 0 to 20 cm depth, after harvesting of maize (Andreea hybrid).

From physical point of view, the analysed soil has a fine texture belong to clayey loam subclass. The percentage contents of the main texture fractions were recorded within the following ranges: clay 36,8 -38,8 %; silt 25,6-27,4 %, sand 5,8-6,4 %. The soil has no carbonates.

The yield and results obtained after laboratory analysis and statistical processing showed that: the lowest crop yield (4585 kg/ha) was obtained in the variants fertilized with 160 kg P/ha and without nitrogen application; the highest crop yield (6653 kg/ha) was obtained in the variants fertilized with N200P80, which is recommended if the maximum or almost highest crop yield is intended to be obtained. At the same phosphorus dose applied, the highest crop yield was attained in the variants with different nitrogen doses applied on a 120 kg / ha phosphorus background; the nitrogen provided the highest yield increases regardless of the applied phosphorus dose. The pH values have decreased from 6,65 in control to 6,33 in the variants fertilized with 150 kg N/ha and to 6,20 in the variants with 200 kg N/ha applied. The long term fertilization with nitrogen and phosphorus did not lead to statistically changes on soil nitrogen and humus contents.

The applied doses of 120 and 160 kg P/ha led to very significant increases of available phosphorus content, from 49 mg/kg in control to values ranging between 90 and 99 mg/kg. The long term fertilization with nitrogen and phosphorus did not lead to statistically changes on soil available potassium content. The long term application of the chemical fertilizers with nitrogen and phosphorus did not determine statistically increases of the soil heavy metal contents (cadmium, copper, manganese, lead and zinc).

Keywords: long-term experience, nitrogen, phosphorus, potassium

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INTRODUCTION

Short-term fertilizer experiments fail to highlight the long-term effect on soil and agricultural production due to soil resilience. Experiences lasting from 15 to 20 years on acidic soils with only ammonium nitrate fertilized at doses of 150-200 kg / ha have led to drastic reduction or total compromise of wheat and maize production, and to the strong acidification of the soil. The research carried out in the Network of Agricultural Research Stations showed that under the conditions from Romania, nitrogen and phosphorous fertilizers have the greatest influence on production. In the 1960s, potash produced significant production increases only on sandy soils and luvosols. This has led to the organization of long-term experimental fields, in most cases, only checking the nitrogen / phosphorus combination. In 1967, a number of experimental long-term nitrogen experimental fields were set up in a network with pedo-climatic conditions at different doses of 0, 50, 100, 150 and 200 kg / ha and phosphorus in doses of 0, 40, 80, 120 and 160 kg / ha.

Long-term experience plays a vital role in analyzing crop production stability, soil quality trends, technological progress, environmental factors, but also in nutrient balance [1].

WORKING METHOD

Soil samples were collected from the long-therm experience of SCDA Lovrin on a typical Chernozem soil. The experience was of bifactorial type, the first factor was the nitrogen with 5 graduations (N0, N50, N100, N150, N200 kg / ha), the second factor was the phosphorus with 5 graduations (P0, P40, P80, P120, P160 kg / ha). The soil samples were harvested after the

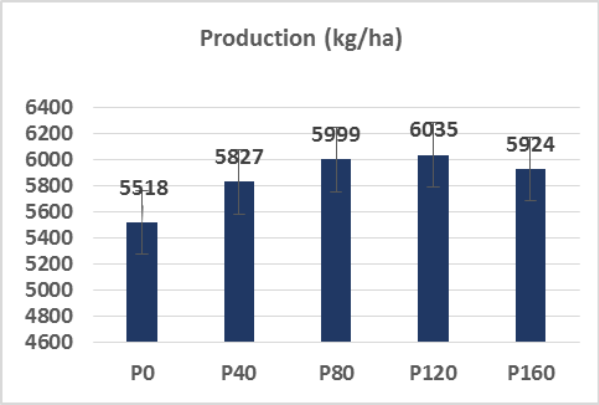
hybrid corn, the hybrid cultivation Andreea, on a 0-20 cm depth.

Sample laboratory analyzes were performed using the following methods:

- humus - STAS 7184 / 21-82; volumetric using the wet oxidation method (Walkley-Black, in the Gogoasa Modification)
- pH potentiometrically determined in aqueous suspension, soil: water ratio 1: 2.5; using a combined calomel glass electrode (pH units) SR 7184-13: 2001; PTL 0;
- total nitrogen (N%): Kjeldahl method, disintegration with H2SO4 at 350 ° C, potassium sulphate catalyst and copper sulphate - STAS 7184 / 2-85; PTL 09.
- Affordable (mobile) phosphorus: Egner-Riehm-Domingo method and colorimetric molybdenum blue dye according to the Murphy-Riley (ascorbic acid reduction) method STAS 7184 / 19-82; PTL 19;
- accessible potassium (mobile): Egner-Riehm-Domingo extraction and flame photometry - STAS 7184 / 18-80; PTL 22;
- the heavy metal content, total forms, was determined by the spectrophotometry with the atomic absorption in atomization in the acetylene flame in the hydrochloric acid solution obtained from soil mineralization with a mixture of concentrated mineral acids: nitric (HNO3) and perchloric

(HClO4). Analytical data was statistically processed using variance analysis.

THE OBTAINED RESULTS



DL 5% = 170; DL 1% = 247; DL 0,1% = 371

Fig. 1. Effect of long-term phosphorus fertilization on wheat production

3.1 The texture of the soil on which the experience was placed

From the physical point of view, the analyzed soil presents a fine texture, framed in the clay subclass. The percentage contents of the main granulometric fractions ranged from: colloidal clay 36.8-38.8%; dust 25.6-27.4%; fine sand 4.3-4.8%; coarse sand total 1.5-1.6%. The soil does not have calcium and magnesium carbonates.

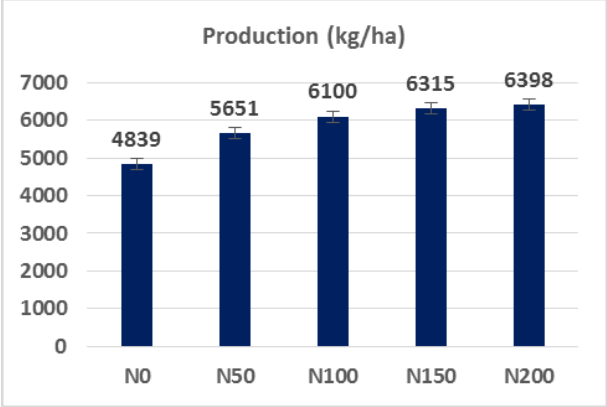
3.2 Influence of long-term fertilization (51 years) on nitrogen and phosphorus on the production of grain corn

Long-term experience plays a vital role in analyzing crop production stability, soil quality trends, technological progress, environmental factors changes, but is also included in the nutrition budget calculation [1].

The influence of fertilization with different doses of nitrogen and phosphorus on the production shown in FIG. 1, 2 and 3, highlighted the following:

- the lowest yield was obtained in fertilized variants with doses of 0-40 kg P / ha without application of nitrogen or at doses of 50 kg N / ha and the highest yields were obtained in the fertilized variants with N150-200P80- 160 kg / ha;
- nitrogen yielded the highest production yield irrespective of the phosphorus dose, but the nitrogen dose should be greater than 100 kg / ha;

In the North China Plain, in an arid zone, 30-year experience, it has been found that NP fertilization has led to very significant increases in wheat production and significant corn production. [2].



DL 5% = 121; DL 1% = 162 ; DL 0,1% = 212

Fig. 2. Effect of long-term nitrogen fertilization on wheat production

3.3 Influence of long-therm fertilization with nitrogen and phosphorus on the pH

After long-term fertilization with nitrogen and phosphorus the soil reaction had a significant and distinctly significant decrease in the application of 150 and 200 kg N / ha on phosphorus-free background. pH values decreased from 6.65 to unfertilized control at 6.33 for fertilized variants with 150 kg N / ha and 6.20 for variants with 200 kg N / ha.

Acidification of soil by the use of acid character fertilizers is faster in areas with abundant precipitation or irrigated precipitation that favor leachate of calcium [3] and stimulates the growth of production [4].

Research in a long-lasting experience (51 years) on a cambic faieosom demonstrated that the application of nitrogen fertilizers alone lead to a decrease of the soil reaction in the surface horizon depending on the applied N dose starting with the N50 variant, decrease very significant for the N150 and N200 variants compared to the unfertilized control; phosphorus fertilizers did not cause significant changes in soil response. [5].

Application of different types of chemical fertilizers in the soil leads to the modification of the soil reaction by degradation of clayey colloids due to:

- the acidic physiological reaction of chemical fertilizers;
- Increased crop consumption with harvested crops as a result of fertilizer use;
- ammonium nitrification and proton penetration resulting in the clay-humic complex instead of bases that pass into the soil solution, thus being exposed to leachate with precipitation water that is filtered through the soil. [6].

Nitrogen fertilizer actively determines the degradation of colloids in the bare soils of unsaturated soils with bases.
Analyzing the evolution of pH (KCl) after 50 years of experimentation on the luvic in luvic soil from Livada, it was found that the most pronounced acidification was generated by the systematic application of ammonium nitrate. This acidification is maintained even with the associated application of nitrogen with phosphorus and potassium. In the acidic and weakly acidic range of pH, the acidification effect on N, NP and NPK fertilization was more pronounced [7].

3.4 Influence of long-term fertilization with nitrogen and phosphorus on the humus content

Under natural conditions not influenced by the application of fertilizers, the organic matter of the soil under the influence of microorganisms leads to the occurrence of mineral nitrogen compounds. Climatic factors, especially temperature and humidity, strongly influence the activity of microorganisms, and the formation of ammonium, nitrites and nitrates in the soil through the mineralization of humic substances has its own dynamics during the year, depending on atmospheric conditions.

The formation of the clay-humic complex between the humic and clay minerals is influenced by the nature of the exchange cations at the clay surface, the pH of the medium and the ionic strength, the molecular mass of the humic substances and the clay minerals.

A great challenge in understanding the global carbon cycle is the vulnerability of large organic carbon basins to the water-land interface to climate change and landscape disturbance. There are great uncertainties surrounding the amount of organic carbon mobilized from soils, ceded to the atmosphere during river shipping and offered to the ocean [8].

Organic carbon is the largest land-bases carbon pool and the key to understanding if ecosystems will be a net carbon source for the atmosphere in a warmer world. The short term temperature increase generally increases the microbial decomposition of carbon in the soil. With the most recalcitrant biochemical organic matter decomposition, the highest temperature sensitivity is seen, the future increases in temperature can generate a positive response to global warming [9].

The soil humus content is influenced by the C / N ratio, the value of the humus is higher as the C / N ratio is lower, while at C / N over 22-24 the mineralization process takes place and, implicitly , decrease in humus content [10].

From the data presented in fig. 4, 5 and 6 show that long-term fertilization with nitrogen and phosphorus did not result in statistically assured changes in soil humus content.

Long-term experiences have shown a decline in organic carbon in the soil as a result of the continuous application of nitrogen fertilizers alone to indigenous Alfisols in India in the wheat-corn rotation. The balanced use of fertilizers with nitrogen, phosphorus and potassium has maintained or even improved organic carbon in soil from baseline values [11].

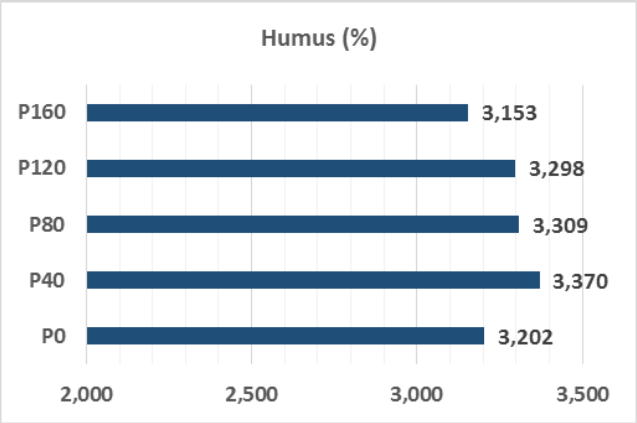
Fertilizer practices have shown that when N is applied at rates ≥ 90 kg ha-1, the soil organic carbon content in the soil (0-30 cm) is either equal to the whole of the check (no N applied) or slightly greater [12].

The organic carbon content in the soil is controlled by changes in management through the annual inputs of organic matter and the rates with which it decomposes [13].

Since vegetal remains introduced into the soil are the most accessible source of microbial metabolism in the soil, much of them (60-70%) will be consumed in the respiratory processes, and only 30-40% will enter the structure of humic compounds, under the name of the humification coefficient or isohumic coefficient [6].

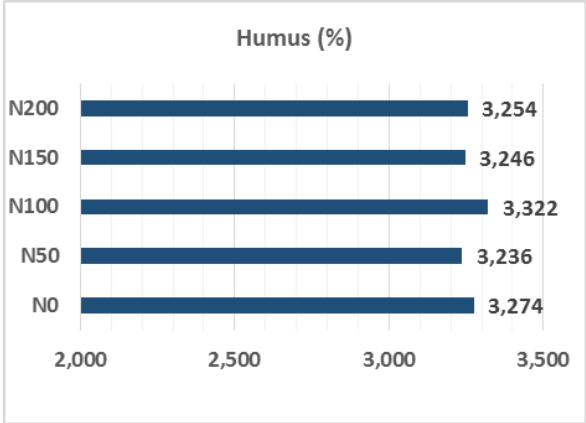
On the basis of long-therm experiences organized on gray soils and different chernozem subtypes, appreciated that the systematic application of mineral fertilizers leads to the stabilization of the organic substance and the organic and mineral fertilization system leads to an increase in the soil humus content . Optimal fertilizer with 9-10 t / ha manure and 150-180 kg / ha NPK in condition of rotation leads to higher yield [14].

The experimental data obtained in stationary experiences, many years after their start, indicates a differentiation of the humus content of the plow layer between the fertilized variants year after year and the unfertilized control. This differentiation occurs as a result of higher annual rates of decrease of humus content in non fertilized soil than in fertilized soil. Experimental data and mathematical models based on them highlight the tendency for the soil system to evolve to equilibrium states in which the amplitude of the humus content change in the pore layer decreases more and more. Humus content tends to "Equilibrium Level" and is significantly higher under balanced fertilization conditions than when it is not fertilized [4].



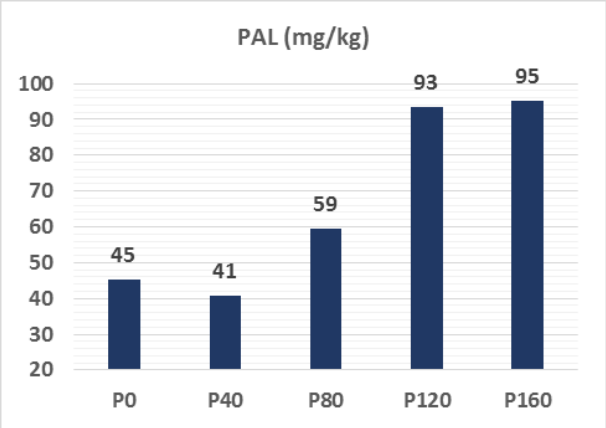
DL 5% = 0,186; DL 1% = 0,270; DL 0,1% = 0,406

Fig. 4. Influence of long – term fertilization with phosphorus on the humus in the soil



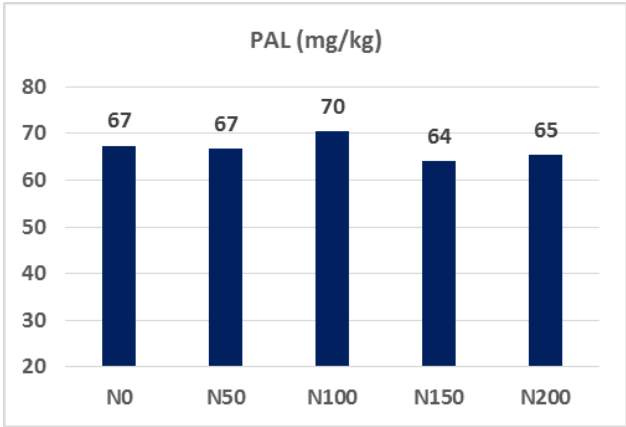
DL 5% = 0,138; DL 1% = 0,184; DL 0,1% = 0,242

Fig. 5. Influence of long – term fertilization with nitrogen on the humus in the soil



Dl 5% = 10; Dl 1% =14; Dl 0.1% = 21

Fig. 7. Influence of long – term fertilization with phosphorus on the mobile phosphorus in the soil



Dl 5%= 5; Dl 1%=6; Dl 0.1% = 9

Fig. 8. Influence of long – term fertilization with nitrogen on the mobile phosphorus in the soil

3.5 Influence of long-term fertilization with nitrogen and phosphorus on the nitrogen, phosphorus and potassium content of the soil

Interaction between N and P can be considered the most important interaction among nutrients with practical significance [15]. Research has shown that the N / P grain ratio (n = 759) indicated that over 40% of crops reach the peak production when this ratio is relatively narrow, ranging from 4 to 6 [16].

The data show that the application of nitrogen and phosphorus fertilizers does not lead to statistically significant changes in the total nitrogen content in the soil, with values ranging from 0.175 to 0.187%.

In Romania, the research carried out within the Soil Quality Monitoring System in the 16x16 km network showed that on the 0-50 cm depth the supply of mobile phosphorus-containing soils is extremely small (<4mg / kg) per 11,36 % of the area (107 sites), very small (4-8 mg / kg) in 21.02% (198 sites) small (9-18 mg / kg) in 33.01% of cases (311 sites), 9-36 mg / kg in 20.70% of cases (195 sites) high 37.72 mg / kg in 9.45% of cases 89 sites) and very high> 72 mg / kg in 4.48% of cases (42 sites). It is highlighted that the small, very small and extremely small values represent 65.41% of the agricultural area of the country [17].

The mobile phosphorus content is presented in Figures 7, 8, 9. It did not suffer statistically significant changes in variants where the phosphorus doses were below 80 kg P / ha. On the background of 80 kg P / ha the application of low doses of nitrogen (0, 50, 100 kg / ha) leads to statistically assured increases in the mobile phosphorus in the soil, but by increasing the nitrogen doses to 150 and 200 kg / ha once with the increase in production, there is no accumulation of phosphorus in the soil. The very significant increase of the

mobile phosphorus in the soil takes place with the application of doses of 120-160 kg P / ha. After 51 years, the phosphorus dose should be increased to 120 kg / ha. In Belgium, values below 120 mg / kg P in soil are considered to be low and this suggests that 115 kg P / ha for this accessible phosphorus supply class is recommended. The target supply level for mobile phosphorus in soil of Belgium is between 120 and 180 mg / kg P. To this target we must also go.

At fertilization with higher doses of phosphorus than productive consumption, the content of mobile phosphorus in soil increases significantly in the first 20 experimental years [18].

Fertilization for 6 years with nitrogen and phosphorus did not result in a change in the level of nitrogen in the soil but significantly increased the level of mobile phosphorus [19].

Compared to the situation when only nitrogen (and potassium) fertilizers are applied, the application of phosphorus fertilizers, natural or industrial products, always influences positively the mobile phosphorus content and improves all the soil phosphate characteristics [4].

A study showed that lowering phosphorus limits reduces N_2O emissions from soils with low content in phosphorus. When the availability of phosphorus is low, the reduction in plant growth decreases nitrogen uptake, leading to a prolongation of the period with higher levels of mineral nitrogen in the soil. N_2O emissions can be reduced by adopting best agronomic management practices. These practices also address phosphorus fertilization, and we expect balanced N and P application to increase N take-up by minimizing N-surplus in soil and reducing N_2O emissions [20].

To avoid K-deficiency and to sustain long-term productivity, a continuous supply of potassium from soils takes place from the soil's internal reserve [21].

Long-term fertilization with nitrogen and phosphorus did not result in statistically assured changes in the soil's mobile potassium content, with values ranging from 165 to 194 kg / kg.

The application of inorganic fertilizers with NPK combined with the incorporation of strains leads to a remarkable improvement in soil fertility [22].

3.6 Influence of long-term fertilization with nitrogen and phosphorus on the content of heavy metals in the soil

Heavy metals are one of the major environmental problems, their high toxicity, the characteristic of not being degraded, the high frequency of this type of pollution, the synergic effects and their capacity for concentration and accumulation in the natural environment [23]. For this reason, supported by the European
Commission, the evolution of the heavy metals in the soil under the influence of long-term fertilization has been studied.

From the results obtained, it was found that the long-therm application of chemical fertilizers with nitrogen and phosphorus did not lead to a statistically increased in the content of heavy metals (cadmium, copper, manganese, lead and zinc) in the soil, the values of these elements being in the class normal: less than 1 mg / kg Cd, 17 mg / kg Cu, 15 mg /kg Pb, 48 mg / kg Zn, 303 mg / kg Mn,

Research on the National Soil Quality Monitoring System revealed the following: the cadmium loading level of the soil was normal (values <1.1 mg / kg) in 88.04% sites weak (1.1-2.0 mg / kg) in 28.45% of sites, medium (2.1-3.0 mg / kg) in 2.55% of sites and strong (3.1-7.0 mg / kg), in 0.1% of sites [17].

The cadmium concentration of the earth's crust is estimated to be between 0.08 and 0.5 mg Cd / kg. Both in the upper horizon of the soil and in the marine sediments, the content varies between 0.1-1 mg Cd / kg, in seawater a concentration of 0.02-0.25mg Cd is estimated. The main sources of cadmium are zinc minerals [24].

The European Commission appreciates in the "Proposal for a Regulation of the European Parliament and of the Council on rules for marketed fertilizer products available on the market and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009" that phosphorus fertilizers sold in the EU are contaminated with cadmium, typically somewhere between 32 and 36 mg / kg of P_2O_5. It has been argued that 80 mg Cd / kg of P_2O_5 is an appropriate legal cadmium contamination limit since - until recently - an average contamination level for "non-accumulation" in the land on European farms was estimated. "Non-storage" means that the cadmium level in contaminated soil in farmland does not rise above current levels, as all new cadmium additions in soil are either taken up by crops (and ultimately consumed by humans or animals) or are washed from fertile orizont of agricultural soils.

The increase in cadmium reserves in the soil influences the amount of cadmium accessible to crops, but the cadmium concentration in durum wheat and flax seed will be severely affected by soil characteristics and environmental conditions in the season of vegetation. The type of crop and soil characteristics and climatic conditions affecting phyto-accessibility must be taken into account when assessing the risk of transfer of cadmium into the food chain under phosphorus fertilization [25].

Increase of cadmium concentration and accumulation in durum wheat strains immediately after phosphorus fertilization, primarily, as a result of the reduction of competition between zinc and cadmium for plant absorption, improvement of root cadmium translocation in the stem and improvement of root development, more than the effect of direct cadmium addition with the phosphorus fertilizer. In the short term, the application of phosphorus fertilizers may increase the cadmium concentration in crops, unrelated to the concentration of cadmium in fertilizers An optimal fertilization strategy, such as in combination with zinc application, is of great importance to reduce cadmium concentration and accumulation in crops.

ACKNOWLEDGMENT

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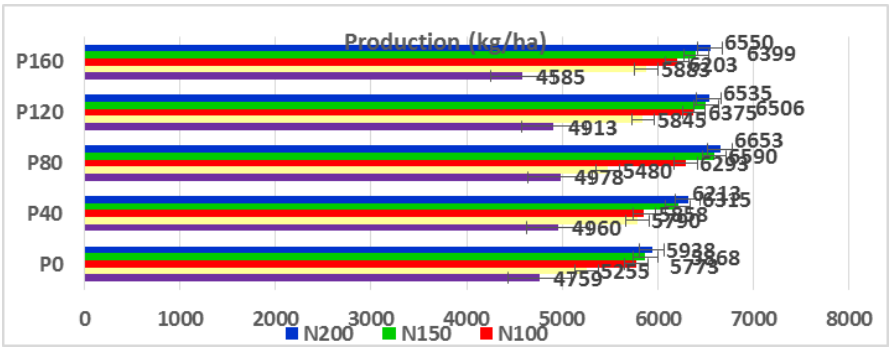
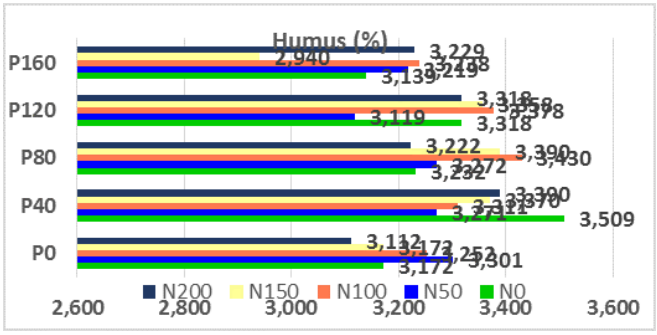


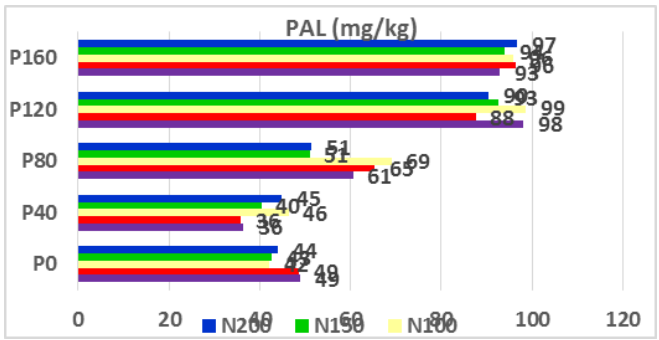
DL 5% = 270; DL 1% = 362; DL 0,1% = 475

Fig. 3. Effect of long-term fertilization with nitrogen and phosphorus on wheat production



DL 5% = 0,262 DL 1% = 0,350 DL 0,1% = 0,460

Fig. 6. Influence of long-term fertilization with NP on the content of humus in the soil



Dl 5%= 11; Dl 1%= 15; Dl 0.1%= 19

Fig. 9. Influence of long-term fertilization with NP on the content of mobile phosphorus in the soil

Wireless routers and their impact on the environment

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*corresponding author

Abstract: Everywhere, in every aspect of life today, wherever someone goes he is subject to certain environmental factors, whether they are natural or man-made. This paper will approach a specific theme, namely the effect of the wireless routers on our lives and our living environment. This paper will approach a specific theme, namely the effect of the wireless routers on our lives and our living environment. This paper aims to clarify the impact the electromagnetic radiation emitted by wireless routers on the health of living organisms and the possible effects they may have on them. The approach chosen to clear this aspect is the development of a universal application for Windows 10 that scans the area around the user for available wireless connections and returns the average value, strongest value and calculates the transmission power, power density and electric field strength in that position based on the router signal strength. The scope of this application is to determine the amount of different connections in the area where the scan is being made and is a good tool to find the strength of the surrounding electric field and the amount of transmission power that is generated by the wireless routers and determine if it is between normal values. This application was developed to demonstrate if the wireless routers have a negative effect on the surrounding electromagnetic field.

Keywords: Wireless routers, environment, electromagnetic radiation, transmission power

INTRODUCTION

There are more studies that focus on the impact of electromagnetic radiation from wireless technology on human health. In his paper, Havas M. uses the term electro-smog, which is the invisible electromagnetic radiation resulting from the use of both wireless technology and mains electricity.

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The most common sources of wireless electro-smog are:

- ✧ Cordless phones
- ✧ Cordless baby alarms
- ✧ Mobile/cellular phone masts/towers/transmitters
- ✧ Mobile/cellular phones
- ✧ Wireless networks

Exposure to electro-smog generated by electric, electronic, and wireless technology is accelerating to the point that a portion of the population is experiencing adverse reactions when they are exposed. [1]

In another paper, Ledoigt G, Sta C, Goujon E, Souguir D, El Ferjani E discuss about the exposure humans and ecosystems are subjected to highly variable and unknown cocktail of chemicals and radiations. Although individual chemicals are typically present at low concentrations, they can interact with each other resulting in additive or potentially synergistic mixture effects. This was also observed with products obtained by radiation actions such as sunlight or electromagnetic fields that can change the effects of chemicals, such as pesticides, and metal trace elements on health. [2]

The interest manifested towards monitoring of wireless connections drove to the realization of multiple application that tracks and grants user some visibility to the network. One of these tools is IntelliAdmin Network Administration Software Tool, a wireless signal meter that checks and measures wireless signal strength. Another useful tool is Xirrus Inspector, a free software designed for Windows operating system. It can monitor real-time wireless network status, traffic and clients, detect rogue access points, ensure high performance of the network, and provides detailed information about available Wi-Fi networks.

Wireless communication links have been used worldwide for a long period as solutions for connectivity in point-to-point and point-to more points. [3]

V. THEORETICAL FOUNDATION

A. Particularities of the electromagnetic field

Radiation represents the emission or transfer of energy, whether as electromagnetic waves or alfa waves, whether as beta particles. In most cases radiation manifests as a wave, known as Electromagnetic Radiation (EM radiation). There are different types of EM radiation, presented in the spectrum below, which can be grouped into ionizing radiation and non-ionizing radiation. Electromagnetic fields (EMF) is generated whenever EM radiation is present, for example when you use your mobile phone or wireless routers. At the same time, it was studied radio frequency (RF) electromagnetic energy (EME), which is emitted from wireless telecommunication sources and whether they produce health effects. It is possible to have separated an electric field or a magnetic field, for example, the earth has a magnetic field. "EMF radiation" is a term used in science and includes both EM fields and EM radiation. [4]

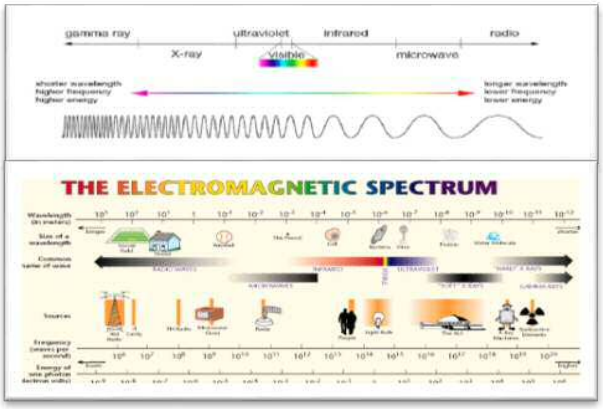

Fig. 1. The electromagnetic spectrum describes different types of radiation, from visible light to gamma rays and more. (from https://imagine.gsfc.nasa.gov/science/toolbox/emspectrum1.html from Lawrence Berkeley National Laboratory)

B. Electromagnetic waves propagation

The electromagnetic field is the consequence of varying electric and magnetic fields that are generated around a conductor carrying a variable (in time) electric current. According to Maxwell's equations, basically any type of body that produces an alternating electric or magnetic field can generate (radiate) electromagnetic waves in space, but radiation will be effective only if the following conditions are met: the frequency of the field (or oscillation) is high enough and the radiant system dimensions need to be comparable to the wavelength. Electromagnetic waves are (periodic) variations in time and space of the electromagnetic field. They are generated around transmitting antennas, which is open oscillating systems and propagated in space at the speed of light. They are characterized by parameters such as: intensity, polarization, wavelength.
The distance traveled in space in a period corresponding to a period of oscillation is called wavelength (λ). As electromagnetic waves propagate in vacuum speed of light(c), the relationship between wavelength and frequency(f) in this case is:

$$\lambda = \frac{c}{f} = \frac{3 \cdot 10^{8}}{f}\left[\frac{m \cdot s^{-1}}{Hz}\right] = \frac{300}{f\,[MHz]}[m] \quad (1)$$

C. Operating frequencies and standards implemented on wireless routers

Like many other devices intended for free usage, wireless routers operate in frequency bands of 2.4 GHz and/or 5 GHz. If the router location is in an area where other routers to produce interference, use of a router operating exclusively in the 2.4 GHz band will not raise problems, but in crowded areas is preferable to dispose of a greater number of channels, including the 5 GHz band.

D. Avoiding interference

The free spectrum of 2.4 GHz is the most used and therefore the busiest spectrum for use in wireless communications. Except US and Japan, frequency channels 1 to 13 are used, according to this chart:

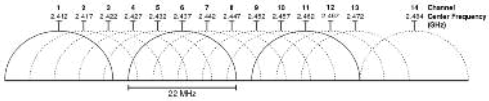

Fig. 2. Frequency channels used in Wi-Fi 802.11b 2.4 GHz band (from https://en.wikipedia.org/wiki/IEEE_802.11)

E. Wireless electromagnetic field characteristics

Wireless Sensor networks are usually composed of small, low-cost devices that communicate wirelessly and have the capacity of processing, sensing and storing. [5] Wireless electromagnetic field is measured in dBm (decibel milliwatts) and defines a negative numerical value. The closer this value is to zero the signal strength is greater. The following figure shows how this field is viewed in applications that detect wireless routers in area present on mobile devices.

Fig. 3. Graphical representation of the wireless signal strength (from https://www.netspotapp.com/what-is-rssi-level.html)

If in the area of the current Wi-Fi router are present more Wi-Fi routers the electromagnetic fields are combined in the two components described by two vectors: E-the intensity of electric field and H-magnetic field strength. WiFi data rates have seen over a 100x increase. [6]

F. Electromagnetic pollution

Electromagnetic radiation is a form of environmental pollution that can affect life and cause destructive effects. [7] Contrary to what is said officially, artificial electromagnetic waves are totally different from natural electromagnetic waves. The main differences are: the "*pulse*" nature of GSM/UMTS/LTE/Wi-Fi frequencies, the presence of *continuous pulse waves*, an enormous intensity compared to the natural intensity in the microwave spectrum. Wireless local area networks (WLAN) are systems to network computers or other portable devices using frequencies in the GHz. WLAN transmissions are intermittent, so the average power transmission is small and depends on the amount of

data transmitted. Exposure depends only from the antenna body positioning, duration and peak power transmission. [8]

PROPOSED SOLUTION AND RESEARCH/DEVELOPMENT METHODOLOGY

The proposed solution would be to scan specific locations in the city of Timisoara and compare the values to the natural level of microwaves. Multiple measurements will be made in the same locations in different positions and afterwards the values that were read will be compared and after that a conclusion can be reached. For this to happen we will use a Universal Windows Platform application that was build using Visual Studio 2015. To keep track of the position we will make use of a Map Control object and to calculate the values the formulas from Annex1 shall be used. Doing this we will have a better understanding of what and how wireless networks impact our environment and can deduce if it is healthy or not to spend time in this electro-smog or simply this electro-magnetic polluted environment.

IMPLEMENTATION

There were many concerns regarding the effects on human health by mobile phones and other equipment linked with them like antennas even in the 90's. A lot of tests were driven and experiments were taken on wireless communication and the results were widely debated. The majority of the studies brought forward the same conclusion, that there are no clues that can demonstrate the short time effects of this radiation on health. But there are still many papers that study the effects, other than the thermic ones, that suggest there may be some adverse effects on humans, though none brought serious proof regarding this. What this application proposes to do is measure the number of parallel connections in a specific position. After some measurements are being made one can compare the different values and measurements to determine the most suitable and safest place where he can spend his time based on the values returned by the application. The application is a Universal Windows App that can run on any Windows device that is equipped with a GPS device. After the application is started and running, the user may scan the area for available networks; once the scan is complete some details regarding the scan are displayed for the user, the number of available connections, an average value of the signal strength from all the networks and the strongest value measured. In addition, to help the user understand the values, a legend is displayed on the top right corner of the window. If the user wants to save this scan he may do so by pressing the SAVE button. A pin will be added to the map with some information regarding the scan. All the data is stored in a SQLite database, and when the user enters the database again the information will be showed on the map.

EXPERIMENTAL RESULTS

Now, after the proposed solution and implementation have been explain we can continue with the experimental part of the project, the measurements that have been done.

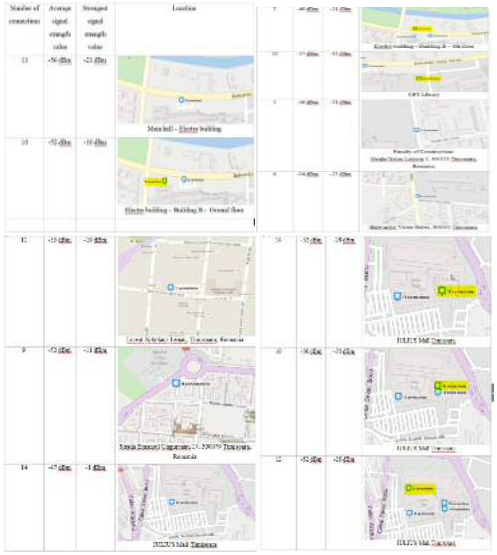

Fig. 4. The measured values

As it can be seen in the measurements table below, we can divide the experiments in four categories, or regions: Student Campus, City center, Shopping mall and Residential areas.

Table I. Values for Student Campus

Index	Number of connections	Average signal strength value	Strongest signal strength value	Transmit Power	Power Density (R=1m)	Electric field strength
1	13	-56 dBm	-21 dBm	7.9 uW	0.632 uW/ m2	0.0154 V/m
2	10	-52 dBm	-10 dBm	100 uW	7.95 uW/ m2	0.0548 V/m
3	7	-49 dBm	-15 dBm	31.6 uW	0.632 uW/ m2	0.03 V/m
4	23	-57 dBm	-32 dBm	0.630 uW	0.05 uW/ m2	0.0044 V/m
5	7	-56 dBm	-21 dBm	794.3 uW	0.632 uW/ m2	0.0154 V/m
6	6	-54 dBm	-27 dBm	1.99 uW	0.158 uW/ m2	0.0077 V/m

The maximum number of parallel network connections that was recorded is 23, but as it can be seen the value measured is not the highest. Distance from the wireless router has a strong impact on the measured signal strength. The average strength of the electromagnetic field in the student campus seems to be a bit over 1000 times stronger than the natural microwaves levels. And this comes only from the wireless routers in the vicinity.

Table II. Values for the Shopping Mall

Index	Number of connections	Average signal strength value	Strongest signal strength value	Transmit Power	Power Density (R=1m)	Electric field strength
11	14	-47 dBm	-1 dBm	794 uW	63.2 uW/m2	0.1544 V/m
12	14	-52 dBm	-28 dBm	1.58 uW	0.26 uW/m2	0.0069 V/m
13	10	-50 dBm	-35 dBm	0.316 uW	0.025 uW/m2	0.0031 V/m
14	12	-52 dBm	-25 dBm	3.162 uW	0.251 uW/m2	0.0097 V/m

The previous measurements revealed that the strength of the electric field around various places in a big city even in our homes is much higher that the natural one. Taking the highest value measured (for a signal strength of -1 dBm) we have compared to the natural value it is times higher. Of course this happens very close to the wireless router, and the value decreases exponentially as we move away from the wireless routers. But we can calculate the average ratio over which we are exposed day by day.

CONCLUSIONS

We measured the strength of wireless routers, converted the values and found out that the differences between this and the natural levels are very high but even though they are much higher the impact they have on our health and the environment is not felt. In the end we can definitely say that the effect that wireless radiation that comes from routers and other similar devices does not have a negative effect on our health in short terms even though it is much higher that the natural level. Wireless networks act as a huge nervous system that allows real information to be seen, stored and analyzed. [9] As a future direction of research, how the measurements that have been done regarding the electromagnetic field and the effects it has on the environment focused only on one aspect, wireless routers, the study can continue with GSM technology and other devices that generate an electromagnetic field.

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Mathematical modelling of thermal desorption of the crude oil polluted soil

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corresponding author

Abstract: The purpose of this paper is to present a mathematical model based on the results obtained during the experiments on the application of thermal desorption at the temperature of 350°C, with treatment durations of 5, 10 and 15 minutes in case of soils with different textures contaminated with crude oil. We opted for a polynomial model, containing both a linear component, and a non-linear component, to which we also added a component of the interactions among the three parameters (treating duration "t"; initial pollutant concentration "C_0"; content of clay in the soil "A") influencing the residual pollutant concentration in the soil in the process of thermal desorption.

Keywords: crude oil, mathematical model, soil pollution, thermal desorption.

INTRODUCTION

Soil pollution with petroleum hydrocarbons and aromatic/polycyclic aromatic hydrocarbons represents one of the most striking and important environmental problems that Romania is currently facing [1].

Rehabilitation of sites polluted with hydrocarbons is a necessity for our country, considering the areas affected by this type of pollution and the negative impact on the environment [2], [3].

Thermal desorption is a technology applicable to a large variety of volatile organic compounds, semi-volatile organic compounds, chlorine compounds, dioxides, slush and pesticides. Thermal desorption is not effective in the case of organic compounds, but, in the case of petroleum products, was obtained high yields (95-98%) [4]. These technologies are performed at low temperatures (100-300° C) and at high temperatures (300-550° C) [5], [6], [7].

The elaboration of a mathematical model is essential to improve any technological process [8].

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The aim of this paper is to present the mathematical modeling of the residual pollutant concentration in the soil during thermal desorption. The model is based on the results of the researches performed on soil samples contaminated with crude oil [9], [10], [11].

MATERIAL AND METHOD

For the experiments regarding thermal desorption was used crude-oil polluted soil (10 g soil/sample). The main parameters tracked during these experiments were the temperature and time of keeping the soil samples in the furnace.

The depollution was done by repeated heating of the samples at temperatures of 350 °C and different treatment time (5, 10 and 15 minutes), following the crude-oil removal from the soil. The soil samples were analyzed at the beginning of the experiments in order to observe the initial quantity of pollutant (Co) and after the experiments have ended in order to determine the quantity of pollutant of the end of the cleaning process (C).

The minimization of the differences between the values determined experimentally for the performance of a process and the ones calculated using the mathematical model is represented by the principle of analysis of linear regression (the method of least squares) and the method of designing statistical mathematical models [12].

More precisely, in the most complex situation of the hereby research (the one describing the variation of the concentration of crude oil in the soil) – for the quantification of the dependence between its concentration and the three process parameters – we opted for a nonlinear mathematical model, with three variables: time (t), initial pollutant concentration (C_0) and clay content (A).

The equation of the mathematical model:

$$C = C_0 \times e^{-12.2585 \frac{t}{A}} \quad (1)$$

RESULTS AND DISCUSSION

The representation of the two-dimensional and three-dimensional variation graphs of this concentration is shown in Fig. 1.

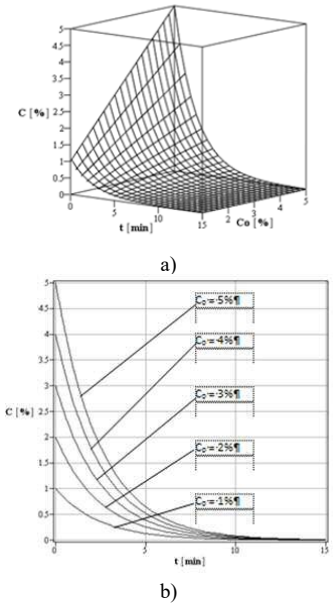

Fig. 1. Dependence of the crude oil concentration on the three variables of the process: a) three-dimensional; b) two-dimensional

From the point of view of the process' kinetics (evolution in time) we can observe that the extraction of the pollutant from the soil is achieved in proportion of 90% during the first 5 minutes of the decontamination process using thermal desorption. In the next 10 minutes, the quantity of 10% remaining in the samples would also be extracted, almost down to 0 (Fig. 1a).

The analysis of the two-dimensional graphs (Fig. 1b) indicates that the treating duration for the samples is a determining factor within the process, because increasing the treating duration leads to the intensification of the decontamination degree.

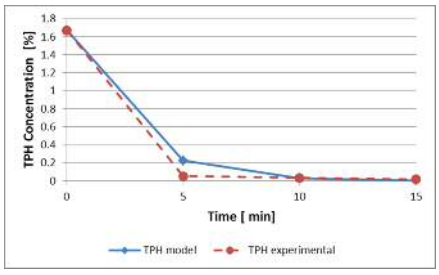

Fig. 2. Comparison between the values experimentally determined and the ones calculated with the mathematical model

In order to verify the integrity and conformity of the mathematical model thus obtained, were calculated with it the values of the final concentrations (C) with the real values obtained through measurements. The good conformity between the values measured and calculated with the mathematical model can be proven by comparing the experimental values – with the ones calculated – as seen in fig 2.

Analyzing the link between the performance of C process (the residual concentration after the thermal desorption) and the process parameters: C_0 (the initial concentration of the pollutant), A (the clay content of the analyzed soil) and t (the time of the desorption process) is revealed an exponential dependency in which the residual concentration is rapidly dropping in the first time interval, afterwards the desorption phenomena is considerably subdued. This model of thermal desorption is valid for all of the studied soil type and for all of the initial pollutant concentrations considered as starting points. This exponential fluctuation means that the widely used linear regression method [13], [14], [15] cannot be used in the case of this paper. For a better approximation of the real phenomena, was necessary to use a non-linear equation of the mathematical model. In order to determine the coefficients, this equation was corrected to a linear one, firstly by variable changes [12], [16] and afterwards using the method of linear regression.

CONCLUSION

The mathematical model hereby obtained describes with a high accuracy the real studied phenomenon. Results show the existence of a good concordance between the experimental data and data calculated using the mathematical model.

ACKNOWLEDGMENT

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Winds effects on the sea level in the western Black Sea based on 10 years data analysis from the climate change perspective

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Abstract: The relationship between the annual wind records from Romanian shore weather station and annual mean sea level, is examined using observations covering period 2006 - 2016. It is demonstrated that even such a relatively short record is sufficient for finding a convincing relationship. Using measured data from a weather station is found to give a slight improvement over reanalysis data, but for both the correlation between annual mean sea level and wind energy in the west–east direction is high. Supplementary data from a numerical hydrodynamic model are used to illustrate the regional variability in annual mean sea level and its interannual variability at a high spatial resolution. Recent climate change and land uplift are causing changes in sea level. This study implies that climatic changes in the strength of winds from a specific direction may affect local annual mean sea level quite significantly. Water levels at a particular location are not only affected by the local air pressure but also by other factors, so this simple correlation is rarely observed. Using 10 years (2006 - 2016) of Constanta - Romania coastal sea-level observations, we examine the contribution of these latter processes to long-term sea-level rise, which, to date, have been relatively less explored. A specific analysis and to evidence the correlation between wind pattern and sea level, the 2014 is chosen due to the frequent western winds that occurred during January and August in the Romanian Black Sea coast.

Keywords: sea level, wind, climate change, coastal area, Black Sea.

I. INTRODUCTION

The Earth climate is warming and the main cause of this phenomenon is human activity / anthropogenic impact. The scientific community and most of political authorities admit today this reality. The phenomenon is indisputable: ecosystems are already affected, and if there is no rapid reaction there will be significant changes with major consequences for the environment and all human activities. Especially those that depend on the exploitation of natural resources, such as fishing.

Numerous studies indicate that climate change will reduce the ability of the Earth system (ocean and land) to absorb carbon emissions produced by human activity, where the tendency to increase the level of carbon dioxide in the atmosphere and thus global temperature will increase more quickly than is predicted (IPCC, 2014; Church et al., 2011).

At global scale, changes in thermal expansion and melting glacier-sphere processes remain the main causes of sea level rise. The most important conclusion, in terms of thermal expansion, is that it will contribute to sea level rise even after maintaining greenhouse gas concentrations so, it will make a much larger contribution than the steady period. Recent research has attempted to quantify this unavoidable consequence of greenhouse effect growth using a simple scenario in which carbon dioxide concentrations rise rapidly (at 1%/year without being considered a realistic historical scenario) up to two or four or the initial value.

On Global-scale projections, Schuerch et al., 2018 suggests that between 20% and 90% (for low and high sea-level rise scenarios, respectively) of the present-day coastal wetland area will be lost. Same authors advanced the projection, based on modelling results, that until 2100, the loss of global coastal wetland area will range between 0 and 30%.

In this paper, we present the analysis of the sea level on the Romanian Black Sea coast based on in-situ / recorded data to quantify oscillations and to detect the trend of the sea level from the climate change perspective. Winds data are taken into consideration in support of our analysis as the main contributors on the coastal sea level variations.

II. DATA AND METHODS

For the analysis of Black Sea level oscillations we used the monthly data series recorded at Constanta (Romania), Varna (Bulgaria), Burgas (Bulgaria), Batumi (Georgia), Poti (Georgia), Sevastopol (Ukraine), Tuapse (Russia) from Permanent Service for Mean Sea Level, http://www.psmsl.org (Fig. 1). For the knowledge of Black Sea level oscillations on the Romanian coast we processed the data recorded at the

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level gauges from Constanta (1933 – 2016) for long-term trends and 10 years of daily averaged data analysis for detecting recent trends and variations (2006 - 2016).

For meteorological data on wind speed and direction (National Meteorological Administration) recorded at: Constanta automatic station ($44^0$13' N, $28^0$38' E) at a height of 12.8 meters from the sea level. The automatic station measures the observations regarding wind direction and speed. Wind speed values are mediated on two minutes.

III. DISCUSSION

This study aims to determine the mean sea level, to explain its variability and identify trends, given the appearance of high or extreme levels with implications for coastal zone. Extreme levels appear as a combination of maximal values in sea level during spring season (Fig. 1) over which overlap the effects of storms. An increase in the average level will of course directly affect the extreme levels but changes in the average level and hence the depth of water will influence the tidal component by changing its wavelength and for tidal energy: by modifying the propagation and dissipation.

The general trend of the Black Sea level is risen (Fig.1), with an estimated rate of (estimated by period average):

- In the western Black Sea:1.37 mm/yr (at Constanta – Romania, average period: 1933 - 1997); **1.22mm/yr** at Varna (Bulgaria, average period: 1929 – 1996) and 1.91mm/yr at Bourgas (Bulgaria, 1929 – 1996);
- In the Eastern Black Sea corner with 1.96mm/yr at Batumi (Georgia, 1882-2015); **6.68mm/yr** (Poti – Georgia, 1874 - 2015);
- In the North – Eastern Black Sea: 2.46mm/yr at Tuapse (Russia, 1917 – 2016) and 1.26mm/yr at Sevastopol (Ukraine, 1910 – 1994).

In the case of the Romanian seaside, the appearance of high levels and their persistence for several days of the year make it possible to see the consequences on the low coastal areas and the slopes. The storm regime, with obvious consequences on the sea level, a, their cumulative effect contributing to the degradation of the Romanian coastal environment.

The storms and waves regime in the Romanian coast, with episodic effect on the shore, temporarily provides scenarios for permanent coastal flooding. On the other hand, permanent flooding by raising the average level leads to the loss of economically important coastal areas or negatively influences the coastal marine ecosystem. That is why it is necessary to analyze these hydro-meteorological factors, with a direct impact on the coastal area.

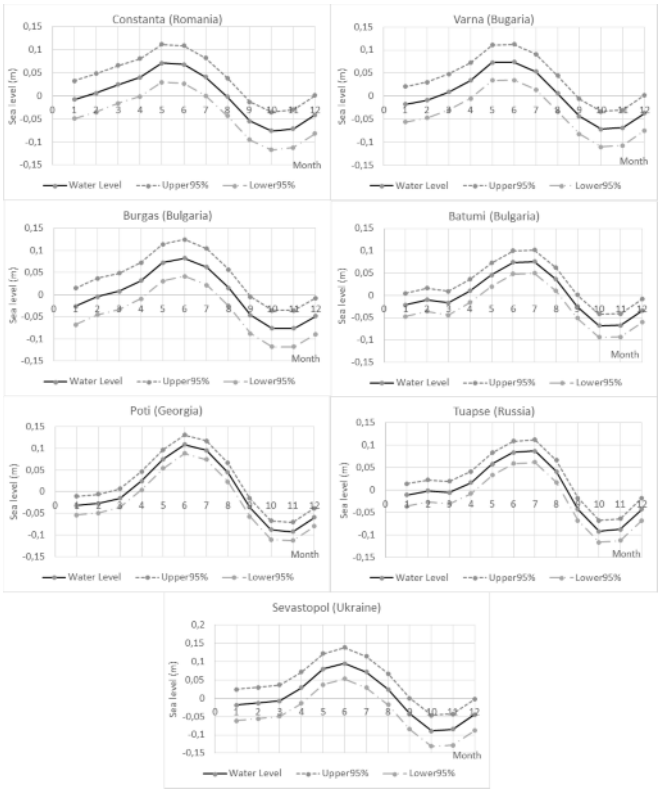

Fig. 3 Black Sea seasonal average sea level (mm/year) at: Constanţa (Romania), Varna (Bulgaria), Burgas (Bulgaria), Batumi (Georgia), Poti (Georgia), Sevastopol (Ukraine), Tuapse (Russia) (http://www.psmsl.org, accessed in 13.10.2018)

We will consider the storm, the time interval, or the moment when it is found that the following characteristic wind sizes have values of at least 10m/s: instantaneous velocity, maximum velocity in the observed range and diurnal average. Also, from our observations, it was observed that the strong wind above the limit shown above is always accompanied by the intensification of other hydro-meteorological phenomena, which become dangerous for the Constanta Harbour. These are: extreme waves, sea ice, increased amplitude of stationary waves, and intensification of nodal currents, coastal sea level rise (heightening), all of which have negative effects on the harbour activity or related hydro-technical constructions. These effects are observable immediately or after a particular time after the equilibrium state is compromised or the change is detected by apparatus or techniques.

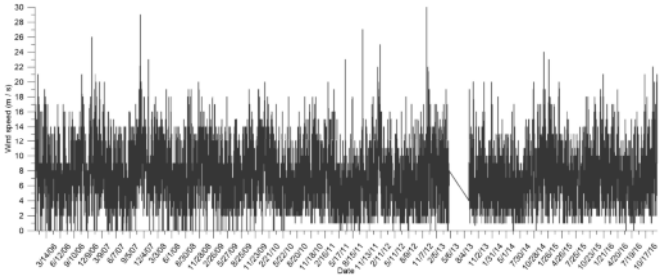

Fig. 4 Wind speed data time series at Constanta, 01.01.2006 – 31.12.2016 period

During the selected period is observed (Fig.2) that on the Western Black sea coast about 25% of the period presents selected storm characteristics. The wind speed mean about 7.63m/s characterize a sensitive coast influenced by the local air masses dynamics.

The data in Figure 2 was used to produce a power spectrum of the wind speed at Constanta - Romania. We computed the average power spectrum, with 95% significance, within regularly spaced 0 to 1 cycles per 10 years of frequency. Figure 3 shows the mean power in each of bins for the data from Figure 2. The frequency of the strongest peak in the spectrum is reported as 1/10yr cycles (corresponding to a 2.74years cycle, the eccentricity cycle) and the second strongest peak is at 0.5 cycles/10yr, corresponding to a period of 1.36 years – the obliquity cycle (Fig.3).

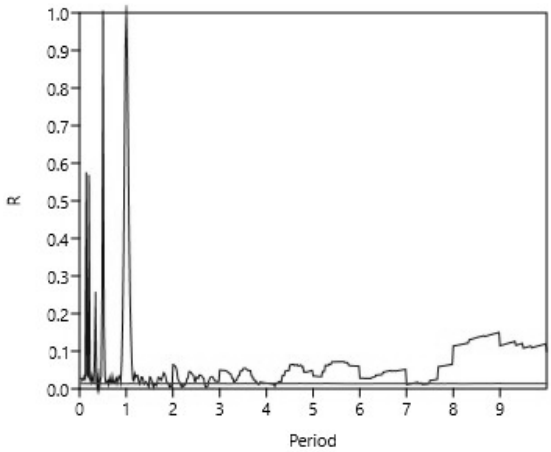

Fig. 5 Point event spectrum of wind speed for data shown in Fig.2.

From our analysis, from the climate change perspective, the sea level continue to raise in the Western Black Sea coast with a trend of 0.12cm/analysed period. One approach to determine the point events spectrum (cyclic), is to decompose the time series into a complete set of sine and cosine components. The power spectra for Constanta sea level indicated in Figure 4 were examined for the same 10-year period.

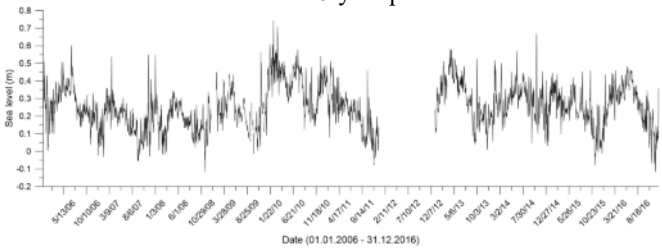

Fig. 6 Sea level data time series at Constanta, 01.01.2006 – 31.12.2016 period

The spectra for sea level on the Romanian Black Sea coast, share several common characteristics. The eccentricity cycle in the spectrum is reported as 0.19/10yr (corresponding to a 5.26years) and the obliquity cycle is at 0.12cycles/10yr, corresponding to a period of 3.28years (Fig.5).

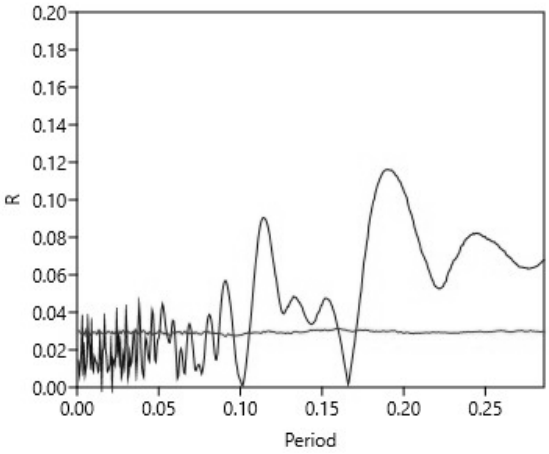

Fig. 7 Point event spectrum of sea level for data shown in Fig.4

For short term analysis we analyse first 8 months of 2014 (01.01-31.08.2014*)*. As is observed in Figure 6, the sea level is strongly influenced by the wind vector components (u, v) and, therefore, is dependent on the season: trends are negative for the W-E component in winter (January) and equal to the N – S wind component.

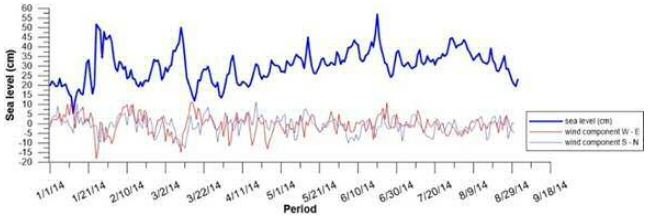

Fig. 8 Sea level and wind components (W-E and N-S) distribution at Constanta, 01.01-31.08.2014 period

Specific for the Western Black Sea due to the coast line orientation, the high sea level values are recorded when the prevailing winds are from the easterly sector. The predominant wind from the western sector determines low sea level (Fig.6).

ACKNOWLEDGMENT

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CO_2 Emission Decrease by Reducing Thermal Loses

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Abstract: All Romanian economic operators who consume annually an amount of energy exceeding 1000 tons equivalent oil / year (11628 MWh / year) have the obligation:

- to carry out periodically an energy audit to underpin the establishment and implementation of measures to improve energy efficiency.

- to develop energy efficiency improvement programs that include short, medium and long-term measures.

These two compulsory actions reveal also possibilities for the improvement of the energy consumption efficiency, mainly by depicting the weak points. The energy gain is further equivalent to less emission, especially the CO2 exhaust is taken into consideration, as according to the Paris Conference, the temperature augmentation by 2015 must be kept under 2 degrees C (even less 1.5 degree C), taken as basis year 1990. The climate change must be hold under control, if one dreams of security, health and sustainable development of the planet.

The paper presents two case studies describing concrete possibilities to reduce heat losses by recovery, and thus considerable amount of CO2 emission is reduced, in comparison to the current functional solutions.

Keywords:CO_2 reduction, energy audit, thermal losses, environmental protection

I. Introduction

Climate change is a reality and generated during the last years very visible changes in all domains of activity, and especially in the life standards. Scientists from all over the world, and of different background, have identified the *two degrees of warming* as the point at which climate change becomes dangerous If up to now a growth in the average temperature level of max 2 degrees C (basic year 1990) was a secure figure in order to assure a sustainable development, presently scientists and more and more politicians, supported by citizens, are planning to reduce the figure to 1.5 degrees [1]. A lot of strategies are currently available in this direction, and all together must complete this goal. Meanwhile, literature from the physical and social sciences makes clear that although climate science can offer projections about possible future climate change impacts, it would be better to plan already best strategies, based on available possibilities, and plan the reduction of costs, simultaneously [2].

The industrial sector1 accounts for about 25% of EU final energy demand and uses gas, electricity, coal, and oil as the dominant energy carriers, according to the EUROSTAT data (https://ec.europa.eu/eurostat/) and definition of the industrial energy sector definitions, which excludes the refinery sector as well as electricity onsite generation. Up to 2015 an intensive Decarbonizing process of the Industry is planned. Thus[3]. The FORECAST modelling platform (www.forecast-model.eu) aims to develop long-term scenarios for future energy demand of individual countries and world regions until 2050.

Thus in Figure 1 the forecast for the EU28 industrial CO_2 emissions using two scenarios (REF and TRANS-IPT), and by different energy carriers (natural gas, coal, oil, process emissions).

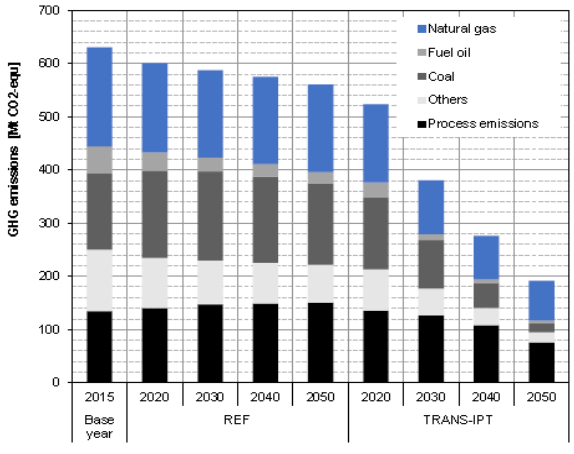

Figure 1.Forecast for the EU28 industrial CO2 emissions [3]

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II. ENERGY AUDIT

Balancing the energy consumption might be a very appropriate solution for improving the energy efficiency as a whole, and in this case, as a direct result, the CO2 emission is reduced, for the same input.

For production objects (production systems) where there are no heat or power plants or secondary energy resource recovery facilities, the outline of the balance sheet coincides with the physical contour of the considered object (s). Where, within the production object, there are thermal or electrical plants, they must be considered as being outside the contour, for which separate balances are made, on contours which coincide with their physical limits. Electricity, heat or fuel consumed in these installations and used inside the contour of the production system concerned shall be considered as originating from outside.

In the case of secondary energy recovery facilities, these are included in the balance sheet for the production object that generates them, but separately their own contours are determined for these plants, on their physical limits, which perform separate balances so that in the general balance sheet on the production objects of which they are part, the energy resources recovered can be separately identified.

The production and supply of energy to a group of consumers on a qualitative and safety level as well as the reasonable and efficient management of a thermal installation presupposes the correct knowledge of the technical and economic performances of each equipment in the respective installation as well as ensuring the optimal conditions from the point of view energy for their operation. The way in which such a functional analysis of the installation is carried out is the energetic balance - exenergetic, the first being the quantitative analysis and by the second qualitative analysis regarding the use of fuel or energy within a defined limit called contour. The energy balance (quantitative) is based on the first principle of transformation thermodynamics and energy conservation.

Whatever the form of balance sheet is, the maximum limit of error (non-closure of the balance sheet) will not be exceeded:

- ± 2,5% in the case of balances where the main sizes are determined by direct measurements, and
- ± 5% in the case of balances where some parameters cannot be measured directly but can be inferred with sufficient precision by measuring another size (indirect determination).

The simple balance refers to the physical heat consumed in the energy carriers (steam, hot water, combustion gases) in the analyzed installation. The actual balance sheet refers to the situation where a piece of equipment or plant is found at a certain moment and reflects the technical level of its exploitation at the balance sheet date. It is mainly based on measurements and analytical calculations and forms the starting point for the studies and research that need to be made to improve the condition and exploitation of the installations concerned. Balancing optimization refers to the necessary technical and economic measures to bring the equipment or plant to the best possible level.

III. ENERGY EFFICIENCY IMPROVEMENT. ENERGY BALANCE

Functionally, turning all of the input energy into the output energy is not possible, when heat energy is included. When one is transforming heat energy of o specific quality and form to another, or move from one place to another, or from one system to another, **energy losses occur**. Heat losses in industry must be avoided by recovering them, either if they have low temperature, and especially when the temperature is higher. Thus, the general efficiency of the industrial assembly will raise and, as benefit, the emitted CO_2 reduction is accounted, under the hypothesis that today is very correct, that the primary energy source was fossil. In industrial energy systems, the basic issue is to find the most appropriate method, from both a technical and economical point of view, to supply economically and securely energy to all production processes developed by the system. This requires prior knowledge of the technical possibilities of all the elements that are part of the whole energy supply system and their correct economic assessment.

The Energy Balance and the Technical Assessment are important study tools which analyze energy transformation processes that take place in the outline of a material production process or the contour of a component part of it. Energy balances can be accomplished for systems consisting of basic or auxiliary energy-technology processes, the basic production systems being those directly involved in the production process, and the auxiliary ones compete with the main production process, without directly participating in the production Basic. Energy balances are compiled for an aggregate, a section, a technological process, or an enterprise as a whole. They aim to determine the energy consumption within the contour of the analyzed process and to highlight these consumption in useful components and losses in detail.

The energy balance is therefore a fundamental technical document to analyze the size of the loss components and the possibilities of maximizing them in order to obtain optimal technical and economic indices. Energy balances serves for:

a) Design of objectives or reconstruction of existing ones:
- Supporting the choice of the most rational energy carriers;
- Quantitative determination of secondary energy resources and direction selection for their recovery and use;
- Preliminary energy consumption of all forms.

b) Qualitative augmentation of the level of technical exploitation, comprising:
- Analysis of various components and categories of useful supplies and losses;
- The establishment of a set of measures to reduce losses;
- Quality considerations, on the basis of the measured and analyzed quantities, of the energy consumption.

c) Approval and acceptance of plant and machinery for production, transformation and processing the use of energy.

IV. RESULTS OF AN ENERGY AUDIT APPLIED FOR A NATURAL GAS DRYING STATION

In Figure 2 one presents the present situation of the energy losses. In order to reduce the energy losses, oneproposed

measures with modest investment and with a recovery period of less than 5 years, as follows

– Recovery of stripping gases and their use as combustible gases in the combustion chamber of the heater

– Equipping recirculating pump motors and frequency converter coolers for adapting to partial load operation and implementing a computer-controlled drying process

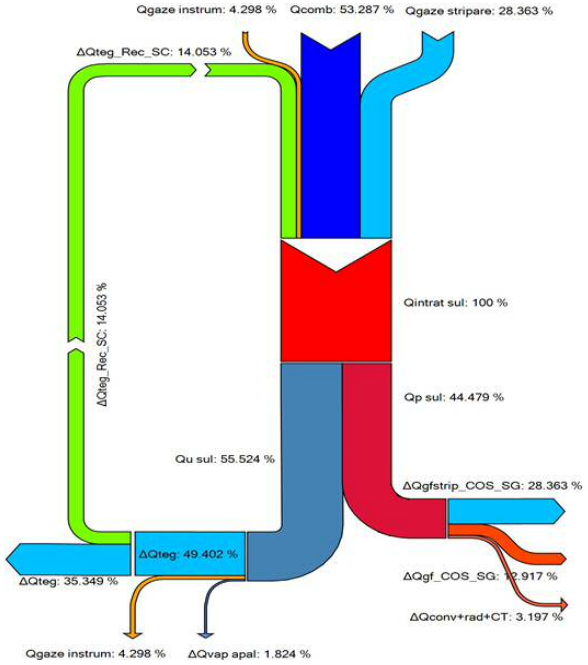

Figure 2.Sankey diagram corresponding current operating mode [4, 6]

Under these circumstances one indicates the possibility of following benefits:

- Estimated economy for the proposed action plan is 200 Tons of oil equivalent (toe) / year.
- Greenhouse gas emission reductions for the proposed measures are 489 Tones Carbon dioxide equivalent (CDE)/ year.

V. Results concerning the technical assessment for a Romanian Aluminum Recycling Company

The optimized thermo-energetic balance considered proposes the installations in the flue gas circuit of a heat exchangers between the hot gases / thermal oil for thus recovering a part of the thermal energy from the hot gases (Figure 3). This thermal oil is then delivered to a combined cycle (ORC) equipment that generates electrical energy.

Two main ideas are resulting:

- Generating electricity through the Organic Rankine cycle (ORC), allows the recovery of approx. 2% of the heat obtained by burning the fuel, under the conditions of technological consumption and under load conditions at the rated capacity of the furnaces.
- For Romania's standard national factor of 0.701 tons of CO_2 / MWh, the greenhouse gas emission reduction for proposed measures is 176 tons of CO_2 / year.

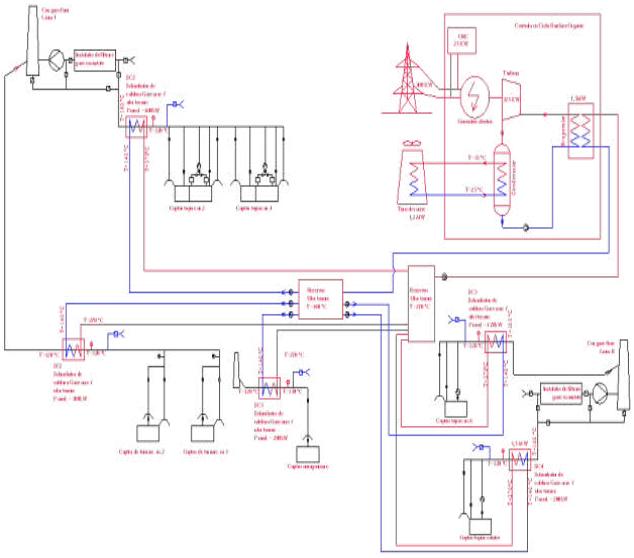

Figure 3. Scheme proposed for the recovery of thermal energy from hot exhaust gases [5, 7]

VI. Conclusions

Identification of heat losses represents anefficient standard method. This can be provided using determination of carbon footprint, as an accessible cost method.

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Research regarding the effect of the urban community on the distribution of benctonic macroconvertebrates in the Bega river near the town of Timisoara

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Abstract: Human impact in various forms changes the water quality parameters and disturb the environmental living of saprobionte organisms.

The present study follows the ecological parameters of the saprobionte organism as a diagnostic method of Bega river water quality in the area of Timisoara city.

In Freuary 2017 in the Bega River were collected 20 quantitative samples of benthic zones, in order to highlight the links between pollution degree and the saprobionte organisms community. Samples were collected from the upstream, middle and downstream of Timisoara city.

After the identification of saprobionte organisms, have been performed the density, abundance and frequency of the sample. Based on these values, we can say that the upstream segment waters falls into the category of superior quality compared to the waters of the central segment, especially in the downstream segment.

Key words: Bega River, saprobionte organisms, water quality,

INTRODUCTION

The benthic macro invertebrates are good indicators of localized conditions, as many of the benthic macro invertebrates have limited migration patterns or a sessile mode of life. Most species have a complex life cycle of one year or more. Sensitive life stages will respond quickly to stress; the overall community will respond more slowly (Moldoveanu and Rîşnoveanu, 2010)

The saprobinte organisms presence of highly polluted waters with high contamination index is explained by their tolerance to these conditions, and the presence in the clean waters of other species is explained by their particular sensitivity to the polluted environment. Being influenced by changes in water quality, the saprobionte categories presence or absence can serve as an indicator of the pollution level (Mălăcea, 1969).

The present study follows the ecological parameters of the saprobionte organism as a diagnostic method of Bega river water quality in the area of Timisoara city.

MATERIALS AND METHODS

In February 2017, in the Bega River were collected 20 quantitative samples of benthic zones, in order to highlight the links between pollution degree and the saprobionte organisms community. Samples were collected from the upstream, middle and downstream of Timisoara city. The benthic samples were collected with Ekman-Sampler and stored in 8 % formaldehyde (Lixandru, 2006, Marin *et al.,* 2011, Péterfi and Sinitean, 2002, Petrovici, 2009).

The collecting stations (S) were located as follows:

S1 is located upstream of Timisoara city, near Ghiroda village, upstream of potable water treatment station.

S2 is located upstream of sewage water treatment station of Timisoara.

S3 is located near Sânmihaiu Roman village from Timis County and downstream of sewage water treatment station of Timisoara.

S4 is located near Otelec village, before the border line with Serbia Country.

There have been calculated the density (Di = ni / Sp), the abundance (A= (ni / N)*100) and the frequency (F = Ni*100/Np), where ni represents the total number of individuals for the i series, Sp the total researched area, N the total number of individuals belonging to all species (from the sample or the studied samples), Ni the number of stations within which been identified the subjected species, Np the total number of stations (Sîrbu and Benedek, 2004,.Verdonschet, 1999).

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Figure 1. The location of the sample collecting stations on Bega River water)

I. RESULTS AND DISCUSSION

Once the benthos samples were processed, it was identified eleven groups of benthic macroinvertebrates (table 1): *Turbellaria* class, *Oligochaeta* subclass *Hirudinea* class, *Lamelibranchiata* class, *Gastropoda* class, *Nematoda* phylum, *Diptera* order (larvae of the families *Chironomidae, Ceratopogonidae* and *Tipulidae*), *Isopoda* order, *Trichoptera* order, *Odonata* order, *Acari* order, and macroinvertebrates density is presented in table 1.

Table I. Groups of saprobionţi in relation with the collection stations

Groups	S1	S2	S3	S4
Turbellaria			x	
Oligochaeta	x	x	x	x
Hirudinea	x			
Lamelibranchiata	x	x		
Gastropoda	x	x	x	x
Nematoda		x	x	x
Chironomidae	x	x	x	x
Ceratopogonidae	x			x
Tipulidae		x	x	x
Isopoda		x	x	
Trichoptera				x
Odonata	x			
Acari	x			x

In many studies has been demonstrated the high tolerance in order of pollution by organic or inorganic matter groups as Diptera order and Oligochaeta subclass (Benbow, 2009, Collier *et al.,* 2010, Courtney and Merritt, 2009, 10. Marchese *et al.,* 2010).

Has been demonstrated that this two groups of invertebrate show widened limits of tolerance to the environmental conditions (9. Lucan-Bouché *et al.,* 1999, Verdonschet, 1999).

After processing benthic samples was observed at station 1 the density of individual's that belong to the subclass Oligochaeta and the Diptera order (larvae of the Chironomidae families) is low compared to stations 2 and 3 (figure 2).

The density of individual's that belong to the Gastropoda class at first station have a density greater than the density of individuals that belong to the Oligochaeta subclass which means that the degree of impurification of this station is very small and we can say at this station are not pollution sources.

At station 2, located upstream of sewage water treatment station of Timisoara, were identified macro invertebrates who belong to the Gastropoda class, Odonata order and Lamelibranchiata class which Lorenz (2003) considers this macro invertebrates indicators of water quality better than individual's that belong to the Oligochaeta subclass and Diptera order (larvae of the Chironomidae, Ceratopogonidae and Tipulidae families).

Once analysing benthic samples from station 3, located near Sânmihaiu Roman village from Timis County and downstream of sewage water treatment station of Timisoara, we can notice that the density of individual's than belong to the Oligochaeta subclass reaches the highest values compared to other stations. Also in this station individual's than belong to the Odonata order and Lamelibranchiata class disappear.

At station 3 were identified individual's belong to the Isopoda order, Nematoda phylum, Turbellaria class and Hirudinea subclass (table I).

The last station is the station 4 and it is located near Otelec village, before the border line with Serbia Country. At this station there were lower densities of all macro invertebrates identified (fig. 1) and here are identified individual's than belong to the Trichoptera order, macro invertebrates who are considered indicators of the indicators of unpolluted water (Lorenz, 2003).

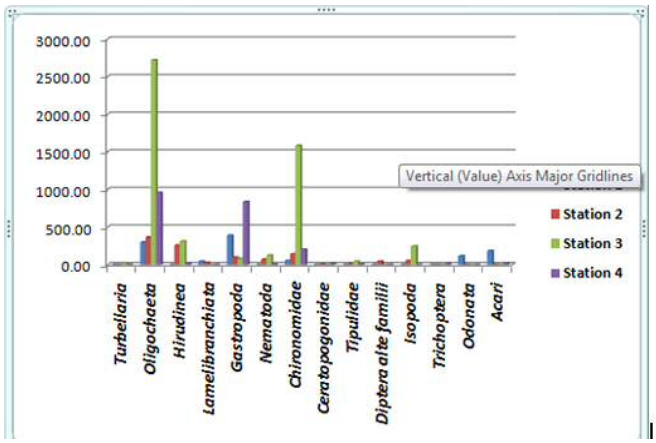

Figure 2. Macro invertebrate's density (individual's m^2) from Bega River

Analysing the frequency, individual's belong to the Oligochaeta subclass and Diptera order (larvae of the Chironomidae families) show a 80 % frequency at the first and the second station and a 100% frequency at the three and the last station.

Individual's belong to the Gastropoda class show a 80 % frequency at the first and the last stations, a 20 % frequency at station 2 and at the station 3 the frequency was 60 % (figure 3).

Macro invertebrates belong to the Lamelibranchiata class has a 40 % frequency at first and second station and at station 3 and 4 the this invertebrates disappear.

Individuals belong to the Odonata order show a 60 %

frequency at station 1.

Macro invertebrates belong to the Nematoda phylum show a 60 % frequency at the second and the the three station and a 20 % frequency at last station (figure 3).

Individuals belong to the Isopoda order and Hirudinea subclass show a 60 % frequency at the second and three and the macro invertebrates belong to the Turbellaria class show a 20 % frequency at the three station (figure 3).

At the last station appear the individual's belong to the Trichoptera order, individual's who are indicators of high water quality.

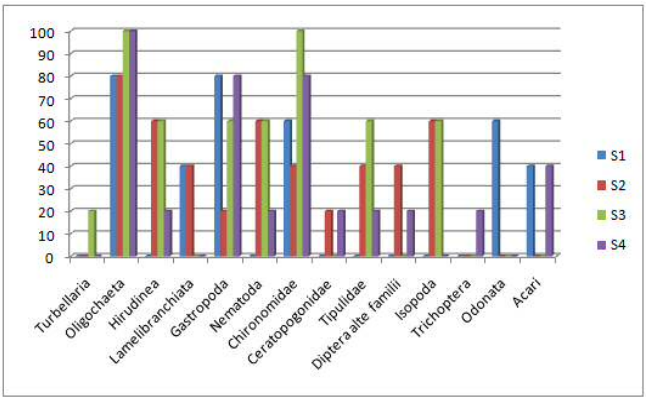

Figure 3. Macro invertebrate's frequency in the Bega River (%)

Analyzing the numerical abundance we can notice that is proportional whit the density, if the density of one group of invertebrate is high then the numerical abundance of this group of invertebrate shows high values (figure 4).

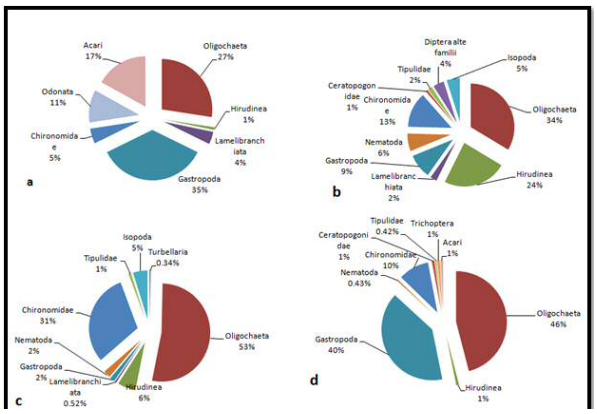

Figure 4. The numerical abundance of the invertebrates group at: a- first station, b- station 2, c- station 3, d- station 4.

II. CONCLUSSION

Have been studied eleven groups of benthic macroinvertebrates (table 1): Turbellaria class, Oligochaeta subclass Hirudinea class, Lamelibranchiata class, Gastropoda class, Nematoda phylum, Diptera order (larvae of the families Chironomidae, Ceratopogonidae and Tipulidae), Isopoda order, Trichoptera order, Odonata order, Acari order.

In conclusions: at station 1 was a high density at the individual's belong to the Gastropoda class and a low density at the groups with a high tolerance to pollution degree (Oligochaeta subclass, Diptera order), at station 2 were identified macro invertebrates belong to the Odonata order and Lamelibranchiata class, who are considered indicators of better water quality, at station 3 density of individual's than belong to the Oligochaeta subclass reaches the highest values, following by the individual's than belong to the Diptera order; also, at this station were identified individual's belong to the Isopoda order, Turbellaria class and Hirudinea subclass, macro invertebrates who record high tolerance to pollution degree., at station 4 was notice a lower densities of all macro invertebrates identified compared to the other three stations and appear the individual's belong to the Trichoptera order.

Acknowledgments. On this way i want to thank my scientific mentor and all my collaborators for their support in achieving these experiments.

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Spatial data geoportal for Local Administration – solution for Smart Cities

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Abstract: Implementing a spatial data geoportal at Local Administration level using EU non-refundable funds could be a smart solution for managing secure, smart city and valuable property based on IoT meant to reinforce Europe's cultural diversity by making our heritage and our cultural creations available to a wider number of citizens.

The cooperation of the citizens, private and the public sector are key elements that develop among all, a smart city for all the stakeholders, opportunities and a good quality of life in the city.

For local administration winning the title for "European capital of culture" initiative implies managing a large amount of data, with infrastructure projects supported by an information platform, Timisoara has to be more socially inclusive and economically resilient. The platform could facilitate a good visibility of the candidate city in the context of enhancing the contribution of culture to its long-term development in accordance with its priorities and strategies.

The conclusion of our study is to point out the importance of SMART CITY concept in the progress of our town. We will show the importance and the role of the smart city in our city in the forthcoming years and expected benefits for the 2021 year when Timisoara will be European capital of culture.

Keywords: Smart city, sustainability, cultural heritage, geoportal.

INTRODUCTION

Nowadays, the cities are faced with challenges such as growing population (Fig. 1), traffic congestion, space, resource management, climate changes, tighter city budgets, aging infrastructure and population that lead to the need for smarter cities [1].

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The European Commission stipulates into the Digital Agenda for Europe [2] the following definition: "A smart city is a place where the traditional networks and services are made more efficient with the use of digital and telecommunication technologies, for the benefit of its inhabitants and businesses."

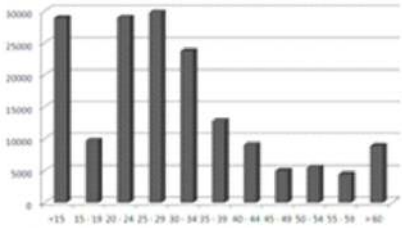

Fig. 1. Migration of Romania's population to urban areas based on age groups in 2015

Sustainable urban planning is the one that seeks to minimize the negative environmental impact of buildings by efficiency and moderation in the use of materials, energy, and development space. It uses a conscious approach to energy and ecological conservation in the design of the built environment with a view of stimulating investments, attracting tourists and increasing the inhabitants' living standards. [3]

Smart cities functioning is based on the idea of sustainability considering the following development directions:

- o environmental sustainability and efficiency;
- o sustainable homes and buildings;
- o efficient use of resources;
- o efficient and sustainable transportation systems;
- o better urban planning. [4]

The Smart City concept (Fig. 2) is therefore based on a six pillars model [5], with the corresponding indicators:

1. Smart Economy: innovative spirit, entrepreneurship, economic image & trademarks, productivity, flexibility of labour market, international embeddedness, ability to transform.

2. Smart Mobility: local accessibility, (inter-)national accessibility, availability of infrastructure, sustainable, innovative and safe transport systems.

3. Smart Environment: attractivity of natural condition, less pollution, environmental protection, sustainable resource management.

4. Smart Governance: participation in decision-making, public and social services, transparent governance, political strategies & perspectives.

5. Smart People: level of qualification, affinity to lifelong learning, social and ethnic plurality, flexibility, creativity, cosmopolitanism/open mindedness, participation in public life

6. Smart Living: cultural facilities, health conditions, individual safety, housing quality, education facilities, touristic attractivity, social cohesion.

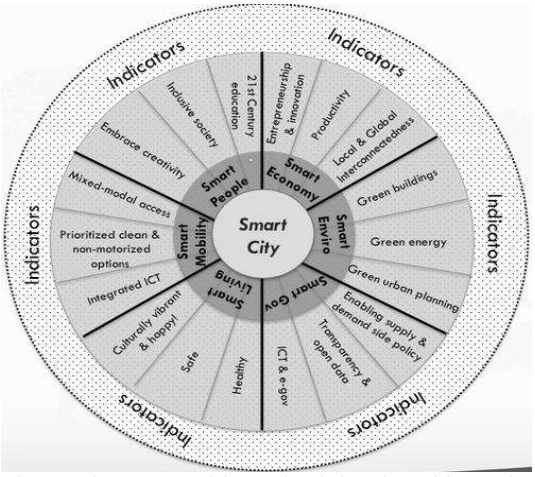

Fig. 2. The Smart Cities Wheel developed by Cohen

TIMIȘOARA AS A SMART CITY

Sustainable urban mobility plan covering the growth pole in Timișoara consisting of the city and 15 adjacent villages and concerns joint strategic objectives such as: accessibility, safety and security, the environment, economic efficiency and the quality of the urban environment.

Local Administration is already active as regards the European Innovation Partnership on Smart Cities and Communities. It was taken the initiative by the partnership formed by Politehnica University of Timisoara, Timisoara City Hall and the Smart City Association submitted the Commitment 7711, related to the use of Open Data Sets for creating smart applications to the benefit of citizens. The result consisted in an increased number of data sets made available by Timisoara City Hall on the governmental portal which located it on the first place in Romania.

Other studies conducted by specialists of Politehnica University Timişoara revealed that the owners of individual houses from Timişoara are interested in their property's value not to drop in investments such as learning, sports and relaxation facilities, quietness, public transport, edilitary and road infrastructure. At the same time, the entrepreneurs from Timişoara, that operate in the investments domain, aim to work within a long-term strategy, to have as big a profit as possible and favorable execution conditions in order for the bureaucracy to be reduced. [6]

The scenario for the spatial development of the urban agglomeration of Timişoara, initiated in 2004 and approved by the Local Administration in 2005 started from the relation between the city of Timişoara with the larger whole – Europe, the Danube-Kris-Mures-Tisa Regional Euroregion, the Western Region of Development, the Metropolitan Area of Timişoara, and resulted in nine different strategies: the electronic city by applying the Geographic Information System, the city of infrastructure, the residential city, the commercial city, the city of services and industry, the green city, the social city, the multicultural city and the universitary city, with specific objectives, development directions and measures.[7][8]

The strategy of the electronic city by applying the Geographic Information System includes the objective of continuous updating of the cadastral and topographic surveys in Stereo 70 on a magnetic support, of the edilitary and road infrastructure, of the Building Permits (BP), of the dismemberments and property transactions, of the overlapping of the laws referring to constitution and reconstitution of the properties, as well as the objective of obtain satellite images and ortophotoplans every year. All these elements being necessary for the realization of the geoportal.

The City Hall of Timişoara is the first institution in Romania starting the Geographic Information System [9] for urban planning purposes [10], at present, being the most advanced city in this domain.

The implementation of the GIS which is the basis of the geoportal, started in 1996 and covered a total area of 129,2km^2; 34 Cadastral Sectors; 900 blocks and 27000 property sheets. Positioning of each entity is made on the reference given by the cadastral digital plan, 1:500. Updating this plan is based on a photogrammetric plan by using existing records, parcelling projects, urbanism certificates, documentations from archives, documents on land retrocession, and modifications on the street scanning as a consequence of systematization etc. aiming to extend this system throughout the metropolitan area. [11]

Local Administration of Timisoara has set its goal to become one of Europe's smart cities and communities, thus developing (among others) a cultural strategy for 2014 – 2024. The strategy includes, besides the context of strategy's elaboration, methodology and analysis of the external environment, general objectives, measures and action plan, procedures and indicators for assessing the implementation of the necessary tools, mapping of cultural resources.

Mapping has been centred on three types of resources: cultural spaces (current and potential), cultural workers (organizations and public institutions of culture) and cultural events (events and large-scale projects, relevant for the city). Joint documentation efforts have meant sending 12 requests for information to the authorities and public institutions, specific documentation, more than 40 interviews with resource persons from the city, interviews and sending questionnaires to the religious institutions in the city and Neighborhood Advisory Councils.

Thus, data from the sociological research carried out within the project Cultural Poles in 2013, also general data regarding social economy of the county, cultural statistics, including cultural vitality, and information provided by cultural operators on special meetings has been corroborated. Mapping of cultural resources provides a general image on both cultural life profile and cultural operators from Timisoara, compared to the region and the rest of the country and highlights most performant cultural domains (in terms of cultural vitality) and those which need support to develop. It includes visual arts; show arts; libraries, publishing houses and written culture; audience development and cultural expressions diversity; cultural education; audience development; amateur arts, multicultural diversity; cultural and creative industries; broadcasting and cinematography; training and support for business ideas incubation in the field the Cultural and Creative Industries (CCI); encouragement of the CCI market through competitive public acquisitions and creative interventions for aesthetic city; workspaces for business incubators, creative hubs; museums; music; architecture – cultural heritage – built environment; contemporaneous architecture; arts and culture spaces; natural heritage.[12]

"The award title of European capital of culture will continue to rely on a cultural program created specifically for European capital of culture, which should have a strong European dimension. The program should also be part of a long-term strategy with sustainable impact on economic, cultural and social development".

The Local Administration is prepared to invest in its heritage and to foster cultural phenomena. The potential offered by the Euroregion of historical Banat represents the foundation for the projects and initiatives meant to support the development of a common identity based on a natural collaboration between people and organizations. Moreover, culture represents an investment for the local economy, which, through the development of tourism based on cultural heritage and on major events, aims to draw visitors and transform the city and the region in a cultural pole with wide international opening.

Competing and winning the title for "European capital of culture" initiative implies involving the entire community in embarking socio-economic and infrastructure projects supported by an information platform which ensures efficient data management for the municipality. This platform facilitates a good visibility of the candidate city in the context of enhancing the contribution of culture to its long-term development in accordance with its priorities and strategies.

SPATIAL DATA GEOPORTAL FOR LOCAL ADMINISTRATION – SMART SOLUTION FOR A SECURE AND VALUABLE CULTURAL HERITAGE

As regards the creation of the 3D models of cultural heritage objects, there are several technologies available for data collection: close-range photogrammetry, laser scanning, UAVs (Unmanned Aerial Vehicles).

For processing and creating 3D models, the alternatives are: model in specialized software (e.g. Cyclone, Solid Scan, GeoVerse, JRC 3D Reconstructor), model directly in 3D CAD (Civil 3D), model only surface (for pure restauration purposes – created from photographs – Corel Draw).

For the present objective the data was collected using a laser scanner. The scanning survey may be divided into three phases: planning, scanning and registration and QA/QC (Quality Assurance/Quality Control). In the processing phase, the scans from different stations are brought in a common reference system and then merged to create a complete model. During this process, registrations are created, namely target to target or cloud to cloud registration in order to obtain the unified point clouds (Fig. 3) and clear the noise.

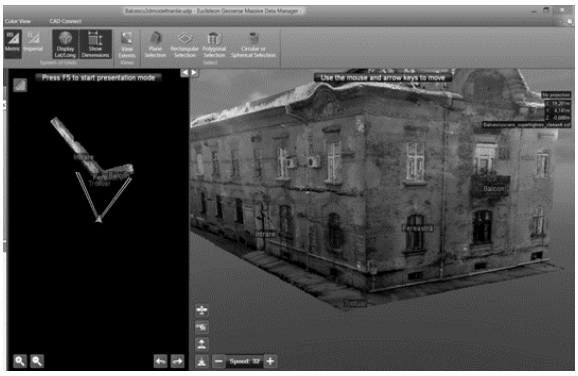

Fig. 3. Point cloud obtained by scanning a historical building from Timisoara

After the 3D models of the cultural heritage objects are created (Fig. 4, 5), they should be uploaded on the geoportal in order to appear when it is interrogated.

Fig. 4. Selecting a cultural heritage object from the geoportal[13]

Fig.5. 3D model of the cultural heritage object

From the applicative point of view such a webGIS solution brings added value for all the institutions that manage and operate with Cultural Heritage objects.

The fact that information is available at a glance as a webGIS resource for different users in an attractive and intuitive manner, it provides a powerful tool for cultural heritage conservation as an efficient strategy of urban planning.

The smart city approach providing solution for visitors and tourism by improving the quality and sustainability of what a destination offers. For the visitors, the hotels, the restaurants and the attractions of the city could benefit from the geoportal which can be used as a guide to lead at quality places to visit.

CONCLUSION

In this paper the authors proposed implementing a spatial data geoportal at Local Administration level (Timişoara City Hall) to streamline the data workflow and provide easy access to it in order to increase the visibility of cultural and historical heritage of the municipality. The need of this geoportal arises from the fact that Timişoara has the widest architectural heritage area in the country, of important value to both Romania and Europe. The dedicated geoportal for the management represents a smart solution which completes the existing urban GIS primarily aiming to contribute to fostering the urban planning and the sustainability of the "European capital of culture" project. This geoportal should include the 3D models of the cultural heritage objects for better preservation over time or restauration purposes and offer virtual tourism tours if they are made available by means of WebGIS. The technical basis for this project should be represented by geodetic measurements, laser scanning, IoT and architectural support ensured by an unceasing teamwork of different specialists.

The actuality of the paper arises from using WebGIS solution in the "Internet of Things" (IoT) context to merge physical and virtual worlds, creating smart environments that represent the next natural step towards the digitisation of our society and economy.

The authors insist on the idea of creating a geoportal for cultural heritage objects as the future brings changings in terms of replacing desktop solutions by WEB solutions in order to allow the dissemination of the results and to increase the possibility of international collaboration between specialists. WebGIS solutions have several advantages among which we mention the access to spatial data characteristic to cultural heritage documentation either for specialists or ordinary users and different purposes.

An efficient urban planning strategy implies creating WebGIS for cultural heritage as the next natural step forward for both conservation and preservation of these objects, and also for understanding and promoting them. Also, together with the unlimited possibilities offered by the World Wide Web, creating physical virtual replicas of Cultural Heritage objects has become more and more attracting and interesting.

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Marine biomass valorization as potential bioresource for biocosmetics and eco-agriculture

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Abstract: **, environmental, social and political pressures due to industry, agriculture, mass tourism and urbanization in the coastal area require the complex valorisation of the Black Sea bioresources by developing and applying innovative and emerging biotechnologies. The superior valorization of the residual marine biomass along Black Sea Coast represents a highly important natural resource for the eco-agriculture, pharmaceutical and cosmetic industries, supplying raw material for the extraction of bioactive substances (vitamins, sterols and collagen). The mixture of residual marine biomass collected from the shallow coastal area has been analyzed depending on their nature: macroalgae, animal biomass, microbial biomass. Bacterial contamination has been expressed as evolution in time of total number of colony forming units (TNCFU). Faecal origin of pollution has been confirmed by calculating the probable number of coliform bacteria (MPN) of CT (total coliforms)/g.; The probable number of coliform thermotolerant bacteria (MPN) of CF (faecal coliforms)/g, ST (total Streptococci)/g, SF (faecal Streptococci)/g and by displaying the presence of Enterobacteriaceae (from the types *Escherichia*, *Salmonella, Citrobacter*, *Enterobacter* and *Klebsiella*), Pseudomonadaceae (*Pseudomonas aeruginosa*), as it raises the possibility of the presence of pathogenic germs. Pathogenic microbial flora isolation and identification have been made on selective culture media, based on biochemical reactions. The increased rates of bioaccumulation and pollution, seasonal temperature variation and summer mass tourism affect the biodiversity but the material is still consistent, microbial charge does not cause sanitary problems and preliminary analyses of the residual biomass anticipate a strong capacity as a potential bioresource for eco-agriculture and biocosmetics.**

Keywords: marine biomass, biocosmetics, eco-agriculture. public health

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I. BACKGROUND

Risk assessment for biological stressors is an issue of growing importance to all countries that are interested in the socioeconomic development opportunities and environmental impacts of increased international trade or mass tourism. In general, environmental stressors are chemical, physical or biological agents capable of causing adverse effects on human or environment health and safety. Coastal land areas provide interesting bio resources, such as residual marine biomass, as well as interesting business opportunities for its use in eco-agriculture (as bio fertilizer) and bio cosmetics field. In this study, quantitative risk assessment for biological stressors has focused primarily on the human health effects of microbial toxicants in the residual marine biomass samples collected from the shallow of Black Sea from three locations (Mamaia-Pescarie Constanta, Eforie Sud – Capul Turcului Golf and Vama Veche - 2 Mai), in the period March - September 2018. Assessing microbial charge should provide integrated information on contaminant input from multiple sources. The biologic role of macrophytes algae is well-known in all aquatic pool, contributing to maintaining the biologic equilibrium and representing the base of primary productivity in these pools. Direct determination of pathogenic germs cannot be performed than extremely difficult. The underlying principles, methods, data and conventions for assessment of biological stressors are much less developed than those for chemical risk assessment for example. The main differences between chemical and biological stressors, generating their difficult management by indirect indicators of probability, are that biological organisms:

- Grow, reproduce and may multiply;
- Disperse both actively and passively, other "in jumps" that are hard to predict. Undetectable low levels of pathogens may increase if ecological conditions permit.
- Interact with ecosystems in ways that can be complex and are hard, if not impossible, to predict;
- Evolve, and this evolution is largely random. Once benign, microorganisms may evolve to become like pathogenic. Many species of bacteria have both pathogenic and non-pathogenic strains, and non- pathogenic, but just opportunistic, causing disease in immunodeficient organisms.

In addition, the collections are submitted to multiple errors, hard to avoid. The water has a very rich autochthon bacterial

biocoenosis that develops at low temperatures; for that reason in practice there are followed the germs which are totally mesophylls (which are allochthonous) (total number of colony forming units TNCFU). But TNCFU is relevant for studying as evolution in time, or together with other indicators.

Germs concentrations indicate only partially the risk that the water and the residual biomass (after separation by sedimentation) present as, for some contagious diseases, the infective dose is 10^4-10^5 germs, and for other germs, for instance *Salmonella* spp., it is much smaller. Contamination of surface water by fecal matter is the major mechanism by which pathogens reach high concentrations in aquatic systems. Fecal contaminants originate from many different sources, including wastewater from sewage treatment plants, industrial parks and residential areas, densely populated touristic areas. Animal husbandry and runoff from grazing pastures are also important sources (Crowther et al., 2002), particularly when animals have unrestricted access to waterways (Wilcock et al., 2006; Collins et al., 2005). In poor rural areas, wash-off from outside latrines may also be an important source of fecal contamination (Causse et al., 2015). Fecal indicator bacteria (FIB) are used as a measurement of the sanitary quality of water and materials that are used for domestic, industrial, agriculture and leisure activities. Cosmetic field involve raw material compulsory sterilization, so germs determination and monitoring are not necessary. The term FIB is used to describe the bacterial community that is released in fecal matter of homoeothermic animals (e.g. humans and other mammals). Total coliforms TC group includes *Escherichia coli* and coliforms, *Salmonella spp*., *Enterococcus spp*., all of which are used as a proxy for detecting the presence of other pathogenic bacteria in environmental samples such as soil and water (Ishii and Sadowsky, 2008; Byappanahalli et al., 2012). Although the initial presence of these bacteria in water is due to fecal contamination, their survival and transfer vary as a function of environmental influences such as sunlight, temperature, competition with other bacteria, predation, and the presence of pollutants such as agro-chemicals (Rochelle-Newall et al., 2015; Chan et al., 2015). Moreover, mobilization and transfer of FIB and pathogens in an ecosystem is strongly affected by hydrology, soil characteristics, and land use in catchments (Chu et al. 2011; Ribolzi et al. 2016a; Ribolzi et al. 2016b). For that reasons, there is a growing demand for modeling methods that allow the assessment of water and wet raw material quality.

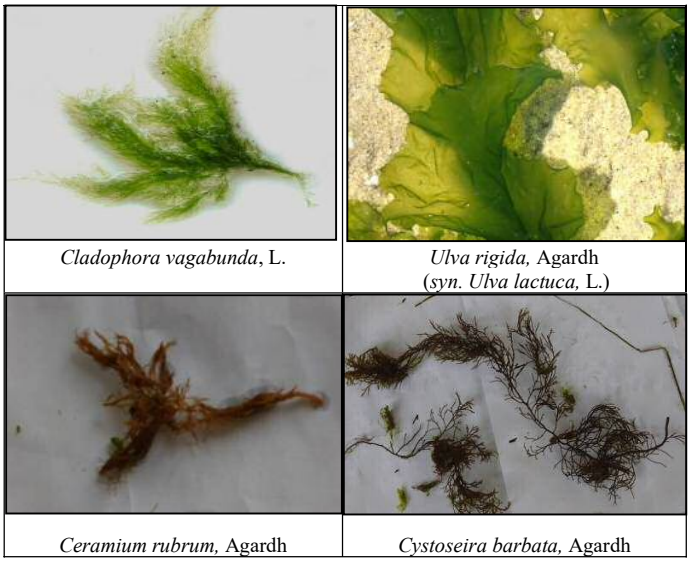
To appreciate the novel risk assessment challenges posed for human health by microorganisms as biological stressors in the residual biomass, we considered that pathogen agents reaching wet biomass may be anthropogenic organic xenobiotics, particularly Enterobacteriaceae (from the types *Escherichia*, *Salmonella, Citrobacter*, *Enterobacter* and *Klebsiella*, *Vibrio cholerae* and *Staphylococcus aureus*. They cause human and animal diseases transmitted through fluids, either by direct contact or by ingestion or inhalation of aerosols from contaminated water or sludge. This part of the study has been conducted to assess sanitary quality of wet residual biomass and separated by sedimentation marine water through microbial fecal contamination levels and to evaluate seasonal variation of microbial contamination by investigating the dynamics and seasonal distribution of fecal indicator bacteria (FIB number) and total coliforms (TC number), as indicators of fecal contamination.

II. MATERIALS AND METHODS

We wish to note that our methodology is very flexible and compatible with various methods for medicine labs. These methods may be a good tool for complex interdisciplinary investigations in ecology, ecotoxicology and marine biology. Further perfection of our methodology and devices can create effective monitoring systems and strategies.

A. Study area and sampling strategy

The catchment covers three stations along the shore: Mamaia-Pescarie Constanta, Eforie Sud – Capul Turcului Golf and Vama Veche - 2 Mai. Sampling was done from March 2018 to September 2018, consisting of wet residual marine biomass samples collected from the shallow coastal area, in the sense that most diseases transmitted by water have as etiological agents the microorganisms eliminated through the digestive tract and the presence of these microorganisms (normally in human and animal feces) in water, normally free of enterobacteria, reveals the possibility of pathogenic germs presence. After triage of residual macroalgae, *Cladophora vagabunda* (L.) and *Ulva rigida* C. Agardh (syn. *Ulva lactuca* L.) - green algae, *Cystoseia barbata* (Stackhouse) C.Agardh - brown alga, *Ceramium rubrum* C.Agardh - red alga, invertebrates and shells biomass (mollusks, crabs, skeleton waste) (Fig. 1) and species identification, the samples were mixed and biomass was separated from marine water by 48 hours sedimentation and microbiological sanitary tests were done separately for marine water (considered as waste water) and for fresh and dry powder epibiota on the surface of the mussel valves [4, 5].



Cladophora vagabunda, L. | *Ulva rigida,* Agardh (*syn. Ulva lactuca,* L.)

Ceramium rubrum, Agardh | *Cystoseira barbata,* Agardh

Residual algae marine biomass

Residual invertebrates marine biomass

Fig.1. Macroalgae and invertebrates species presents in the residual marine biomass along Black Sea Coast

B. Climate, demographic and dominant economic activities data for Constanta region

Based on data from National Meteorological Administration, Constanta is one of the warmest cities in Romania. It has a moderate subtropical climate with considerable maritime and some continental influences. There are four distinct seasons during the year. Summer (late May to mid September) is warm, dry and sunny with a July and August average high of 25.9°C (78.6°F) and 25.8°C (78.4°F). The beginning of summer brings plenty of precipitation, but by early July the weather becomes settled and dry. Most summer days see a gentle breeze refreshing the daytime temperatures. Nights are warm and somewhat muggy because of the heat stored by the sea. Autumn starts in mid or late September with warm and sunny days. September can be warmer than June, owing to the heat accumulated by the Black Sea. The first frost occurs on average in mid November. Winter is much balmier compared to other cities in southern Romania. Snow is not abundant but the weather can be very windy and unpleasant. Winter arrives much later than in the interior and December weather is often mild with high temperatures reaching 6.4°C (43.5°F) - 12°C (54°F). Average January temperature is 1°C (34°F). Winter storms when the sea becomes particularly treacherous are a common occurrence between December and March. Spring arrives early but it's quite cool. Often in April and May the Black Sea coast is one of the coolest places in Romania found at an altitude lower than 500 m (1,640.42 ft) (http://www.meteoromania.ro/anm2/?id=489).

Province of Constantza has a high population density (average population density is 95.4 inhabitants/kmq), 684,082 inhabitants, and industry and agriculture are the dominant economic activities. Constanta city has four economic and industrial zones (2 harbors, one industrial platform, one petrochemical platform) and urbanization is increasing with a growth rate of 3^0 (elaborations processed by Urbistat on ISTAT data – National Accounts and the Ministry of Economy and Finance). All this factors can negatively affect water quality.

(https.//ugeo.urbistat.com/AdminStat/en/ro/classifiche/dati-sintesi/province/sud-est/22/2).

C. Laboratory microbiological determinations

1) Sanitary tests

Bacteriological level of water and biomass pollution was determined using a specific procedural guide (Table 1.) based on classical microbiological methods as described in international standard methodology (SR EN ISO) in the Microbiology Laboratory of Natural Sciences and Agricultural Sciences Faculty of "Ovidius" University of Constanta.

Sanitary quality of wet residual biomass (fresh and dry powder) and separated by sedimentation marine water was assessed through microbial fecal contamination levels

2) Pathogenic strains isolation

Preliminary identification of unsporulated Gram negative bacilli aims taxonomic classification of isolates in Enterobacteriaceae family, with a minimum number of tests: microscopically (Nikon, 90x) observed morphological characters (usually by Gram stain method), bacterial growth in the presence or absence of O_2, bacterial growth on non-selective and selective culture media, catalase and oxidase test. Confirmation (definitive identification) involves a combination of several biochemical tests on multiple-test culture media (triple-sugar-iron TSI; mobility-indol-urea MIU; mobility-indol-lysine decarboxylase-fenil-alanil deaminase MILF) that allows correct taxonomic classification.

3) Model description and validation data sets

In this study we used a simplified 2D model for the distribution and seasonal dynamics of TC in separated from biomass marine water. To do this, we supplied the model with data on temporal variation of temperature as main possible factor driving the input of TC. The results were compared with monthly field measurements of bacteriological contamination indicators (total number of bacteria TB, total number of coliform bacteria TC, total number of faecal coliforms TFC) of mixed samples over seven months experiment period. The results are presented as the temporal changes in TC (UFC/L) concentration at all given sampling stations (mixed samples)(Fig. 1.).

Our model has a limitation because it consider only one type of waterborne coliforms (*E. coli*), gradually disappearing due to mortality and settling, without explicit interaction with suspended particles. However, it is known that fecal bacteria can be in the water column either as free floating bacteria or attached to suspended particles [3]. The free and attached bacteria are transported differently: the attached bacteria are subject to vertical processes (deposition and resuspension) while these processes are negligible for free bacteria. Indeed, Garcia-Armisen and Servais have shown that free *E. coli* were not subject to settling [1] [2]. They are also reported to be subject to different mortality rates due to the "sheltering" effect of the particles.

III. RESULTS AND DISCUSSIONS

A. Sanitary tests.

Contamination indicators (total number of bacteria TB, total number of coliform bacteria TC, total number of faecal coliforms TFC) determination. A number of 1488 of bacterial strains (CFU) were isolated and analyzed. Based on microscopically (Nikon, 90x) observed morphological characters 372 Gram negative bacterial strains (CFU), representing 25.00%, were retained. The faecal contamination indicators (total number of bacteria TB, total number of coliform bacteria TC, total number of faecal coliforms TFC)

were determined monthly over the entire period of our experiment (Table 2., Table 3.). The absence of morphological homogeneity, as evidenced by the presence of a large number of cocci and bacilli, was found. Most of the studied bacterial strains belonged to the bacillary forms. The bacillary forms had straight or rounded ends and different sizes. Most of them were sporulated, with oval, round or fusiform spores. The spores were centrally, subterminal or terminal disposed, many of them deflecting the cell. On nutritional agar, they developed weak, moderate or abundant growths in characteristic white, white-dirty, cream-whitish and rarely rust-colored forms. In the smear they had a more or less characteristic mood and Gram (+) or (-) staining. The types of the colonies were very different, from colonies with a round appearance and a smooth and glossy surface, with regular margins (type S), to flat, ruddy and non-regular (L-shaped) rosettes. Many colonies also had a mucilaginous consistency (type M). Only the bacterial strains represented by unsporulated Gram-negative bacilli were retained assuming they are enterobacteria, possible pathogens.

Table 1. Specific procedure of detection and number of bacterial species for bacteriological examination of marine water and separated biomass

Detection and number of bacterial species	Standard international method
TNCFU (Total Number Colony Forming Units)	SR EN ISO 4833-1: 2013 SR EN ISO 4833-2: 2013
Enterobacteriaceae MPN (Most Probable Number)	SR EN ISO 21528-1/20017 SR EN ISO 21528-2/20017
Faecal coliforms *E. coli* (44^{0}C)	SR EN ISO 7251-96 SR EN ISO 16649-2/2007
Shigella spp.	III. **SR EN ISO 21567:/2004**
Salmonella spp.	SR EN ISO 6579/2002/(E)
Yersinia enterocolitica	SR EN *ISO* 21567:2004
Staphylococcus aureus (*Coagulase* +)	SR EN ISO 6888-2/A1:2002
Vibrio cholerae	IV. **SR EN ISO 21872-1:2017**
Enterobacter sakazaki	ISO/TS 22964:2006
Klebsiella spp	API 20E
Proteus spp	API 20E

Table 3. Comparative microbiological characterization of the raw material and the dry powder in the residual marine biomass

Crt. Nr.	Microbiological determinations	Raw material Fresh residual marine biomass (CFU/g)	Dry-powder residual marine biomass (CFU/g)
1.	Total number of bacteria (TB)	10^5	5 x 10^3
3.	Total number of coliform bacteria (TC)	100	30
4.	*Fecal Streptococcus*	50	absent
5.	*Escherichia coli*	absent	absent
6.	*Salmonella ssp.*	absent	absent
7.	*Staphylococcous aureus*	absent	absent
9.	*Vibrio cholerae*	absent	absent

Monthly variation in the total number of bacteria TB (log_2 of the number of bacteria) in the samples analyzed between march-september 2018 displayed a minima in march and two peaks in June and September (Fig. 2), probably related to the high temperature, incresead salinity of marine water due to evaporation in summer, change in pH, excess accumulation of organic waste and overcrowding of the coast during the warm season. The model simulations of the temporal variations generally follow the dynamic trend of TC number in the water when the output data are compared with the *in situ* measurements at each of the selected stations.

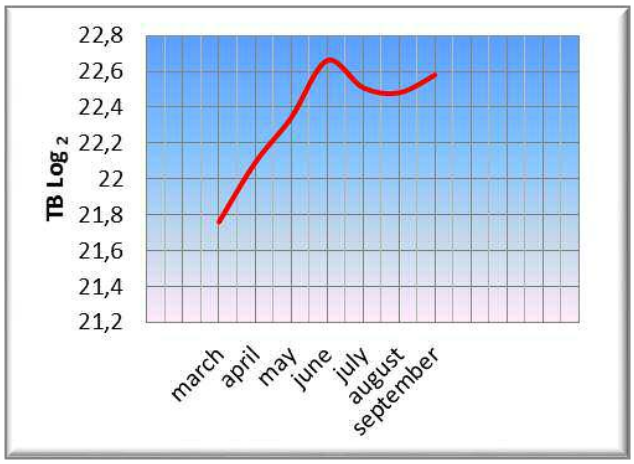


Fig.2. Monthly variation in the total number of bacteria TB (log2 of the number of bacteria) in 2018

B. Pathogenic strains isolation

Percentage of identificated genera from total number of Enterobacteriaceae (Table 4.) varied within wide limits; the smallest values have been recorded for *Yersinia* (0,64%) and the highest values were recorded for *Escherichia* (43,80%).

IV. CONCLUSIONS

1. Bacteriological *analyses* of residual marine biomass did not detect enhanced concentrations of marine xenobiotics, particulary Enterobacteriaceae (*E. coli, Salmonella ssp., Shigella ssp.*), *Vibrio cholerae*. and *Staphylococcus aureus.,* but anthropogenic bacterial pollution is present.
2. The microbial charge does not cause sanitary problems and preliminary analyses of the residual biomass anticipate a strong capacity as a potential bio resource for eco-agriculture and biocosmetics.
3. Our study is one of the few on fecal contamination of marine water in a basin that covers Romanian shore. A simplified 2D model that simulate seasonal variation of bacterial indicators of fecal contamination, compared with field data collected over a 7 months, confirms the usefulness of the model for exploring the impact of marine water in residual biomass management strategies on microbial contamination, with some limitations because it consider only one type of waterborne *E. coli* (gradually disappearing due to mortality and settling), without explicit interaction with suspended particles. Dynamic system models will be further developed to synthesize and analyse laboratory data and to produce scenarios for key business applications of this bioresource in the circular bioeconomy and biomedical field.

Table 2. Marine wastewater bacterial contamination indicators: total bacterial count TB, total coliform count TC, total faecal coliform count TFC in 2018

Month	Number of isolated colonies	Number of selected strains (Gram-negative, unsporulated bacilli)	Total number of bacteria (TB) (CFU/mL) (log_2 CFU)	Total number of coliform bacteria (TC) (CFU/L)	Total number of faecal coliform bacteria TFC (CFU/L)
march	179	45	282×10^7 (21,76)	2465	1115
april	189	47	395×10^7 (22,09)	2529	1271
may	195	49	506×10^7 (22,34)	2635	1285
june	248	62	695×10^7 (22,66)	3544	1301
july	224	56	598×10^7 (22,51)	3595	1348
august	221	55	582×10^7 (22,48)	3688	1398
september	232	58	643×10^7 (22,58)	2083	1008
SUM:	1488	372			

Table 4. Identified enterobacteriaceae genera in marine water (number of strains and percentage)

NR.	**GENERA**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**SUM**	**% from total number of isolated colonies (Gram negative bacilli)**	**% from total number of determined Enterobacteriaceae**
1.	*Escherichia*	15	17	17	22	20	21	20	205	8.80	43.80
2.	*Shigella*	-	2	-	-	1	2	1	10	0.42	2.13
3.	*Salmonella*	2	-	1	2	-	1	1	8	0.34	1.70
4.	*Citrobacter*	1	-	-	2	2	-	2	10	0.42	2.13
5.	*Klebsiella*	7	8	8	9	8	7	6	84	3.60	17.94
6.	*Enterobacter*	3	3	4	4	5	5	3	41	1.76	8.76
7.	*Hafnia*	1	2	3	1	1	1	3	19	0.81	4.05
8.	*Serratia*	2	3	2	3	3	4	3	29	1.24	6.19
9.	*Proteus*	4	3	4	5	5	4	4	43	1.84	9.18
10.	*Providencia*	-	-	2	1	-	1	2	10	0.42	2.13
11.	*Morganella*	2	-	-	1	-	-	1	6	0.25	1.28
12.	*Yersinia*	-	-	1	1	-	1	-	3	0.12	0.64
Enterobacteriacee:		37	38	42	51	45	47	45	296		
Unsporulated Gram negative bacilli:		45	47	49	62	56	55	58	372		

ACKNOWLEDGEMENT

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Low-Cost System to Acquire Environmental Parameters in Urban Areas in the Context of IoT

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Abstract: Over the past few years, we have seen the development of mid-range wireless technologies such as Wi-Fi, Bluetooth, LoRa, ZigBee, which are increasingly used in the Internet of Things related development domains. The project proposes to develop a system that can be universally used at any level to monitor the parameters in a given environment. Using Dragino LoRa shield, a cheap development board, sensors will collect all the real-time data from the environment and these real-time data will be taken over by the web server and displayed. The user can access this data as graphs using the ThingsSpeak service from anywhere via the Internet. Dragino LoRa shield works as a motherboard that connects the number of nodes defined by the LoRa protocol sensors. The Wireless Sensor Networks (WSN) protocol will be used to collect environmental data in various applications such as monitoring an enclosure or monitoring environmental parameters in a city in road traffic. The Internet of Things (IoT) can be described as a protocol that connects everyday objects such as smart phones, smart TVs, sensors and Internet drives, so the devices are connected intelligently and independently, allowing us forms of communication between things and people as well as between things themselves.

Keywords: environmental monitoring, smart cities, LoRa, IoT.

INTRODUCTION

The need for wireless protocols has increased exponentially in the last decade, as current technologies allow the use of a very large number of monitoring and control devices on a relatively small surface. By using a standard interconnection mode, with the help of wires, whether we are talking about copper wires or fiber optics, there is a very high clutter of workspace, which can lead to various problems: of technical nature, by the occurrence of diaphragms between very close or human cables, which may cause confusion between the cables to be connected to a certain pin / interface / port at a certain point in time time to perform a certain functionality. Although wireless solutions have been explored since the beginning of personal computers, only in the recent past has been emphasized their use in a large number of situations, due to the need to solve the above problems. The number of applications that wireless protocols have found or can find applicability is quite large. It has grown quite a lot lately since it has been sought to optimize the wireless environment usage parameters: transmission speed, channel interference limitation, packet size, etc. Even if the performance of the twisted-pair, coaxial or fiber-optic cables is never likely to be, the wireless solutions are intended to be a viable alternative to medium-distance communications without creating any inconvenience to the user. From a practical point of view, the implementation of the presented paper aims at highlighting the superiority of the LoRa protocol in various circumstances and also demonstrating that it is an ideal candidate for implementation in Internet of Things technologies. The goal the end of the paper is to get more systems that can easily integrate into a home that adopts Internet of Things technology to drive the concept of "smart cities."[1]

INTERNET OF THINGS (IoT)

The Internet of Things (IoT) is a concept that defines a world where all objects (cars, home appliances, lighting, mobile devices, portable devices, etc.) are connected to each other via the Internet.[2] The Internet of Things is not just based on computers to exist. Every object, even the human body, can become a part of the Internet of things if it is equipped with certain electronic components. These parts will certainly vary depending on what they have to do, but they fall into two major categories:

- the object must be able to capture data, usually through sensors.
- the object must be able to transmit this data elsewhere via the Internet.

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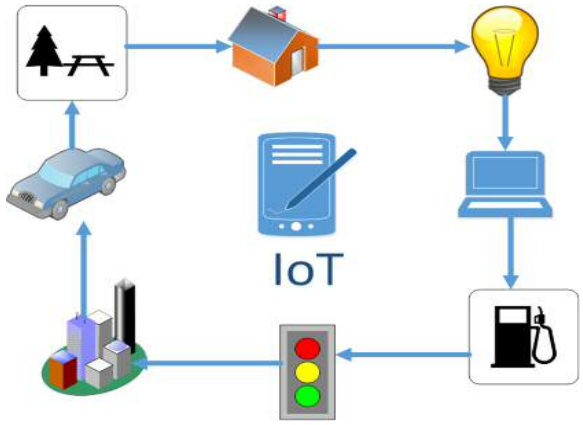

Fig. 1. General scheme of IoT

A sensor and a connection, therefore, are the two primary electronic parts of an object included in the Internet of Things. According to some industry analysis, in 2015 there were between 10 and 20 billion objects connected to the Internet. This linked object ecosystem forms the foundation of the Internet of Things. The number of connected objects in 2015 was small compared to how many will be connected in 2020. Estimates vary, but it is generally predicted that the number of objects connected by 2020 will be 40-50 billion including everything, from pens to dwellings, machinery and industrial equipment.[3]

LoRa Technology

The term LoRa (or LoRa technology) refers to a category of high-power (low power) long range radio communications. Unlike conventional digital radio transmission technologies, LoRa technologies have the capability of communicating data over miles of miles or even tens of kilometers, with extraordinary applicability in wireless sensor networks, the Internet of Things (IoT), and networking of smart devices. Behind the term LoRa is actually a multitude of proprietary or open technologies, similar to functionality but totally incompatible as implementation - the field of long distance radio communications is currently in a pioneering phase in which standardization stability and technological interconnection methods are a far-reaching goal. Other terms used to refer to high-bandwidth digital radio networks are LoRaWAN (Low Range Power Network), LPWAN (Low Power Wide Area Network), Low Power Network (LPN). Some of these terms are registered as brands belonging to certain companies or consortia being used to identify a particular LoRa technology (even the term LoRa is a registered trademark of Semtech).[4]

LoRaWAN is a radio transmission protocol that creates smart object networks. The network consists of a star-of-stars topology, with gateways serving as transparent bridges that transmit messages between sensors and the central server. Gateways connect to the network via traditional IP bundles and sensor devices use single hop wireless communication to one or more gateways. The structure is similar to a mobile network, but instead of having a single interconnected network, LoRa allows the deployment of more independent networks over the same infrastructure like is shown in Fig. 2. Thus, the LoRa infrastructure allows 4 gateways to cover a very large area.[5]

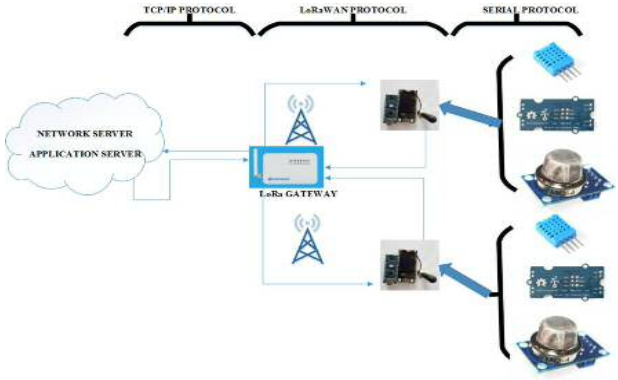

Fig. 2. LoRaWAN architecture

A generic architecture of a LoRaWAN network (Fig. 2) is composed of:

- Nodes: Represents the elements of the LoRa network that monitors and controls the given infrastructure (parking sensors, smart meters, lightning telegrams, etc.). They are usually located remotely.

- LoRa Gateway: It is the gateway through which it receives the data from the nodes through the LoRaWAN protocol and then transfers it over the Internet to the network server. The connection to the LoRa network server can be Ethernet, cellular or any other wired or wireless telecommunications connections that provide Internet connection. Base stations are connected to the network server using standard IP connections. In this way, the data uses a standard protocol that can be connected to any telecommunication network, whether public or private. Given the similarity of a LoRa network with a mobile telephony network, the LoRa base stations can often be co-located with a cellular base station. In this way, we can use the spare capacity of the cellular station for data transmission to the network server.[4][5][6]

- Network server: The LoRa network server manages the network. The network server acts to remove duplicate packets, recognition programs, and control the data transmission speed. Given the way it can be deployed and connected, the complexity of implementing a LoRa network is very low.

- Application server: Applications from the application server can access applications that consume data from nodes and display them in such a way as to provide the most relevant information for the client. Moreover, LoRa allows for bi-directional communication between nodes and the network server, remote commands can be sent to nodes, these commands can be node management (remote software update) but also control of some elements from a system (eg closing / opening a remote door).[4][5][6]

EXPERIMENTAL STUDY

In this paper, a cheap solution will be presented (as an example the acquisition of temperature and humidity of the environment) with IoT reporting through LoRa. The proposed solution is a simple one and addresses a very current problem: remote monitoring of environmental parameters in urban areas where we have internet infrastructure or GSM infrastructure in the context of smart grids, the basis of smart cities. In addition to temperature and humidity, other soil parameters can also be acquired (intelligent farming applications) or proximity and integrity (security applications) acquisition. An increasingly common problem in large cities is the pollution problem due to intense traffic and road jams. In the context of smart city, several solutions have been implemented to monitor the parameters of pollutants in the middle of large urban agglomerations. Following the example of temperature and humidity monitoring in an environment, an inexpensive system can be implemented to monitor the values of road traffic noise in large cities, especially in the busiest hourly ranges, so it can be created an interactive map city's main polluted areas. Thus is possible to find viable and long-lasting solutions to reduce the amount of pollutants on citizens.[7]

For this IoT system, an Arduino Uno development board, a Dragino gateway and a Dragino LoRa shield equipped with a 868MHz LoRa radio module will be used, like is shown in Fig. 3. [8]

For the acquisition side we will exemplify the temperature measurement using a brick sensor (DHT11) connected to the development board.

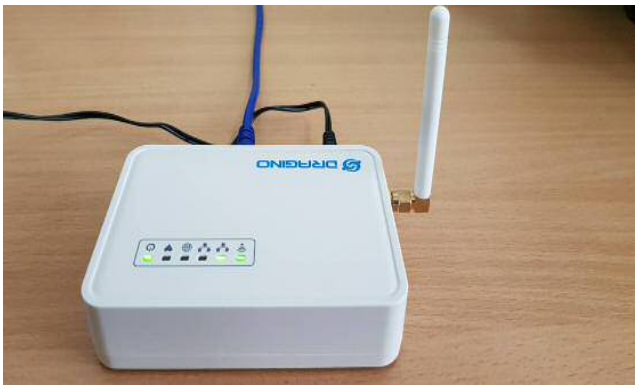

Fig. 3. Dragino LoRa shield

DHT11 is a humidity and temperature sensor. The temperature is measured with a thermistor and the relative humidity is measured using a capacitive sensor. These elements are pre-calibrated and the output is provided as an analog signal. This sensor is compatible with the most popular development boards, such as Arduino. The DHT11 temperature and humidity sensor is very convenient, providing good precision, simplicity in use, and small size at a low price. The sensor can measure humidity in the range of 20% - 90% with a precision of 5% and a temperature in the range of 0 - 50 ° C with an accuracy of 2 ° C.

In order to build and test the system, Arduino IDE 1.8.1 was installed with the Dragino Yun extension installed as well as LoRa specific libraries and the DHT11 sensor was connected to the Dragino shield like is shown in Fig. 4.

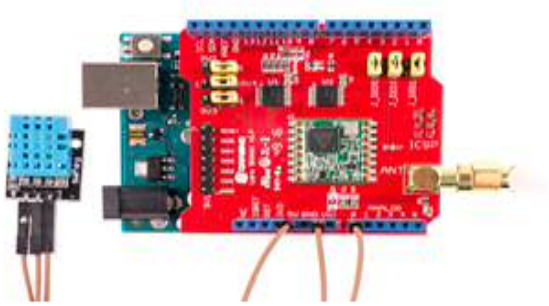

Fig. 4. DHT11 connection to the Dragino shield - top view

The system will report the acquired values (temperature and humidity) to the IoT ThingSpeak service as well as the voltage of the battery that feeds the system. The loop () section of the Arduino program implements both the acquisition part and the network transmission through the LoRa communication protocol. The value of the key parameter to be obtained from the free registration on the ThingSpeak site must be customized within the code. Acquisition and reporting are performed at a changeable interval, in the inactivity range, both the LoRa module and the 32u4 microcontroller are in low consumption mode.

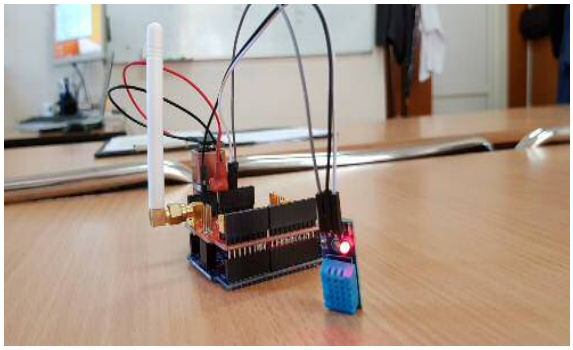

Fig. 5. The DHT11 sensor connected to the LoRa shield

Our system is a typical IoT system that uses the ThingSpeak online platform. Use of the platform requires registration, but this is free.

The ThingSpeak platform is one of the most popular IoT platforms that offers storage, processing and data viewing. One of the major advantages of the platform is the ability to run programs written in Matlab.

After recording, a new Channel Record (My Channels / New Channel) will be defined. Defining the channel will also generate the Write API Key that should be used in the program. Once the system is powered up, it will also be possible to see the data sent by the device (the PrivateView section, Fig. 6).

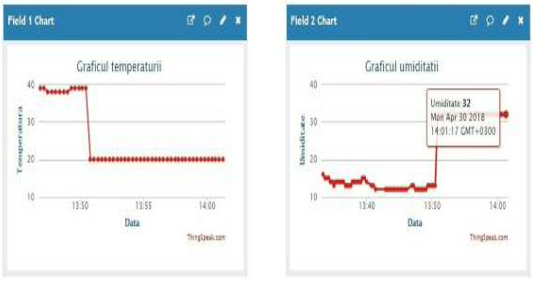

Fig. 6. The temperature and humidity graphs viewed in ThingSpeak

Fig. 7 shows a graph showing the voltage from the battery used to power up the data acquisition and transmission system. Acquisition the voltage value is done using an analog input of the board after a voltage divider has been made to limit the voltage applied to the input.

Fig. 7. Battery voltage chart viewed in ThingSpeak

Also with the help of the IoT ThingSpeak service, we also created a program that sends commands to shut down or open a relay that can trigger lighting in an enclosure.

As a result of the tests carried out in the testing laboratories at the University of Petrosani, it was possible to establish that the maximum distance to which end-node devices can communicate with the gateway device is more than 250 m, taking into account the internal infrastructure of the building and the density specific to the urban area. This value can be greatly improved if you choose to change the original communications antennas of the system with some compatible but higher gain.

Following the implementation example described above can acquire the values of harmful gases from urban environments resulting from heavy vehicle traffic using MQ sensors but for greater accuracy of data that can be taken from the environment, a MiCS-6814 sensor can also be used. The MiCS-6814 is a robust MEMS sensor for the detection of pollution from automobile exhausts and for agricultural/industrial odors [9].

This multichannel gas sensor is a environment detecting sensor which can detect many unhealthful gases, and three gases can be measured simultaneously due to its three channels, so it can help to monitor the concentration which more than one gas.

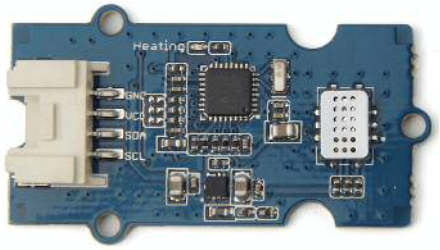

Fig. 8. MiCS-6814 sensor

This sensor is belong to Grove system, and you can plug it onto the base shield and work with Arduino directly without any jumper wires. The interface of it is I2C, so we plug it onto the I2C port of base shield, then we can start to work it.

Features:

- three fully independent sensing elements on one package
- built with ATmega168PA
- I2C interface with programmable address
- heating power can be shut down for low power
- detectable gases: carbon monoxide (CO) , nitrogen dioxide (NO2) , hydrogen (H2) , ammonia (NH3) , methane (CH4)

The silicon gas sensor structure consists of an accurately micro machined diaphragm with an embedded heating resistor and the sensing layer on top. The MiCS-6814 includes three sensor chips with independent heaters and sensitive layers. One sensor chip detects oxidising gases (OX), the other sensor detects reducing gases (RED) and the other detects NH3. The minimum and maximum values (parts per million - ppm) of all gases that can be detected by the sensor are shown in Table I.

Table I. Detectable gases

Detectable gases		
Carbon monoxide	CO	1-1000ppm
Nitrogen dioxide	NO_2	0.05-10ppm
Ethanol	C_2H_5OH	10-500ppm
Hydrogen	H_2	1-1000ppm
Ammonia	NH_3	1-500ppm
Methane	CH_4	>1000ppm
Propane	C_3H_8	>1000ppm
Iso-butane	C_4H_{10}	>1000ppm

It is recommended to take into account the following recommendations before using the MiCS-6814 to avoid erroneous readings and to prevent the device from permanent damage:

•The sensor must be reflow soldered in a neutral atmosphere, without soldering flux vapours.

•The sensor must not be exposed to high concentrations of organic solvents, silicone vapours or cigarette smoke in order to avoid poisoning the sensitive layer.

•Heater voltage above the specified maximum rating will destroy the sensor due to overheating.

•This sensor is to be placed in a filtered package that protects it against water and dust projections.

The technical specifications include the following:

- Voltage: 3.1~ 5.25V
- Max Heating Power: 88mW
- Max Power: 150mW
- ADC Precision : 10Bits
- I2C Rate: 100kHz

The main feature that recommends using this type of sensor although it has a higher price is that it can measure the values of three different types of gases with three channels that can be accessed independently.

As main results of this paper, we can outline the aspects regarding the functioning and testing of the LoRa network as well as the experimental implementation of a system based on the IoT principle that can monitor the quality of the environment in an urban agglomeration. LoRa is a long-range telecommunication and low-power telecommunication system for the "Internet of Things". The physical layer of the entire system uses the LoRa module, a proprietary technology with a MAC protocol. LoRaWAN is an open standard with the specifications available for free. This paper provides an analysis of the bidirectional operation of the LoRa protocol on an experimental platform specifically designed to study the performance of the network, documented in this paper. The results obtained during the preparation of this paper show that LoRa modulation, due to modulation of spectrum dispersion and high sensitivity of the receiver, offers good interference resistance. Field trials demonstrate that LoRa can provide satisfactory network coverage of up to 3 km on a network in a suburban area with not very dense residential dwellings. LoRa is therefore suitable for low power, low speed and long range. The experimental results also show that the protocol is reliable and very simple to implement. Also after validating the LoRa network, the data from different sensors that can measure different environmental parameters in the context of urban road traffic were validated. Starting from a simple implementation of a DHT11 sensor that can take on the temperature and humidity of the environment, an experimental system has been created that can take and transmit data of various pollutants in graphical form. For this purpose, the IoT ThingSpeak online service was used.

PROPOSAL FOR FURTHER DEVELOPMENT

For further development, it is proposed to modify and optimize an application created in LabView that currently displays only data of weather conditions in a city, as shown in the Fig. . It is proposed to integrate the system outlined above in the paper to be able to display data on the quality of the environment regarding the values of the pollutants in an urban agglomeration.

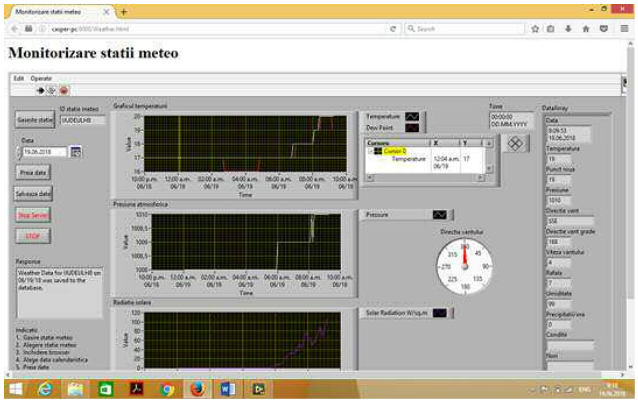

Fig. 9. The current LabView application accessed through a browser

The current LabView meteorological data application can be accessed through an internet browser from anywhere in the world using a public IP address. Fig. 10 presents the general scheme of the proposal for further development of the entire monitoring system.

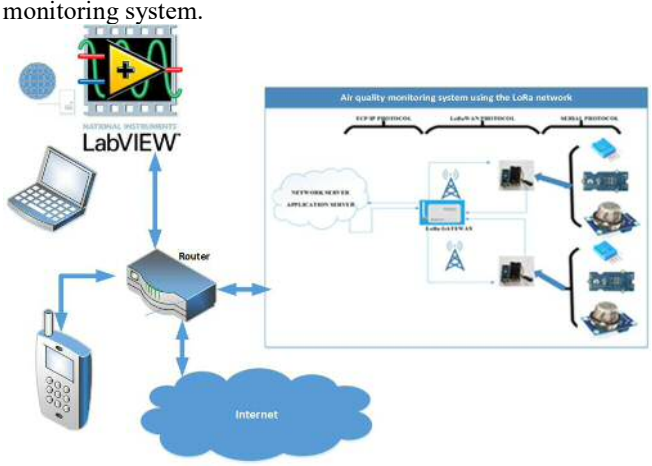

Fig. 10. General scheme of the proposal for further development

Thus, starting from the air quality monitoring system and meteorological monitoring application, the entire system will be adapted to allow the LabView application and data on environmental pollutants to be displayed. The LabView monitoring application can be accessed from anywhere in the world, from a laptop or smartphone, using a router configured and connected to the internet.

CONCLUSION

The use of the Lora network and an IoT online service makes it extremely easy to implement a pollutant monitoring system in an urban environment in the context of traffic congestion. With minimal material resources, it is possible to monitor air quality online in certain areas of an urban agglomeration. All of these data taken and displayed as graphics could be a starting point in an attempt to develop sustainable solutions in the context of smart cities to reduce pollution. The data obtained with the sensors presented in this paper were validated by effective comparison with the data obtained using specially designed systems for this purpose and at a relatively much higher cost. It can be stated with certainty

that a low-cost system can also be used to monitor environmental factors in a city affected mainly by the increasing number of motor vehicles. Against the background of recent developments in smart grid and smart city concepts, there is a growing need to create environmental monitoring systems to create a general framework for sustainable development. It highlights the necessity to develop low-cost systems in an attempt to make comparative environmental quality studies in order to reduce pollution especially in large urban agglomerations starting from the city of Petrosani where in the last years there is an increase in the of the number of vehicles crossing the entire city. Although in recent years there has been a sharp decline in industrial pollution due to the closure of many manufacturing companies, there has been a sharp increase in pollution from the emissions from the large number of vehicles that are often very old and no longer agree on emission standards polluting.

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Facing the challenge of developing mariculture at the Romanian Black Sea: Shellfish Aquaculture Demonstrative Center

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Abstract: Since 2012, at the first meeting of the GFCM Black Sea Working Group (WGBS), it was concluded that mariculture is a development priority for the Black Sea region. The main features identified, namely a heterogeneous development in the various regions of the Black Sea (Turkey vs. Bulgaria vs. Romania), constraints related to environmental factors (climate, salinity, exposed coastline, no sheltered areas), difficulties in integrating mariculture with other uses of the marine and coastal environment (transport, tourism etc.), the need to implement an appropriate legislative framework with clear certification procedures for marine aquaculture products, all call for immediate attention and focused research.

Keywords: mariculture, shellfish, technologies, legislation, training

BACKGROUND

Mussel culture has been known since the last century. The development of technologies based on scientific observations was possible only a short time after advancing the knowledge of the physiology and ecology of mollusks [1].

Due to their undeniable culinary qualities and the high content of biochemical compounds with nutritional value (amino acids, vitamins, enzymes, proteins, carbohydrates), many species of mollusks are industrially harvested or grown in specialized aquaculture farms [2]. The world production of bivalves has increased over the last 50 years, from 0.9 million tons in 1950 to over 22 million tons in 2010. The increase is largely due to the share of aquaculture, which grew rapidly in the 1990s. World production of farmed bivalves increased from 3.3 million tons in 1990 to nearly 20 million tons in 2010, with an annual average increase of 11% [3].

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In Romania, bivalves are not considered a common food, but in the last decade there has been a slight increase in the consumption of mussels and oysters in public nutrition.

The increase in the demand for bivalves for food consumption in recent years has encouraged the harvesting of mussels from natural populations, growing mussels on floating installations (long-line systems) and acclimatization of high-value bivalves - the Japanese oyster, for instance [4].

The annual quantitty of mussels harvested in the Romanian Black Sea coast area amounts to approx. 15 tons (estimated value), and the only existing mariculture farm, S.C. MARICULTURA S.R.L., can produce annually approx. 5 tons of cultured mussels [4].

In some countries bordering the Black Sea, mussel culture is relatively well represented, having an obvious increasing development over the last two decades; for example, Ukraine produces about 400 tons per year, while Bulgaria is approaching 4,000 t/year [4]. However, given that mussel culture is little developed in Romania, the promotion of scientific, technical and technological bases for this activity is absolutely necessary.

MATERIAL AND METHODS

At the Meeting on the Establishment of a Demonstrative Center for the Promotion of Sustainable Aquaculture in the Black Sea, 27-28 September, 2017, Constanta, Romania, it was decided:

- NIMRD "Grigore Antipa" will host and coordinate a demonstration production module for the cultivation of mussels (*Mytilus galloprovincialis*): Shellfish Aquaculture Demonstrative Center (S-ADC);
- CFRI Trabzon, Turkey, will host and coordinate a Demonstrative Module of Growth and Repeated Breeding of turbot (*Psetta maxima*) and trout (*Salmo trutta labrax*): Finfish Aquaculture Demonstrative Center (F-ADC);

The arguments for selecting NIMRD to host the S-ADC were the following:

- NIMRD has specific responsibilities and extensive experience in the development of studies in the field of Black Sea Living Resources, as well as data reporting to regional bodies (Black Sea Commission) and international (GFCM, FAO, JRC/DG-MARE, MEDIAS, MEDITS, ICES) [5];
- NIMRD hosts the National Oceanographic and Environmental Data Center (RNOEDC) [5];
- NIMRD has National Scientific Responsibility for the General Fisheries Commission for the Mediterranean (GFCM), coordinated by the Black Sea Working Group (WGSB) (Dr. Eng. Simion Nicolaev) [5];
- NIMRD coordinates and hosts the Regional Activity Center for Fisheries Environment and Other Marine Living Resources Management, as well as other National Focal Points within the Black Sea Commission [5];
- National scientific responsibilities for the collection of fisheries data and the assessment of living marine resources (in accordance with GD No 253/2015) and for the implementation of the Marine Strategy Framework Directive (MSFD) [5];
- NIMRD hosts and ensures the functioning of the Training Centers for the Environment and Fisheries professions [5];
- NIMRD has qualified staff, an extensive experience in marine aquaculture and infrastructure [6, 7, 8].

RESULTS

Shellfish Aquaculture Demonstrative Center in Constanta (S-ADC)

The S-ADC is a part of the well-established research facilities of the National Institute for Marine Research & Development "Grigore Antipa" (NIMRD), Constanta, Romania. NIMRD has semi-pilot scale production installations (with potential for expansion in the future) and takes advantage of existing infrastructures and expertise to share knowledge and to improve cooperation. It meets the establishment criteria about the nature and functions of the S-ADC as recommended during the WGB Constanta Meeting (2017) [9]:

1) It is a regional hub able to respond to Black Sea countries' needs & expectations for aquaculture development;
2) Raising awareness at every level on the aquaculture potential, among others, in terms of economic opportunity for coastal communities, source of sustainable seafood & contribution to the conservation of ecological services provided;
3) Useful tool for local and national administration to assess new aquaculture projects proposals;
4) Cooperative approach and knowledge sharing of best farming practices;
5) Attract the interest of the private sector to invest on aquaculture activities instrument whose results should offer further employment opportunities;
6) Be pivotal to launch aquaculture pilot projects in specific areas of the Black Sea;
7) Follow an ad hoc, integrated & holistic approach, focus on the Black Sea region;
8) Consider the different level of national aquaculture development & requirements;
9) Take into the account the diverse ecological & environmental conditions in the Black Sea area;
10) Build upon the various expertise/disciplines available in the Black Sea riparian countries.

The demonstration production module for mussel culture is based on the long-line technology and has 2 components:

- long-line system on sea floats and boats (Fig. 1);
- shore facilities (analytical laboratories and purification system).

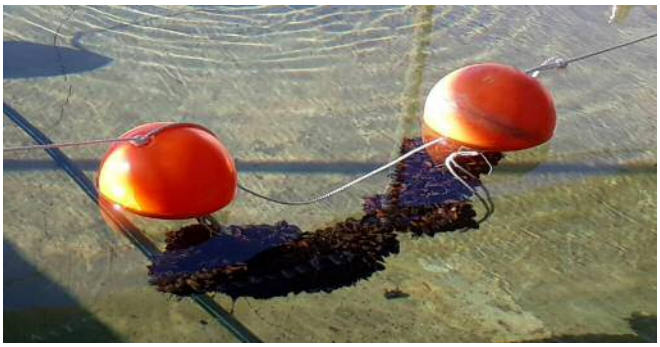

Fig. 1. Long-line system suitable for Black Sea mussel culture.

The demonstration module for mussel production forms the basis of training activities in the field of mussel culture and covers all aspects of the production cycle:

- Biology and ecology of *M. galloprovincialis*;
- Providing brood and collecting larvae from the natural environment;
- Design and construction of the long-line system;
- Mussel growth and handling technologies;
- Mussel processing and purification technologies;
- Production management systems (production costs, market analysis);
- Training in methodological and practical aspects of the sanitary-veterinary classification of mollusks for domestic consumption / export.

The target groups and beneficiaries of the S-ADC activities are:

1) national and local management authorities/administration involved in aquaculture planning, management, sanitary control;
2) private sector, especially the small-scale producers with limited investment capacity, potential & existing investors, small farmers including coastal fishers;
3) public institutions & other organizations (e.g. NGOs) to increase their awareness on the relevance of aquaculture in particular for its potentiality;
4) scientific existing networks which could benefit from specific aquaculture training courses national & international R&D organizations dealing with aquaculture existing & future

partnerships between fisheries actors & other local private & public stakeholders.

The S-ADC working methods are the following:

- Modules to provide hands-on practical experience & facilitate technology transfer;
- Showcase different shellfish aquaculture production technologies, well-established systems, species & technology that have proven to reduce investment risks;
- Training programs, seminars, & ad hoc visits, based on end-user needs;
- Production demonstrative/didactic material;
- Linkages and synergies with existing Black Sea aquaculture research facilities and farms.

S-ADC Training Course on Mussel Culture
17-28 September 2018, Constanta, Romania

The first short term activity of the S-ADC was the "Demonstrative Training on Mussel Farming", carried-out between 17-28 September 2018 in Constanta, Romania, involving trainees from Bulgaria, Georgia, Turkey, Ukraine and Romania, from research organizations, authorities and the business sector. Representatives from the sanitary-veterinary authorities also attended and were engaged in discussion regarding certifications aspects of shellfish waters. The aim of the training was to enhance the theoretical and practical knowledge, focusing on legal and administrative issues [10].

Fig. 2. Training visit at the shellfish packing plant during the S-ADC Training Course on Mussel Culture, 17-28 September 2018, Constanta, Romania.

The training was made by including 5 modules and their related theory and practical classes, involving:

i) mussel biology (e.g. theory: life cycle, growth and reproduction, practical: anatomy and filtration rate estimation);

ii) culture systems (e.g. theory: system installation, on-growing techniques, production planning and farm development, practical: farm visits and related practical experience);

iii) legislation-licensing (e.g. EU legislative Hygiene Directive (EC) No. 492/91, the classification of the production areas Directive 91/492/EEC) [11, 12];

iv) monitoring services (e.g. theory: microbiology, algal blooms, establish bivalve zones, practical: water sampling, *E. coli* estimation, toxic algae identification and production capacity estimation);

v) post harvesting technology and quality management (e.g. theory: EU seafood legislation, depuration tanks design, storage, distribution, expedition and quality management of shellfish products, practical: depuration operation, design and operation of the shellfish product chain, Hazard Analysis of Critical Control Points - HACCP - development).

The practical hands-on part of the module focused on shellfish packing/processing plant visit in order the participants to be familiar with the shellfish factory plant specifications, work flow of the raw shellfish material from the harvesting up to dispatch for further processing distribution, HACCP plan operation and new shellfish product forms/packing developments and marketing needs (Fig. 2).

Fig. 3. Graduates of the S-ADC Training Course on Mussel Culture, 17-28 September 2018, Constanta, Romania.

The training concluded with the awarding of graduation certificates (Fig. 3). Future training organized in the frame of the S-ADC will focus on developing the skills of potential investors and people working in the shellfish culture around the Black Sea, aiming at transferring the know-how into the market.

CONCLUSION

The first S-ADC course focused on the holistic approach of the steps to establish the sector. It was focused to bring together people from different levels of the decision making in order to fill the gap between them so as to support the sector development from the "farm to the fork" of the consumer. The industry development has multi-scale and multidimensional levels, as a socio-ecological system depending on the captured-based approach of aquaculture.

The next step is from the holistic approach to focus on a certain module development, targeting on techniques and skills to support essential principles for Allocated Zones for Aquaculture (AZA) Development. In order to achieve this target, a review of the existing tools for AZA could be used in conjunction with shellfish zone specifications. Training on the monitoring sampling protocols, as well as on the tools for AZA will be carried out.

Similar interest for the further development of the post-harvesting shellfish quality management systems could be referred on the mussel depuration demonstration, as well as on the exploitation and handling of the *Rapana sp*., another high value shell-fisheries product in Black Sea.

ACKNOWLEDGMENT

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Pollutants Emissions Indicator Regarding Electrical Power Supply

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Abstract: Currently, the main part of the energy used by population on a global level is obtained on the basis of burning fossil fuels. They represent a finite resource and governments should be concerned to move to other energy types, especially to renewable energies when it is the discussion regarding electrical power supply. Due to constant development of daily human activities based on large energy consumption, pollutants emissions, especially CO_2 emissions, but also NO_x and SO_2 emissions, are increasing faster than it has been firstly assumed. Emerging industrial activities implies that the concern over negative environmental impacts grows as well. There are several methods and tools used for environmental impact assessment, a pretty used and interesting one being the method based on calculating the environmental footprint of different products or processes. The environmental footprint actually measures pollutants emissions because of resources demand based on diverse consumption processes taking place in production processes and in our daily life. Although renewable energy resources provide substantial benefits for our climate, health and economy, there are nowadays many debates regarding potential environmental impacts of the technologies used for transforming renewable energy resources in electric and thermal energy necessary for our daily activities. Pollutants emissions in the whole life cycle of renewable energies will be emphasized and compared to pollutants emissions when using fossil fuels. The environmental footprint of using renewable energies will be debated by establishing corresponding pollutants emissions. Each Earth resource has its own environmental footprint, the vision should be to use the Earth resources having the smallest environmental footprint so that finally the undesired environmental impact should be as low as possible.

Keywords: renewable energy sources, environmental footprint, life cycle assessment, environmental assessment

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INTRODUCTION

Technological and socio – economic advance registered in the last decades on global level has emphasized on the one side the ability of humanity to use technological applications for increasing its quality of life but on the other side the status of the finite nature of almost all Earth's natural resources, as emphasized already in the '70n years by the Club of Rome [7]. It is known that by producing and making available products and services more or less necessary for our human life, these activities are in almost all of the cases accompanied by negative impact on environment and recently also on society [10]. On the one side, pollutant emissions due to various economic activities are rapidly growing, and on the other side, most of the energy required in mankind everyday life is currently mostly obtained on the basis of fossil fuels combustion in power plants [5]. It is more than clear that our everyday life needs energy resources, which are non-renewable and renewable ones. Regarding non-renewable energy resources, although energy supply systems on their base are nowadays pretty well developed and worldwide used, the big challenge is the fact that these resources are limited ones [5, 10]. Renewable energy resources appear currently to be the best solution in the given situation, due to the fact that the energy resources and their use are inexhaustible, being available for usage on almost every place on the Earth, and they also have a minimum impact on the environment [6, 8].

REMARKS ABOUT SUSTAINBLE ENERGY SUPPLY

Beside technical aspects, environmental and socio-economic aspects play simultaneously an important role in assuring the sustainability of our human society [2, 5, 9]. Assuring sustainable development of our human society means actually getting sustainability on a global level by establishing appropriate frameworks for shaping sustainable cities and by this for shaping sustainable regions as well [1, 9]. As it was already mentioned debates related to humanity development have started for more than a half of a century and the most stringent discussions have had at their base the concern regarding assuring the energy supply needed by the evolving world population [5, 7]. Developments on scientific side related to ones on technological and social side have pointed out that trends on global level without taking account potential environmental and social impacts would hardly

impact human society. In this regard dialogue on scientific and political level was stringent needed in order to find a pretty soft solution to the challenges humanity has been facing [4].

Worldwide began discussions on scientific, political and social levels in order to find corresponding solutions for the problems shown above, which could be applicable to several countries, with respect to regional differences. The concept of sustainable development was defined for the first time in the Brundtland Report [4] was accepted as a possible solution for the global complex environmental, economic and social problems. This concept was very large discussed in 1992, during the Conference for Environment and Development in Rio de Janeiro known as the ”Rio Conference” and it stated in the closing document ”Agenda 21“[10]. Connected challenges have been debated during the ”Rio + 10” – Conference held in Johannesburg, as well as during the ”Rio + 20” – Conference held again in Rio de Janeiro. A pretty discussed issue was related to the fact that made experiences in last time are demonstrating that there is actually a need to firstly shape local sustainability models in the form of sustainable cities and regions. Only thereafter it could be possible to debate frameworks for shaping sustainable national models by taking into consideration also the cultural perspective, often existing relevant cultural differences among different societies [1, 9].

Many actions and events carried out in the meantime have emphasized that the evolution of technical, social and environmental systems has to be analysed in synergetic relation, in order to succeed the successful operationalization of sustainable development on different levels, on global, national, regional as well as on a local level [5, 10]. The goal was and still is to find the best strategies for assuring the sustainability of our society, by taking into account the multitude of aspects related to the technological part, economic and social activities [1, 2, 5]. At this point should be stated that assuring the sustainability of our human society means developing and applying proper sustainable development strategies on different levels, i.e. on national, regional as well as on local level. Gaining strategies on regional or local level means actually developing strategies for the urban sustainability in diverse regions and cities. The vision of having in the future *sustainable cities*, by taking into account regional differences, is worldwide a pretty discussed topic, also in some Eastern European countries, where the issue of assuring a reliable electrical and thermal energy supply is a dominant one regarding technical aspects when applying sustainability concept, as presented in Figure 1 [2, 9].

Renewable energy resources need special attention in the context of different aspects from technical field in connection with the social one. In order to succeed in assuring global and regional sustainability, the field of renewable energy supply systems becomes pretty relevant because of the need to apply sustainable energy supply systems [1, 6, 8]. Humanity should always have as a goal finding an equilibrium state between technological progress, which assured in the past the desire of humanity to increase its quality of life and environmental protection. Developments in the last century have however emphasized that beside wanted effects of technological progress, undesired, even unthinkable negative effects can appear [5, 10]. Currently humanity is facing global problems, not only environmental ones, but also social ones, their complexity basing on interconnectedness and on fast changes taken place in technological field, as shown in Figure 1 [5].

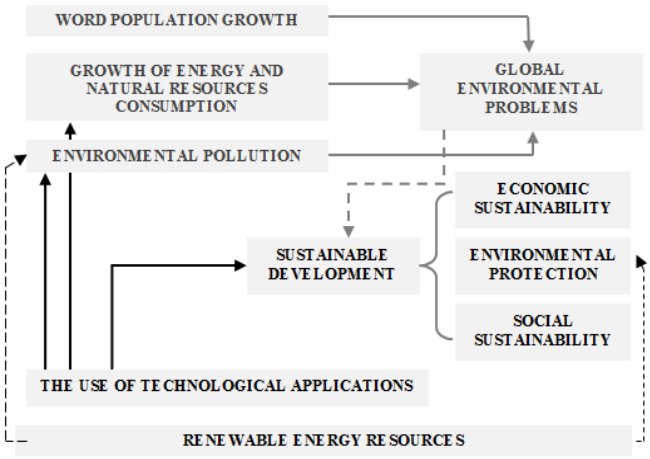

Fig. 1. Technological applications for assuring sustainable development as response to global problems.

ENVIRONMENTAL ASSESSMENT BY USING LIFE CYCLE ASSESSMENT

The issue regarding potential environmental impacts of energy supply systems is currently worldwide debated by pointing particularly out the existing fact regarding the usage of renewable energy systems in comparison to the non-renewable ones [6]. The need of using certain specific methods is pointed out in order to carry out a comprehensive environmental assessment of renewable energy supply systems [6, 8]. In this regard, in order to carry out a holistic environmental assessment the method based on environmental footprint will be applied [8, 10]. The establishing way of the environmental footprint of using renewable energy systems is presented.

Concretely the usage of a photovoltaic panel system is presented by approaching existing phases. To make a complete presentation firstly the general life cycle of a photo-

voltaic system is given, as shown in Figure 2. In this way it is possible to calculate the corresponding pollutant emissions in comparison to a fossil fuel based system [9, p. 35].

For carrying out environmental assessment of renewable energy supply systems, here of photovoltaic systems, its general life cycle has to be considered, as emphasized in Figure 2.

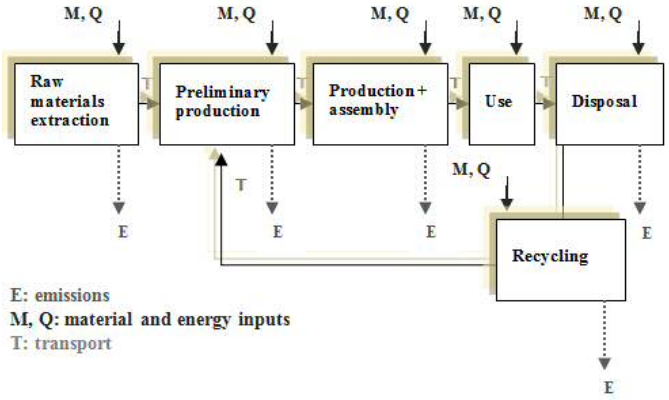

Fig. 2. General Life Cycle of a Photovoltaic System.

A specific remark for photovoltaic systems is the fact that a photovoltaic panel does not contribute to environmental pollution during its usage phase, when it is producing electric energy because it is not producing at all pollutants emissions [8, p. 36]. On the other hand, the following phases: the raw materials extraction, the preliminary production and the production and assembly have a significant contribution to environmental pollution and have to be specifically considered [8, p. 36].

CASE STUDY REGARDING ENVIRONMENTAL ASSESSMENT oF ELETRICAL POWER SUPPLY

The presented case study consists in a public educational institution from Alba Iulia city, which is connected to the national electricity supply network in order to cover its own electricity demand.

In order to have a comparative analysis of the environmental pollution by considering pollutant emissions of the electricity production, there are considered two cases:

- the one is the real situation, namely the usage of fossil fuels for the production of electricity in power stations delivered in the national energy system, to which the considered institution is connected;
- the second case is the case of using renewable energy through photovoltaic panels.

In both cases the environmental pollution will be assessed by calculating air pollutants emissions.

The annual consumption related to electrical energy of the institution is 660420 kWh [11]. The needed electrical energy is covered from the national energy supply system. Furthermore it is considered that this electrical energy is covered about 65% of the fossil fuel based thermal power plants, whose efficiency is about 46% [2]. Having these data the thermal power required to produce the corresponding electricity in the heat generators can be calculated. Finally, the coal mass entering the combustion process of the thermal power plant can be established.

In order to determine the pollutant emissions, presented in Table I, the carbon, azote and sulfur masses have been initially determined, knowing that, on average, coal contains 75% C, 10% N and 3% S [10].

Table I. Pollutant emissions resulted from the use of non-renewable resources for producing in fossil fuel based power plants the indicated electrical energy consumed in one year

Electrical energy, GJ	Thermal energy, GJ	CO_2 emissions, t	NO_2 emissions, t	SO_2 emissions, t
1545	3358,6	604,4	72,2	13,1

Taking into account the needed electrical energy to be covered, mentioned in Table 1 and assuming the use of the SW 285 mono black photovoltaic panel model [12], the following further considerations are made regarding the potential use of renewable energy supply systems.

Given the characteristics of the photovoltaic panel model chosen for the case study, the electric energy produced by this system can be established, as presented in table II, considering the following equation [13]:

$$E = A \cdot \eta \cdot H \cdot PR \quad (1)$$

where:

E - electric energy produced in one year (kWh/ year);
A - the area of photovoltaic panel (m^2);
η - the photovoltaic panel efficiency (%);
H - the annual average irradiation on the panel surface (kWh/ m^2);
PR - (0,5 – 0,9) – default value = 0,75 [13].

Table II. Electric energy produced during a year by the SW 285 mono black photovoltaic panel model

Parameter	Value	Electric energy production/year, kWh/ year	Electric energy production/year, MJ/ year
The area of photovoltaic panel (m^2)	1,676	321	1155,6
The photovoltaic panel efficiency (%)	17		
The annual average irradiation on the panel surface (kWh/ m^2)	1500		
The coefficient of losses	0,75		

Considering the phases of the general life cycle of a photovoltaic system, as presented in Figure 2, it can be mentioned that during the panel use period, no pollutants emissions are recorded. Pollutants emissions are recorded during the production phase of the photovoltaic panel and maybe during recycling and transport processes. In Table III the main equipment used in the production phase is presented, their electric power and needed operating time are mentioned, so that their energy consumption can be established [14].

Table III. Electrical energy consumption from assembly machines

Equipment	Equipment's capacity	Power equipment, kW	Time, s	Electrical energy needed for the equipment to operate, MJ
E1 – photovoltaic cell linker	700 solar cells/ hour	3	308,4	0,92
E2 – stringer	150 strings/ hour	2	360	1,44
E3 – laminator	12 modules/ hour	27	300	8,1
E4 – framing equipment	12 modules/ hour	5	300	1,5
E5 – testing equipment (sun simulator)	12 modules/ hour	3	300	0,9
E6 – testing equipment (EL inspection)	3 – 7 sec/ module	3	25	0,075
			Total energy consumption	12,94
			Total electrical energy based on fossil fuels (p = 65%)	8,41

The thermal energy required to obtain the needed electricity for equipment operation can be established, finally calculating the pollutant emissions resulted from the coal combustion, knowing the coal calorific value (Q_{coal} = 15,281 MJ/ kg) [8] data given in Table IV.

Table IV. Pollutant emissions in the production phase of a photovoltaic panel

CO_2 emissions, kg	NO_2 emissions, kg	SO_2 emissions, kg
4,374	522,5	96,2

Considering the electrical energy consumed by the institution in one year, the number of needed photovoltaic panels can be calculated in order to cover the electricity produced by the power plant. It results a number of about 2957 photovoltaic panels needed for covering the energy demand of the considered institution.

The total environmental impact is determined by calculating the pollutant emission indicator for electricity generation, namely the CO_2, NO_2 and SO_2 emissions corresponding to the production of electricity in the thermoelectric plant and also with the photovoltaic panel. Therefore, taking into account a whole year, in the thermoelectric installation and in the 1330 photovoltaic panels, this specific indicator of the above-mentioned pollutant emissions related to the produced electricity is given by the relationship between:

- pollutant emissions calculated for the power plant and photovoltaic module;
- electricity produced by the power plant and by the photovoltaic panel.

Therefore, the result of the pollutant emissions indicator for electricity production in both cases is presented in Figure 3.

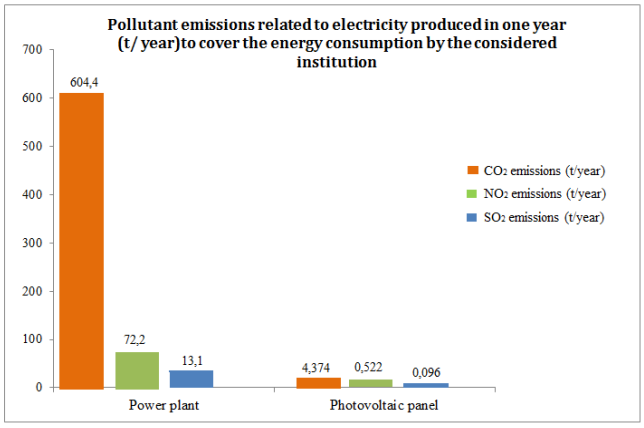

Fig. 3. Pollutant emission indicators for power generation in case of a power plant and a module of photovoltaic panels for the electricity produced in one year

CONCLUSION

Regarding environmental assessment of a photovoltaic system the general life cycle has been used in the presented case study. Its environmental footprint has been established with the goal of emphasizing the corresponding environmental impact of using such renewable energy resources. In order to analyse the whole life cycle of a photovoltaic system, it has to be taken into account that during its use phase, a photovoltaic panel system does not produce any pollutants emissions, only in the other corresponding phases. Therefore, in the phase of raw materials extraction, the preliminary production as well as the production and assembly phases of a photovoltaic panel system, there are significant pollutants emissions. By taking into account all phases of the life cycle and by evaluating pollutants emissions in each phase it is possible to carry out an environmental assessment of energy supply systems, based on fossil fuels or on renewable energy resources. By applying the same algorithm it is also possible to extend the environmental assessment of photovoltaic systems to other renewable energy supply systems with the goal of recognizing hidden aspects connected to the usage of renewable energy resources.

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Role of EDTA in lead mobilization and its uptake by maize grown on an artificial Pb-polluted soil

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Abstract: Presence of heavy metals in agricultural soils is of major environmental concern and a great threat to life on the earth. Soil pollution with heavy metals is a serious issue worldwide. Mining operations, industrial production and domestic and agricultural use of metal and metal containing compound have resulted in the release of toxic metals into the environment. Metal pollution has serious implications for the human health and the environment. Phytoremediation is considered an economical and environmentally friendly method of exploiting plants to extract contaminants from soil. The purpose of this paper is to study the maize seedling, growing and behaviour in a soil polluted with heavy metals. Maize is known from literature as lead accumulators in artificially polluted soil with 1000, 2000 and 3000 mg / kg Pb of soil and in the presence of different treatments with EDTA as the mobilization agent. Significant increases are at all variants versus control. This means that the treatment choice for phytoextraction (Pb concentration, EDTA concentration) is the amount of biomass. From the statistical calculation it results that in the variant with 1000 mg Pb / kg soil + ratio EDTA / Pb = 0.5 have no significant decrease in leaf weight. In conclusion, EDTA application does not influence hyperaccumulation. The toxicity of 3000 mg Pb / kg is too high and the plant does not tolerate this toxicity. Thus, another ligand / lead ratio has to be chosen and other Soilutions are sought to stimulate plant growth and increase the accumulation of metals in the plant.

Keywords: lead, soil pollution, EDTA, EDTA/Pb ratio.

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INTRODUCTION

Soil heavy-metal pollution is one of the main global environmental problems (Wan et al., 2016).

Regarding their role in biological systems, heavy metals areclassified as essential and non-essential. Essential heavy metalsare those, which are needed by living organisms in minute quantitiesfor vital physiological and biochemical functions. Examples of essential heavy metals are Fe, Mn, Cu, Zn, and Ni (Cempel and Nikel, 2006; Gohre and Paszkowski, 2006). Non-essential heavy metals are those, which are not needed by living organisms forany physiological and biochemical functions. Examples of nonessentialheavy metals are Cd, Pb, As, Hg, and Cr (Penget al., 2009; Sanchez-Chardi et al., 2009; Dabonne et al., 2010). Heavy metal concentrations beyond threshold limits have adversehealth effects because they interfere with the normal functioning of living systems.

Phytoextraction of heavy metals can be practiced in two modes, natural and induced. In natural or continuous phytoextraction, plants are used for removal of heavy metals under natural conditions i.e., no soil amendment is made. In induced or chelate assisted phytoextraction, different chelating agents such as EDTA, citric acid, elemental sulfur, and ammonium sulfate are added to soil to increase the bioavailability of heavy metals in soil for uptake by plants (Elkhatib et al., 2001; Lai and Chen, 2004; Lone et al., 2008; Sun et al., 2011).

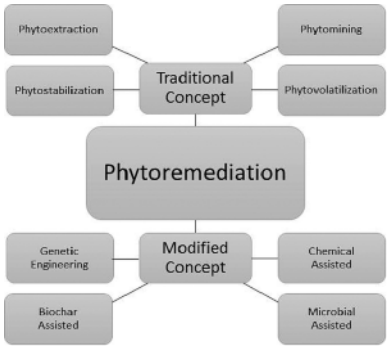

Fig. 1 Approaches for heavy metals phytoremediation (Sarwar et al., 2017)

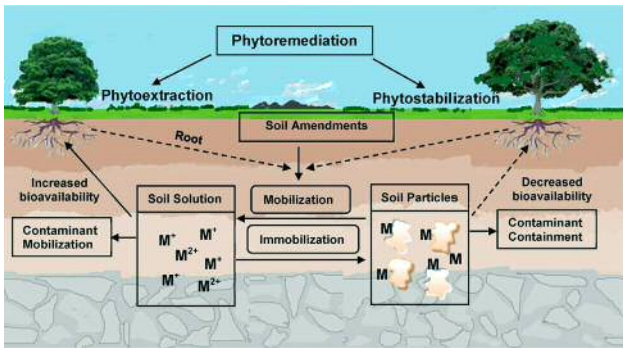

Fig. 2 Illustrated diagram showing the relationship between immobilization, bioavailability and phytoremediation of toxic heavy metals (Bolan et al., 2014)

MATERIALS AND METHODS

The purpose of this paper is to study maize seedling, growing, and behavior. Maize is known in the literature as being accumulator for lead in the soil polluted artificially with 1000, 2000 and 3000 mg Pb / kg of soil and in the presence of different amounts of EDTA as a mobilization agent.

Experiment consists in 8 variants in three repetitions. The test plant chosen is maize. Different variants for maize: V17 - V32 variants: 1000-3000 mg Pb / kg soil + EDTA (in different ratios to Pb). The set options are as follows:

V17: Control, cambic chernozem from Fundulea, without treatment.

V18: Soil (+ **1000** mg Pb /Kg) – EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{0}\right)$

V19: Soil (+ **1000** mg Pb / Kg) + EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{0{,}5}\right)$

V20: Soil (+ **1000**mgPb/Kg) + EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{1}\right)$

V21: Soil (+ **1000**mgPb/Kg) + EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{2}\right)$

V22: Soil (+ **1000**mgPb/Kg) + EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{10}\right)$

V23: Soil (+ **2000**mgPb/Kg) – EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{0}\right)$

V24: Soil (+ **2000**mgPb/Kg) + EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{0{,}5}\right)$

V25: Soil (+ **2000**mgPb/Kg) + EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{1}\right)$

V26: Soil (+ **2000**mgPb/Kg) + EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{2}\right)$

V27: Soil (+ **2000**mgPb/Kg) + EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{10}\right)$

V28: Soil (+ **3000** mg Pb/Kg) – EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{0}\right)$

V29: Soil (+ **3000** mg Pb/Kg) + EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{0{,}5}\right)$

V30: Soil (+ **3000** mg Pb/Kg) + EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{1}\right)$

V31: Soil (+ **3000** mg Pb/Kg) + EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{2}\right)$

V32: Soil (+ **3000** mg Pb/Kg) + EDTA $\left(\frac{\text{Ligand}}{\text{Lead}} = \mathbf{10}\right)$

Table I Particle - size distribution in the soil material taken from Fundulea area, Calarasi county (n = 3), in mm, % from mineral size (g/g)

	Particle - size distribution (in mm) (% of the mineral part of the soil)				**Symbol - subclass texture**	Carbonates (%)
	Coarse sand	**Sand**	**Silt**	**Clay**		
	2.0-0.2mm	**0.2-0.02mm**	**0.02**	**<0.002 mm**		
Mean	**0.3**	**33.1**	**30.7**	**35.9**	**LL – Medium Clay** (Romanian Soil Taxonomy System, 2003)	-

Table II Chemical characteristics of Calcic chernozem from Teleorman area (n=3)

Characteristics	**U.M.**	**Mean value**
pH_{H2O}	-	6.84
Total nitrogen content	%	0.255
Organic carbon content	%	3.98
Mobile phosphorous content	$mg \cdot kg^{-1}$	17
Mobile potassium content	$mg \cdot kg^{-1}$	140

The content of heavy metals in cambic chernozem from Fundulea area (n=3)

Heavy metals content	U.M.	Mean value
Cadmium	mg · kg^{-1}	0.3
Copper	mg · kg^{-1}	27
Cobalt	mg · kg^{-1}	10
Nickel	mg · kg^{-1}	34
Lead	mg · kg^{-1}	25
Manganese	mg · kg^{-1}	761
Zinc	mg · kg^{-1}	83

RESULTS AND DISCUSSIONS

The maize vegetation period was 8 weeks.

The evolution of the plants from sowing, emergence to harvesting was followed. Regarding leaf appearance and emergence, there was a strong influence of Pb treatment with EDTA or Pb + EDTA.

After harvesting maize plants measurements of plant height and weight of the resulting biological material as well as lead dosages were made to determine the amount of lead accumulated in plants (Figures 3-5).

Following the variance analysis (Tukey test, Fisher test), statistical data showed a different evolution of these parameters depending on the treatment applied. There are statistically significant differences both in the weight of the biological material at harvest and at plant height, but also in the lead content of the biomass.

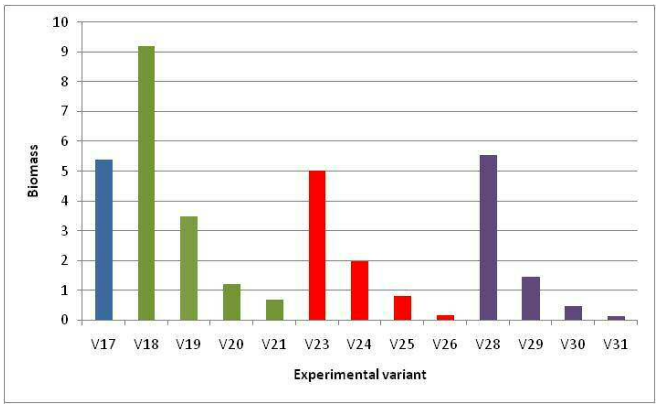

Fig. 3 Biomass evolution of maize plants on a soil polluted with 1000, 2000 and 3000 mg Pb/kg and EDTA/Pb ratios by 0, 0.5, 1 and 2

For soil polluted with 1000 mgPb / kg and treated with increasing amounts of EDTA (ligand) such that the ratio of EDTA: Lead reaches 0; 0.5; 1 and 2, leaf weight decreases significantly from the control of each variant in which the ligand (EDTA) was applied in the 0.5, 1 and 2 reports (Fisher test). At V18 (without EDTA), the increase in leaf weight against the control (V17) is likely due to the higher nitrogen content of the Pb nitrate that acted as a fertilizer in this case. The significant decrease in leaf weight compared to the V17 control appears only in variants V20 and V21, ie where the EDTA / Pb ratio is higher: 1 and 2. The decrease is not significant compared to the V17 variant in variant V19: Sol (+ 1000 mg / Kg Pb) + EDTA / Pb = 0.5.

There is a distinctly significant decrease in leaf weight with increasing EDTA concentration (increase in EDTA / Pb ratio). At the same time, in these variants, including the V24 EDTA / Pb = 0.5 variant, the biomass decrease is distinctly significant which means that the use of maize as a hyperaccumulative plant on a 2000 mg Pb / kg soil loaded can be tested in EDTA an EDTA / Pb ratio <0.5, i.e. in a variant where the decrease in biomass is not significant. Figure 2 shows the soil treated with a lead content (2000 mg / kg) and different EDTA contents (EDTA / Pb = 0, EDTA / Pb = 0.5, EDTA / Pb = 1, EDTA / Pb = 2 molar ratio).

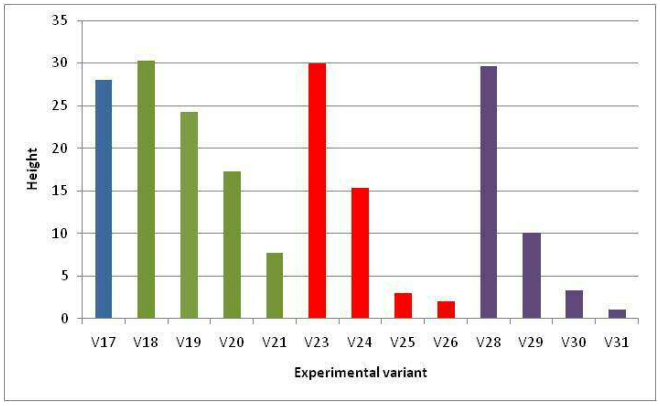

Fig. 4 Height of maize plants on a soil polluted with 1000, 2000 and 3000 mg Pb/kg and EDTA/Pb ratios by 0, 0.5, 1 and 2

Plant height decreases significantly from the control. The height evolution is similar to the weight of the leaves. If the treated soil with a lead content (2000 mg / kg) and different contents of EDTA (EDTA / Pb = 0, EDTA / Pb = 0.5, EDTA / Pb = 1; EDTA / Pb = 2 molar ratio), there are differences in the thickness of the leaves. The maize leaf height values also significantly decrease.

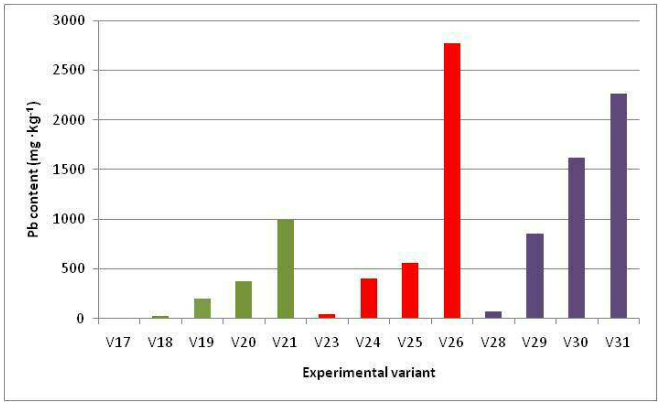

Figure 5 Pb content of maize plants on a soil polluted with 1000, 2000 and 3000 mg Pb/kg and EDTA/Pb ratios by 0, 0.5, 1 and 2

Concerning leaf lead content, there is a distinctly significant increase in each variant compared to the V17 control. Significant increase of Pb relative to the control occurs in variants V19, V20 and V21, i.e. where EDTA treatment was performed. The bioavailability of lead increased with increasing EDTA concentration in the soil.

Corroborated, the evolution of the Pb content of leaves with the evolution of biomass weight and plant height, from the test experience, we can say that only until the EDTA / Pb ratio of 0.5 does not show a significant decrease in biomass; the ligand does not react to this level of negative concentration, although the lead concentration increases.

The content of Pb increases significantly in all leaflets, which means that even at concentrations of 2000 mg Pb / kg soil the bioavailability of lead has increased with the increase in EDTA content. Values greater than 450 mg / kg occur in variants V25 and V26, i.e. where the ligand treatment was EDTA / Pb = 1 and EDTA / Pb = 2.

The lead concentration significantly increases in all variants compared to the control. Values greater than 1053 appear only between V30, EDTA / Pb = 1; V31: EDTA / Pb = 2 and the V17 control on the one hand and between the same variants (V30, V31) and V28 where the soil with the concentration of 3000 mg Pb / kg does not contain EDTA.

Since the decrease of biomass is significant even from V29: EDTA / Pb = 0.5 and the lead concentration increases significantly (> 1053) from V30: EDTA / Pb = 1 the conclusion is that the application of EDTA can not influence the hyperaccumulation; the toxicity of 3000 mgPb / kg is too high and the plant does not tolerate this toxicity. Thus, another ligand / lead ratio has to be chosen and other solutions are sought to stimulate plant growth and increase the accumulation of metals in the plant.

On the treated soil with different lead concentrations (1000 mg Pb / kg, 2000 mg Pb / kg, 3000 mg Pb / kg) and the same EDTA content (EDTA / Pb = 0.5 molar ratio), the Pb concentration in the leaves increases with soil Pb. Significantly significant increases are at all variants versus control. This means that the choice of the best treatment for phytoextraction (Pb concentration, EDTA concentration) is the amount of biomass. From the statistical calculation it results that in the version of 1000 mg Pb / kg soil + EDTA / Pb = 0.5 no significant decrease in leaf weight occurs.

In the case of increasing the lead concentration at the same EDTA / Pb ratio of 0.5, the Fisher Test shows a significant decrease in biomass weight and a distinctly significant height of maize plants; phenomena which can also be seen in figure 4.

In the case of the lead concentration increase (1000, 2000 and 3000 mgPb / kg soil) at the same EDTA / Pb = 1 ratio, the Fisher test shows a distinctly significant decrease of both biomass and corn plant height. This aspect of biomass and plant height development in this type of treatment can be seen in Figures 3 and 4.

A distinctly significant decrease of the two parameters (biomass and height) is observed in the version of 1000 mgPb / kg soil; this again excludes the EDTA / Pb = 1 ratio even for this version of 1000 mg Pb / kg soil. The increase in the concentration of Pb in the Leaf is significant in all variants, but the evolution of biomass is also decisive and how it decreases significantly at all three concentrations compared to the blank, the EDTA / Pb = 1 variant can not be taken into account calculation.

CONCLUSION

EDTA application does not influence hyperaccumulation. The toxicity of 3000 mg Pb / kg is too high and the plant does not tolerate this toxicity. Thus, another ligand / lead ratio has to be chosen and other Sollutions are sought to stimulate plant growth and increase the accumulation of metals in the plant.

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Thermal degradation of photovoltaic panels: evaluations using a range of testing methods

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*corresponding author

Abstract: (PV) cells are prone to thermal degradation in time, therefore they have to be monitored. When their parameters reach critically low values, they have to be replaced. The aim of our studies is to explore a range of testing methods for such a monitoring, including: Scanning Electronic Microscopy (SEM), Atomic Force Microscopy (AFM), Optical Coherence Tomography (OCT), as well as hardness measurements. Some of them are presented in this work. Two categories of samples are considered for the study: new and used PV cells. The latter have been exposed to various atmospheric conditions for several years, the most significant being the temperature influence. Differences in the structure and properties of the two categories of PVs are assessed using these three methods. A good agreement between the results of the comparisons made between used and new PVs has been obtained using the methods considered.

Keywords: Renewable energy sources (RES), Photovoltaic cells (PV), Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM).

INTRODUCTION

In order to decrease climate changing emissions, renewable energy is used on an increasing scale nowadays. Among the sources of green energy, the solar energy can replace significant amounts of fossil fuels [1]. This can be seen from the fact that the ratio of the photovoltaic (PV) electricity in the energy mix has increased at an accelerated pace, and this trend is expected to continue in the future. Thus, the European PV cumulative installed capacity for example has progressed rapidly over the past decade from less than 1 GW in 2003 to more than 30 GW in 2010, 70 GW in 2012, and it has reached about 302 GW in 2016 [2].

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As PV panels are widely used, those that have already been installed for years now have to be monitored. When their parameters reach critically low values, they have to be replaced [3, 4]. This issue of PV monitoring, related to the change in their parameters over time is unavoidable due to their exposure to rough atmospheric conditions, especially solar radiation [5] and significant thermal differences between day and night (as well as between seasons), but also wind, dust, and humidity [6].

According to the EN/IEC 61215 standard test, every PV module has to pass a defect test, which determines how long the module can withstand both the internal and external factors that can cause performance failures and thermal breakdown [7]. This is due to the fact that testing results have shown that PV modules do fail after some time, sometimes even before their expected life span. As a consequence, PV modules degradation has become a challenge to researchers, in relationship to the negative impact it may have on the PV's reliability and stability.

Numerous researches have been carried out on such topics [9-16]; in comparison, there are not so many researches on the physical/external effect of thermal degradation on PV modules/cells. Some of these latter works are using a certain investigation method, like Scanning Electronic Microscopy (SEM) [8], Atomic Force Microscopy (AFM) [9], or Optical Coherence Tomography (OCT) [10, 11]. The aim of our current investigations is to use not only one method, but to couple several testing methods, both non-destructive and destructive, and to compare the way the assessment of the PV's degradation can be done with different methods applied in parallel.

The necessity of such studies comes from the fact that the three methods above (i.e., SEM – which is the gold standard for surface micro-topography, AFM, as well as destructive mechanical methods) are fundamental ways to validate results that can be obtained with other, somehow more attractive methods like OCT. The latter, even if it has much lower resolutions than SEM or AFM, has fundamental advantages, including the capability to carry on investigations in a non-destructive way, on a much larger surface than AFM, and in situ. We have also demonstrated that OCT could replace the more costly, time-consuming, and lab-based SEM in the analysis of some surface microstructure investigations [12]. In this respect, our current studies thus lay the foundation to address PV monitoring with methods like OCT, by exploring

and comparing the assessment of PV thermal degradation with methods like SEM, AFM, as well as mechanical destructive methods.

MATERIALS AND METHODS

Two monocrystalline solar cells of the same type have been selected in order to perform this study. One of them is new, while the other one has been in use, exposed to solar irradiation and to different environmental conditions for a period of 10 years. As this latter used PV material came from a PV module located in Timisoara, Romania (with mild conditions regarding wind, dust, and humidity), we may say that the main factors of influence for its possible degradation is related to temperatures changes during the day-and-night, as well as the seasonal cycles – in close relationship with its role, of processing solar radiation.

Figure 1 presents the type of PV samples considered for investigations, with a manufacturer's dimension of 10 x 10 mm. A range of testing methods and systems has been used to investigate the two types of PV samples.

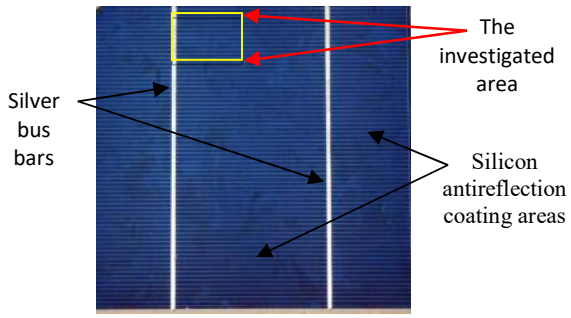

Fig. 1. Monocrystalline solar cell considered for investigation. Dimensions: 10 x 10 mm.

Scanning Electron Microscopy (SEM)

For the SEM analysis a high vacuum FEI Quanta 250 SEM and a secondary Everhard–Thomley electron detector have been used. The two samples, i.e., the new and the used PV cells have been inserted in the microscope and examined at various magnitudes. They were mounted on a copper or aluminum conductive holder stub using carbon wafers with adhesive on both sides. The mounting of the samples was done using the lens of a binocular microscope in order to expose the investigated area directly to the electron beam scanning the sample. A sample alignment has been done in order to reduce the possible tilting inside the SEM.

Atomic Force Microscopy (AFM)

AFM investigations for the PV probes have been carried on using a Scanning Probe Microscopy Platform (MultiView-2000 system, Nanonics Imaging Ltd., Israel) using only an intermittent mode in normal conditions (24-25°C). During the analysis a cantilever beam with a tip doped with chromium has been used; this tip has a 20 nm radius and it has been driven at a resonance frequency of 30-40 kHz. With regard to other methods like optical microscopy or SEM, AFM has the advantages that it does not use lenses or beam irradiation, respectively.

Hardness test

While the two methods above are non-destructive, in order to better understand the changes induced by the exposure to temperature variations in the investigated areas, mechanical destructive test can be performed. Hardness tests have been carried out using a Falcon-500 Inovatest device (Fig. 2) on new and old PV cells. The Falcon-500 machine offers micro Vickers, Knoop, and Brinell hardness test by an electronically controlled closed loop system and an advanced force sensor technology. The range of force offered by this device spans from 10^{-3} kgf ($9.82*10^{-3}$ N) to 62.5 kgf (612.9 N).

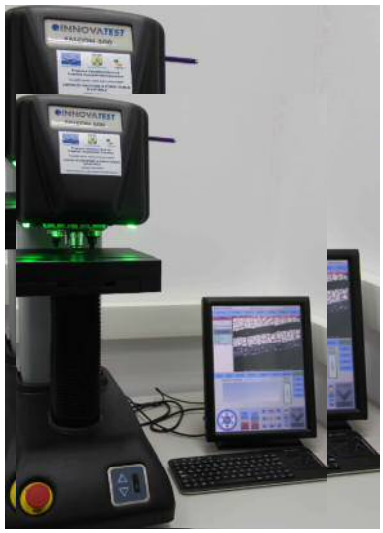

Fig. 2. The Falcon-503 Inovatest utilized for hardness investigations of the PV samples.

RESULTS AND DISCUSSION

SEM Analysis

In Fig. 3(a) and (b) the SEM micrographs of the used and the new sample, respectively, are presented. A certain degree of damage can be observed in the surface structure, from the internal layer crystal matrix. It can be attributed to the irreversible destruction resulting from their exposure to atmospheric conditions [8].

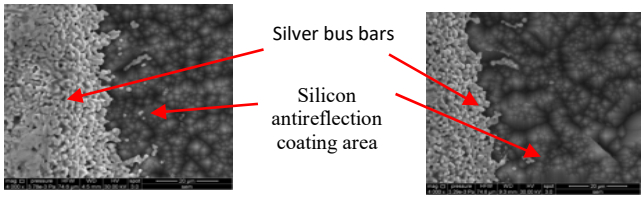

Fig. 3. SEM images of a similar area for a used (a) and a new sample (b).

Analysis of the AFM images

From AFM images, there are even better distinguishable differences regarding the size of the formations on the surface of the two PV cells – with regard to SEM images. Thus, both samples, used and new, have pyramidal formations with different directions that are more visible in three-dimensional

(3D) AFM images with regard to two-dimensional (2D) SEM images.

From the further analysis of the AFM images, several characteristic parameters can be obtained, by using only height parameters (wavelength, spacing, and hybrid parameters could be used as well, but they are less common and less straightforward): Average roughness (S_a) can be used, for example, i.e. is the extension of R_a (arithmetical mean height of a line) to a surface, expresses, as an absolute value, the difference in height of each point compared to the arithmetical mean of the surface. The highest peaks were observed in the used sample (1.58 μm), as well as the largest pit depth (-1.31 μm), and this is correlated with the higher roughness obtained for the used sample.

Finally, it can be concluded that 3D AFM images are more relevant than 2D SEM images in the proposed assessment of the PVs degradation, although the latter has been more frequently used for such studies. The former method also allows for a quantitative assessment of the samples characteristics, as performed above.

CONCLUSION

Our studies explore the specific capability of each considered investigation method to assess the thermal degradation of PV cells. Thus, 3D AFM images proved more useful than 2D SEM images (although the latter have been more used for such investigations), and they can also offer quantitative evaluations of a range of the PVs' parameters, including roughness. Mechanical testing methods can also be useful from this point of view, as they provide clearly numerical assessments of certain parameters – such as the Vickers hardness. However, such a mechanical testing is destructive – with regard to AFM investigations. Using all the three methods, consistent results regarding the degradations of used with regard to new PV cells have been concluded. Future work in our group comprise such researches using another imaging method, OCT, for which the three methods pointed out in the present study represent necessary validation capabilities.

ACKNOWLEDGMENT

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Vacuum annealing effect on Fe-based nanomaterial's removal efficiency of U(VI) and some accompanying elements from diluted aqueous systems

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Abstract: Uranium mining activity has a rich tradition in Romania leaving behind a radioactive and toxic legacy represented by the low radioactive waste dumps, tailing ponds, mine waters and other wastewaters resulted from the nuclear fuel fabrication. The mine waters' and poor ores' samples chemical analysis showed that U(VI) is accompanied by other heavy metals such as Cu (II), Cr(VI) and Mo(VI). All those elements cause severe ailments so that remediation solutions are compulsory necessary. Zero valent iron nanoparticles have been recently considered as eco-friendly highly effective remediation tools for organic and inorganic pollutants. The present contribution aims to point out the vacuum annealing effect on Fe-based nanomaterial's removal efficiency of U(VI), Cu(II), Cr(VI) and Mo(VI) from diluted aqueous systems as natural analogues for mine waters. Two types of Fe-based nanomaterials were investigated, as follows: Fe-based nanomaterials synthesized in laboratory by the reduction of Fe (II) salt with sodium borohydride ($NaBH_4$)-NMS and Fe-based nanomaterials synthesized in laboratory by the reduction of Fe (II) salt with sodium borohydride ($NaBH_4$) and vacuum annealed – NMSTT, respectively. The obtained results have suggested that the vacuum annealing treatment increases the Fe-based nanomaterial's stability and decreases its' reactivity in the first hour of reaction.

Keywords: Novel materials and environmentally friendly technologies, vacuum annealing, Fe-based nanomaterials, U(VI) and accompanying elements.

I. INTRODUCTION

The diversified environmental pollution caused by our society's continuous high-tech development challenges the scientific community to come up with sustainable, reliable, effective and money saving remediation solutions. Under this context Romania owns a highly dangerous legacy due to the uranium mining activities, that has left behind low radioactive waste heaps piled up at the galleries' mouth, mine waters caused by the weathering phenomena, tailing ponds and different other wastewaters generated during the nuclear fuel cycle Fig.1 [1].

The mine waters' and poor ores' samples chemical analysis showed that U(VI) is accompanied by other heavy metals such as Cu (II), Cr(VI) and Mo(VI) [2], [3], [4].

The available data have shown that besides U(VI) potential carcinogenic action the accompanying elements have a toxic effect on the human body causing different ailments, some of them extremely severe, such as chronic bronchitis, pulmonary tuberculosis, gastric disorders, enteritis, liver damage caused by Cr (VI); pruritus, rash and dermatitis due to Cu (II); skin, eyes and respiratory tract irritation caused by Mo (VI) [5]. The radioactivity presence requires effective protection for the people living in the area [6].

The usual separation methods, namely chemical methods (precipitation, complexing method and oxido-reduction), solvent extraction, ultrafiltration, electrodialysis, reversed osmosis, ionic exchange, adsorption, biosorption, flotation-separation method with adsorptive bubbles have the specific

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advantages and disadvantages in some cases.

For example, solvent extraction despite its high selectivity has a number of disadvantages such as solvents degradation, third phases formation, stable emulsions occurrence, reduced mechanical resistance, utilization of toxic and inflammable reagents, long reaction time, high complexity and practical utilization difficulty, high cost.

The nanotechnologies represent a new research direction, which consists in the utilization of nanomaterials for pollutants' immobilization. Starting from the utilization of zero-valent iron as remediation tool in reactive permeable barriers, different types of iron nanoparticles have drawn scholars' attention.

Zero valent iron nanoparticles have been recently considered as eco-friendly highly effective remediation tools for organic and inorganic pollutants.

The present contribution aims to point out the vacuum annealing effect on Fe-based nanomaterial's removal efficiency of U(VI), Cu(II), Cr(VI) and Mo(VI) from diluted aqueous systems as natural analogues for mine waters. Two types of Fe-based nanomaterials were investigated, as follows: Fe-based nanomaterials synthesized in laboratory by the reduction of Fe (II) salt with sodium borohydride ($NaBH_4$)-NMS and Fe-based nanomaterials synthesized in laboratory by the reduction of Fe (II) salt with sodium borohydride ($NaBH_4$) and vacuum annealed – NMSTT, respectively.

The obtained results have suggested that the vacuum annealing treatment increases the Fe-based nanomaterial's stability and decreases its' reactivity in the first hour of reaction.

II. EXPERIMENTAL ACTIVITY

All the reagents were analytical grade and the solutions were prepared using Milli -Q water. The working parameters were:

V_{sample}=300 mL, $C_{U(VI)}$= 10 mg/L (prepared of $Na_2U_2O_7$), $C_{Cu(II)}$ = 10 mg/L (prepared of $CuCl_2$), $C_{Cr(VI)}$= 10 mg/L (prepared of $CrCl_6$), $C_{Mo(VI)}$=10 mg/L (prepared of MoO_2Cl_2), m_{NMS}=0.15 g and m_{NMSTT}=0.15 g, the sampling time t = 0, 1, 2, 3 and 24 h, the pH = 6, 7 and 8 provided using buffer systems.

The studied parameters were pH, reacting time, contaminants and iron concentrations, redox potential (ε_h).

The Hanna Instruments meter (model HI 8424) was used for pH and ε_h measurement. CINTRA 404 UV-VIS spectrophotometer was used for U(VI) and Mo(VI) determination and UNICAM PAY SP9 atomic absorption spectrometer for Fe(III), Cu(II) and Cr(VI) determination.

The solid samples were analyzed using FTIR a and TG-TDA analysis.

The NMS and NMSTT contaminants' immobilization efficiency was compared.

III. RESULTS AND DISCUSSION

The possible species calculation pointed out that, for pH in the range 7-9: for U(VI): $[(UO_2)_3(OH)_5]^+$, $[UO_2OH]^+$and $UO_2(OH)_2$; for Cu(II) is $[CuOH]^+$; for Cr(VI) is CrO_4^{2-} and for Mo(VI) is MoO_4^{2-}. The redox potential measurements emphasized in both cases the reducing conditions presence signalized by the shift from the initial value of +200 mV to about -200 mV for NMS and NMSTT as well.

We observed the NMS chemical reactivity superiority in comparison to the NMSTT at U(VI) immobilization, when after one hour contact at pH=8 (pH specific for mine waters) the residual concentration is $C_{U(VI)}$=0.7 mg/L and $\%R_{U(VI)}$=93 for NMS in comparison to $C_{U(VI)}$=1.35 mg/L and $\%R_{U(VI)}$=86.5 for NMSTT, which is pointed out by the residual $C_{Fe(II+III)}$=4,5 mg/L for NMS after two hours compared to only 3 mg/L for NMSTT. This chemical behavior is confirmed by the FTIR analysis and the TG-TDA one. Both analyses of the Fe-based nanomaterials have pointed out that the vacuum annealing process causes boron impurity migration towards the nanomaterial's surface increasing its' stability and decreasing the contaminant's accessibility to the zero-valent iron core so that initially NMSTT's reactivity was lower than NMS's one.

At this pH value Cu (II) precipitates as hydroxide and Cr (VI) is possible to be adsorbed on the Fe (III) oxyhydroxide formed. The small Mo (VI) removal efficiency at pH=8 may be explained by the rejection forces, which may occur between the nanomaterials negatively charged surface and MoO42- charge.

IV. CONCLUSION

The results have shown that the vacuum annealing increases the Fe-based nanomaterial's stability and life span. The NMS has at the experiment's beginning a higher reactivity due to its' instability. This information could be useful for the large scaled up setup because vacuum annealing involves additional fabrication costs.

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Assessment Of Molecular Diversity And Strains Identification In Of Some *Sinorizobium meliloti* Isolates from Alfalfa Root Nodules

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Abstract: (TNR, 10 points, bold, justify) These instructions gi Endophytic bacteria were isolated from root nodules of alfalfa (*Medicago sativa L.)* plants, from different soil profiles in the west part of the country. Molecular diversity studies of 15 rhizobia isolates from were conducted using Enterobacterial Repetitive Intergenic Consensus (ERIC) molecular markers and PCR fingerprinting method and a phylogeny dendrogram was constructed. Based on their genetic diversity scores, 10 isolates were analyzed by 16S rRNA region by DNA sequencing in order to identify their strain and defining their position in their taxon. Five of analyzed strains were found to be nonsymbiotic bacteria related to *Pseudomonas* and *Bacillus* genera, known as universally coexistent with symbiotic bacteria in the nodules. For the other 10 it was found that they are part of *Rhizobium* symbiotic bacteria order. Our study suggests that among isolated bacteria there is an obvious correlation, since they are coexisting in root nodules. Moreover, our results suggest that the symbiotic and nonsymbiotic bacteria interact together with their habitats.

Keywords: bacterial biodiversity, Rhizobium identification, ERIC- PCR, 16S rRNA gene.

INTRODUCTION

Nitrogen is essential for plant growth and development being the constituent of aminoacids, structural proteins, enzymes and coenzymes, intermediates involved in synthesis and energy transfer as well as nucleic acids.

Nitrogen is found in soil, especially in the form of inorganic ammonium ($NH4^+$) and nitrate ($NO3^-$) combinations which can be used directly by plants. Since annual nitrogen consumption from the soil reserve exceeds its recovery through pedological processes, the applications of chemical fertilizers is necessary. But this source of nitrogen is expensive and in the same time polluting for soil and water.

One of the cost-effective sources of soil nitrogen enrichment in forms directly assimilable by plants is the biological fixation of molecular nitrogen. The process is carried out within a symbiotic system, established between microorganisms, the nitrogen fixing bacteria and leguminous plants. Following the nitrogen fixation process, the plants assure their nitrogen needs ($NH4^+$), the excess being released into the soil [1].

The average nitrogen fixation rate is about 100kg /ha/year but depends on the symbiotic plant species and also on external factors such as soil type, temperature, soil nutrients and humidity. Among leguminous plants, *Medicago* and *Trifolium* genera are of great importance for an efficient and non-polluting agriculture due to their high rate of biological nitrogen fixation (250Kg /ha/year) [2] [3].

In order to establish a sustainable agricultural culture, it is not always sufficient to exploit the populations of microorganisms from the soil, but it is necessary to inoculate the seeds with specific bacterial strain to settle the symbiotic system. Therefore, the aim of this research was to isolate and characterize different bacterial strains specific to alfalfa which could be used for biological inoculants production.

The first step for bacteria characterization is phenotypic evaluation, but it is not highly accurate and is not always correlated with the molecular data. Therefore DNA based procedures were applied, first for the assessment of molecular diversity and then for the taxonomic identification in accordance with the DNA databases [4].

Since 1991, DNA repetitive sequences with 126 bp lengths have been identified, located in different positions in the bacterial genome, but always in transcribed chromosomal

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regions. Considering that they were identified in the genomes of Escherichia coli, Salmonella typhimuirum and other enterobacteria they were named Enterobacterial Repetitive Intergenic Consensus (ERIC) sequences [5]. Based on this sequence a class of molecular markers was developed named ERIC applied with success for molecular diversity evaluation for a large category of bacterial species, including Rhizobium [6] [7] [8].

For accurate bacterial specie identification the housekeeping gene encoding the small subunit of the ribosomal RNA (16r RNA) is one of the most used genes because it is present in all the bacteria and is suitable for PCR amplification and easy to sequence [9].

PCR amplification is facile due to the highly conserved sequences flanking the gene, highly conserved in all living species, therefore the use of universal primers being possible. The repetitive gene arrangement in the genome provides large amounts of the DNA matrix, allowing amplification even for the smallest organisms. Its 1500bp size allows for accurate and doubtless results based on informatics evaluations [10].

MATERIALS AND METHODS

A. Biological material

15 soil samples were harvested from different farmland locations in the west of the country and distributed to vegetation pots. The seeds of a lucerne genotype were sown in the 15 vegetation pots (about 20 seeds / vessel). The experimental variants were numbered in accordance with the date of arrival at the laboratory of the soil sample, from 1-15, (Table I).

Table I. Samples analysed in this study.

Sample code	Location of soil sample prelevation
1	**Timișoara a, Timiș county**
2	**Giarmata a, Timiș county**
3	**Aldești a, Arad county**
4	**Almaș, Arad county**
5	**Sebiș, Arad county**
6	**Șag, Timiș county**
7	**Giroc, Timiș county**
8	**Dumbrăvița, Timiș county**
9	**Jimbolia, Timiș county**
10	**Cărpiniș, Timiș county**
11	Săcălaz, Timiș county
12	Ghiroda, Timiș county
13	Timișoara b, Timiș county
14	Giarmata b, Arad county
15	Aldești b, Arad county

B. Obtaining of bacterial isolates

Isolation of the bacteria from the nodules was performed 21 days after sowing, according to the Vincent method, 1970. The root fragments on which the nodules were located were cut and then sterilized in the hood with sterile air flow by immersion in 96% ethanol 5-10 min, 0.5% sodium hypochlorite (NaOCl) for 2-4 min, and finally five successive steps of washing in sterile distilled water. The nodules were cut and the bacterial cells inoculated onto YMA culture medium (2% agar, 10 g mannitol 0.1% yeast extract, 0.1% CaCO3, 0.05% K2HPO4, 0.02% MgSO4. 7H2O and 0.01% NaCl), pH 6.2 ± 0.2.

Bacteria from each nodule were inoculated on culture medium and the resulting plates were maintained at 25° C in a closed incubator for 2 days. Next, a strain corresponding to each experimental variant was selected and then inoculated into liquid YMA culture medium.

C. Isolation of total genomic DNA

10 ml of bacterial cultures were centrifuged at 5.000 rpm for 3 minutes to pellet the cells. The bacterial cell pellet was rinsed with 0.5 ml of sterile PBS buffer, and centrifuged at 5.000 rpm-3 minutes. Total genomic AND was isolated from the bacterial pellet using the Isolate II Genomic DNA Kit, (Bioline, France).

The quality and quantity of extracted DNA was assessed by spectrophotometry method (NanoDrop 8000 Spectrophotometer, ThermoScientific).

D. Phylogeny of bacterian isolates assessment using ERIC- PCR fingerprinting method

Bacterial isolates were fingerprinted using the enterobacterial repetitive intergenic consensus polymerase chain reaction (ERIC-PCR), using the primers ERIC lR: 5'ATGTAAGCTCCTGGGGATTCAC 3' and ERIC 2: 5'AAGTAAGTGACTGGGGTGAGCG3'.

PCR amplification was carried out in final reaction volumes of 25 µl containing 100 ng of DNA template. The composition of amplification mixture was carried out according to instructions for GoTaq Green (2X) kit (Promega, USA). The reaction was performed on a Eppendorf Mastercycler Pro S Thermal Cycler with the program : first denaturing step for 5 min at 94°C, followed by 45 cycles of denaturation at 94°C for 45 - 60 sec, annealing at 50°C for 45 - 60 sec and extension at 72°C for 2 min, the final step of extension at 72°C for 5 min.

The resulting PCR products were run on 1.6 % agarose gels in TAE buffer at 100 V for 90 minutes. The PCR products were visualized and photographed under UV light. The obtained data were analyzed with VisionWorksLC software and based of identified alleles a binary matrix was constructed. The Jaccard coefficient has been used to compare between the set of variables and to develop a similarity and a genetic diversity matrix. The sofware calculates and transforms similarity coefficients into distances and makes a clustering using the Unweighted Pair Group Method with Arithmetic mean (UPGMA) algorithm.

E. Molecular identification of bacterial straines.

Identification of the bacterial strains was accomplished by sequencing the DNA fragment corresponding to the 16 S rRNA region. The DNA fragment was obtained by PCR reaction using the primers: F27: 5 'AGA GTT TGA TCM TGG CTC AG 3' and R1494 5 'CTA CGG YTA CCT TGT TAC GAC 3'. The amplification mix was carried out in final reaction volumes of 50 µl containing 50 ng of DNA template, using the GoTaq Green (2X) kit (Promega, USA). The reaction was performed on a Eppendorf Mastercycler Pro Thermal Cycler with the program: first denaturing step for 3 min at 94° C, followed by 35 cycles of denaturation at 94° C for 45-60 sec, annealing at 50° C for 60 sec and extension at 72° C for 1 min, the final step of extension at 72° C for 7 min.

The gel fragments containing the amplified DNA fragment, with the expected size of 1500 pb, were excised and purified using the PureLink Quick Gel Extraction & PCR Purification Combo Kit kit. (ThermoFisher Scientific, Lithuania), and sequenced by Macrogen Laboratory, Amsterdam, Holland

Obtained sequences were uploaded in the *NCBI Data Base* and analized using the *Blastn* function of the software in order to identify the bacterian strain.

RESULTS AND DISCUSSION

Our study aimed to highlight the diversity of Rhizobium strains that can make symbionts with alfalfa plants. For this, soil samples were collected from 15 different locations in the west of the country, and were sown, in laboratory conditions with lucerne seeds. From the nodules developed on the roots of alfalfa plants, bacterial cultures were made from which total genomic DNA was isolated and purified. The first step of our study was the determination of the diversity of bacterial isolates with the aim of selecting a group of isolates whose genetic similarity is very low. These selected isolates were bacterial strains that were identified by the 16S rRNA gene sequencing method.

The ERIC-PCR technique was used to determine the degree of kinship between bacterial isolates. Very accurate DNA fingerprints were obtained in all 15 samples using both ERIC primers. The fingerprints were used for the development of genetic similarity and diversity matrices. The matrices values were used for the development of a phylogenetic dendrogram (Fig. 1).

By analzing the dendrogram it can be noticed that the bacterian isolates were grouped in two major clusters. As it can be seen in the Fig. 1, the bacterian isolates are not clustered according to their geografic origin. Moreover, with five exceptions, the values from the obtained matrices denote that these isolates are very different from the genetic point of view, which leads us to the conclusion that there is a great possibility that besides the symbiont bacteria there are other species bacteria to compete for the appearance of such a low similarity.

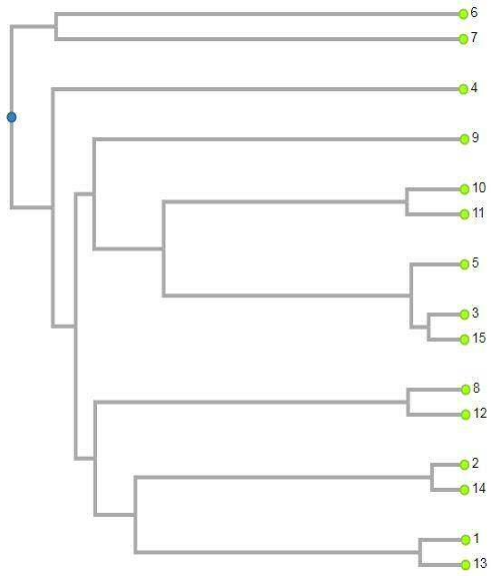

Fig. 1. UPGMA Dendrogram of E. coli isolates, created by DendroUPGMA program using data from the two ERIC markers systems.

The five exceptions were considered the isolates between which the genetic similarity index exceeded the value of 0.9, which means a very high degree of genetic similarity, so that these isolates certainly belong to the same species. This was the case for bacterial isolates found in soil samples taken from locations 1 and 13, both being in the Timisoara region; 2 and 14 both being taken from the Giarmata area; 8 and 12, which were harvested from different localities, Dumbrăviţa and Ghiroda, respectively, and samples 3 and 15, from the soil samples of the same locality, Aldeşti. Being so similar one of the two was eliminated from the bacterial strain identification study.

DNA sequencing allowed the identification of strains from bacterial isolates, thus providing explanation for the high degree of genetic diversity that emerges from the first stage of the study. The presence of other bacterial species in or on the surface of the root nodules has been mentioned in the literature (bibliography). In our study, only the presence of *Sinorhizobium meliloti* was identified in two of the 10 isolates for which sequencing was performed, namely isolates 1 and 2, which in turn were very similar to isolates 13 and 14. *S. meliloti* was also identified in other 6 bacterial isolates namely, 6, 7, 8, 9, 10, but in these cases other bacterial species were also identified as follows: *Enterobacter spp*., in isolate 6; *Rahnella aquatilis* in isolate 7; *Pseudomonas spp*. in isolates 8, 9, 10. *Rhizobium tibeticum* was identified in isolates 3 and

15 but also in isolate 5, where the presence of *Bacillus spp*. was also identified. In case of isolate 4, only the presence of the species *Rhizobium leguminosarum trifolii* was recorded.

The results obtained in this experiment suggest that the diversity of bacterial populations in the root nodules of alfalfa plants is high, and the bacterial inhabitants of those nodules are not always the nitrogen fixing species. However, more studies need to be conducted in order to decipher the relationship between these bacterial species and if those other inhabitants may alter the nodulating capacity and thereby inhibit the production capacity of the alfalfa plants.

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Energetic and Environmental Efficiency of the Cogeneration of a Baking Plant

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Abstract: One of the most modern possibilities to capitalize on the thermal potential of secondary energetic resources is represented by cogeneration. The paper deals with the installation of a cogeneration system at a baking plant, system which has one thermal engine in order to reduce on one hand the losses of thermal energy through burnt gases and on the other hand the environmental pollution and impact. The baking plant has a continuous yearly operation and in its classical operation scenario it comprise steam and hot water generation, necessary for the technological processes specific to the bread industry. The main problem consists in checking the operation conditions capable of offering natural gas and electricity economies within profitable limits. Identifying the profitability of adopting the cogeneration solution is carried out using comparative determinations which take into consideration energetic, monetary and environmental expenses for different exploitation conditions of the baking plant. Taking into consideration the measured parameters as reference data at the moment of the research, the opportunity and the profitability of using a cogeneration based on an electricity generating driven by a heat engine was assessed.

Keywords: cogeneration, energetic indicators, economic indicators, carbon footprint.

AIMS AND BACKGROUND

The heat engine of a cogeneration system (i.e. steam / gas turbine, combustion engine) drives an electricity generator which supplies electricity while the exhausted heat (i.e. steam, burnt gases and / or cooling water) is recovered and produces technological steam or heating agent. Usually and simplistically, the consumers cover their heat and energy demand from their own steam generators which use fossil fuel and also by purchasing electricity from the grid. Producing the energy through classic methods (using central heating power plants) most of the energy contained by the fuel is dissipated into the environment as low level heat (during the steam condensation process, steam which is used as a thermal agent). *Cogeneration (CHP-Combined Heat and Power)* recovers thus this loss and simultaneously produces electricity and heat more efficiently and in the same time with reduced polluting emissions compared to classic technologies. If it is adequately applied, cogeneration may lead to the substantial reduction of energy costs for the consumers. The use of cogeneration for the simultaneous supply of the two types of energy from a common source was extensively applied in Romania by the large central heating supply systems for the industrial platforms and cities [1]. Taking into consideration the present state of the technology, the procedure became possible and profitable even for a series of reduced capacity applications installed for the consumers. Cogeneration at low and medium loads may become a domain of interest for a substantial number of factors involved, which are presently insufficiently documented regarding specific technical and economic aspects. The energy requirement is generally a heat and electricity complex. Consumers frequently require both heat and electricity. The heat demand which can be met using the cogeneration systems is the heat used for space heating (i.e. hot water, hot air, low pressure steam), and hot internal water or for industrial processes of low and moderate temperature. High temperature consumption are not taken into account when speaking about cogeneration (i.e. home and tertiary sector cooking, pyro-energetic processes comprised by the chemical, petrochemical, metallurgic and construction industries) because there is a direct supply of fuel which doesn't have any alternative.

PROBLEM FORMULATION

Taking into consideration the technological processes which are carried out inside by the heat generators of the baking plant, the possibility of completely removing the hot water generators and a steam generators was analyzed, replacing them with an electricity generator group capable of meeting the hot water demand and partially the steam demand. The advantage of such a group is that it is able to cover the heat demand as well as a part of the electricity demand. The main problem though consists in checking the operating conditions which are capable of reducing the natural gas and electricity consumption to affordable limits. Identifying the efficiency of

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adopting such a solution which involves cogeneration is carried out through comparative determinations focusing on energetic, monetary and environmental expenses for different usage conditions of the considered system. The characteristics of the consumption determine unproportioned variations in smaller and smaller tranches of energy economy respectively energy expenses in relation to the installed tranches in cogeneration. Doubling the capacity does not necessarily double the fuel economy. Therefore the optimum dimension of the thermal capacity of the cogeneration installation stops at an inferior level of the maximum thermal load [2]. This limitation is mainly defined by the following aspects:

- the investment for a capacity increment over a certain limit is not justified by the additional economies with energy expenses;
- the operation period of the additional possible tranche would be more reduced than the one imposed by the efficiency conditions.

The differences of thermal load, which exceed the available cogeneration capacity of CHP are covered from professional steam or hot water generators.

The electricity load differences, which exceed the available power of cogeneration (considering the variation of the thermal consumption which determine the available electric power) are covered by the energy absorbed from the electricity grid. Taking into account these amounts, the energy which might be received from the system during periods in which the price of the supplier is lower than the price resulted from the local production with the cogeneration installation (reduced tariff periods) may also be taken into consideration. [3]. The characteristic indicators of the energetic balance for an internal combustion engine are presented for information in Table 1[4]:

Table 1. Characteristic indicators of the energetic balance for a system powered by an internal combustion engine

	Otto	Diesel
Fuel consumption	100	100
Electricity generation αe	35	40
Heat generation αt	50	43
Out of which: burnt gases	20	21
Cooling water	30	22
Total efficiency	85	83
Heating index – y-(of cogeneration), [J_e/J_t], [kW_e/kW_t], [kWh/Gcal]	0.6…0.93 700…1082	

The heat recovered from this type of engine is mainly used for processes which require temperatures up to 100°C [5]. In some cases, they are produced with these type of systems as well as reduced steam quantities necessary for some processes. The main economic indicators of different cogeneration installations are presented in table 2.

Table 2. Economic indicators of cogeneration

	Piston engine	Gas turbine	Steam turbine
Specific investment, [EURO/kW_e]	1500...400	1200...530	1500....1000
Specific maintenance cost, [EURO/MWh_e]	20...5	7...4	2.3...1.5
Investment recovery period, [years]	2...3	2...3	3.5...4
Life span, [years]	10	15	30

The decision to use cogeneration with an internal combustion engine, comparing the data comprised in table 2, is justified by the dimensions of the installation in relation to the existing available space, by the turn on and turn off speed and by the complexity of its maintenance and its pumping assemblies for the steam turbine and respectively the gas turbine. Another argument in favor of choosing the internal combustion engine consists in the fact that presently there are container units with a range of 150 kW-1000 kW, which are easier to install than steam/gas turbines.

At its place of installation, the most rigid condition of the operation is determined by the thermal consumption. The differences of electricity between local consumption and the production of the installation (in direct proportion to the thermal load) is compensated without technical difficulties from the electric grid to which the installation is connected. Therefore, the dimensioning and the operation of cogeneration is determined by the thermal criterion.

Cogeneration uses complex pumping assemblies, respectively increased value ones. In order to be cost efficient (with sufficient energy economies to compensate the investment effort), they need to be used as long as possible and at loads as large as possible. An operation period of over cca 4000 h/year may be considered as one of the basic rules to be respected [6].

CASE STUDY

The paper studies the opportunity of introducing cogeneration for a baking plant using a combined heat power group powered by a combustion engine. Presently, the continuous operation baking plant uses hot water and steam generators for the specific technological processes. Considering the measured parameters as reference data at the moment of the study, the opportunity and the cost efficiency of using cogeneration CHP powered by a combustion engine were assessed.

Table 3 brings forward and compares the measured values of the thermal parameters corresponding to the present situation concerning the operation of the baking plant using steam and hot water generators and respectively for the case when it uses a 600 kW_e cogeneration CHP group.

Table 3. Measured values for the thermal parameters corresponding to the two operation scenarios

Measured parameters for the present situation		Nominal parameters for using an electricity generating group	
Natural gas consumption for the heat generators (steam and hot water)	C_{gas} = 174 m^3_N equivalent to 1839 kWh_t	Natural gas consumption for the electricity generator group	$C_{gas\ el.group}$ = 137 m^3_N equivalent to 1446 kWh_t
Steam thermal flow	$D_{thermal\ steam}$ = 930 kWh_t	Steam thermal flow	$D_{thermal\ steam\ el.\ g.}$ = 348 kWh_t
Hot water thermal flow	$D_{thermal\ hot\ water}$ = 730 kWh_t	Hot water thermal flow	$D_{thermal\ hot\ water\ el.\ g.}$ = 320 kWh_t
Electricity	**0**	Electricity	$E_{electric\ el.\ g.}$ = 600 kWh_e
Total thermal flow thermal heat generators	D_{total} = 1660 kWh_t	Total thermal flow electricity generating group	$D_{total\ el.\ g.}$ = 668 kWh_t

The study has analyzed a series of additional calculation data such as: the yearly operation period, which according to the beneficiary was estimated to be: τ_{year} = 4000 ÷ 8760 hours/year; the price of a kWh of electricity $p_{el.}$ = 0.304 lei/kWh; the price of a kWh gas thermal energy p_{gaz} = 0.128 lei/kWh; the price for a m^3 of gas $p_{gaz\ m^3}$ = 1.35 lei/m^3; the energetic equivalent of a m^3 of gas 1 m^3 of gas = 10.57 kWh; 1 ton equivalent oil 1 t.o.e. = 11.627907 MWh; the average value of the CO_2 emission factor for gas fuel in Romania f_{CO2} = 0.535 kg/kWh; investment cost $C_{inv.} \approx$ 2 700 000 lei; maintenance cost $C_{maint.}$ = 30 lei/hour. 1 Euro = 4.67 lei

The nominal values of the technical parameters and the nominal energetic performances of the cogeneration group are presented in Table 4.

Table 4. Design energetic performances of the gas powered electricity generator group

No.	Energetic measure	Value
1	Thermal power of the gas	1446 kW
2	Gas flow	137 m^3_N/h
3	Mechanical power at the shaft of the engine	620 kW
4	Electric power of the electricity generator	600 kW_e
5	Available thermal power for the steam generator	348 kW_t
6	Available thermal power for heating and hot water	320 kW_t
7	Electric efficiency	41.5 %
8	Thermal efficiency	46.2 %
9	Cogeneration efficiency	87.7 %
10	Cogeneration index	0.898 kW_e/kW_t

In order account the thermal energy fluxes of the proposed gas operated cogeneration CHP the hourly energetic balance was created, the values and percentages of the inlet and outlet energies from the outline of the balance being presented in Table 5.

Table 5. Inlet and outlet energetic measure of the outline of the balance

No.	Energetic measure	Value	Percentage
1	Used energy	1446 kWh	100 %
2	Useful energy	1268 kWh	87.69 %
3	Losses inside the electricity generator	20 kWh	1.383%
4	Losses with the exhausted burnt gases	94 kWh	6.501 %
5	Losses with the reduced potential water	41 kWh	2.835 %
6	Radiation losses (engine, generator)	23 kWh	1.591 %
7	Total lost energy	178 kWh	12.31 %

The energetic performance indicators (yearly effective energy economy, additional fuel expenses), the financial performance indicators (yearly effective economy when using the cogeneration CHP), as well as for the environmental performance index, i.e. reducing the carbon footprint. Their variation depending on the time is presented in Figures 3-8 highlighting thus their variation according to the operation period.

Energetic quantification of the estimated economies

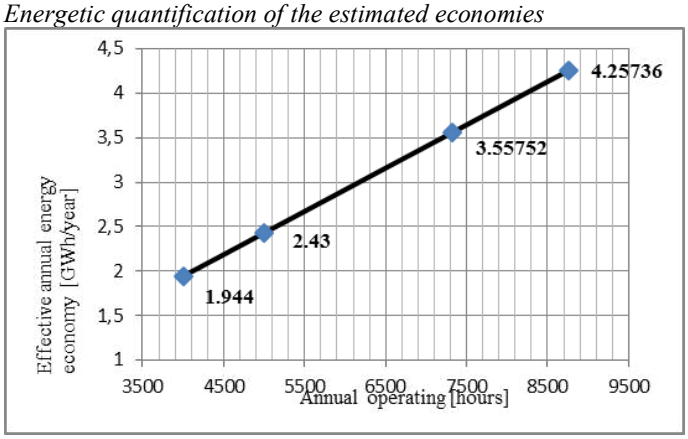

Figure 1. Effective annual energy economy

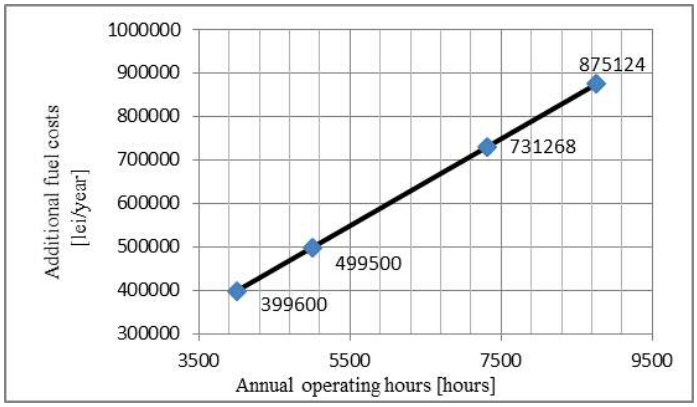

Figure 2. Additional fuel costs

Financial quantification of the economies estimated

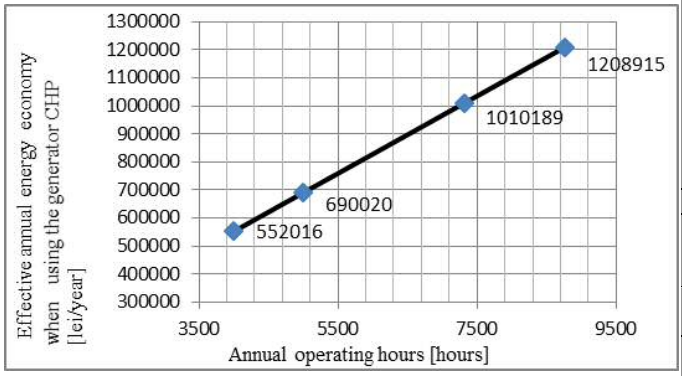

Figure 3. Effective yearly energy when using the CHP generator

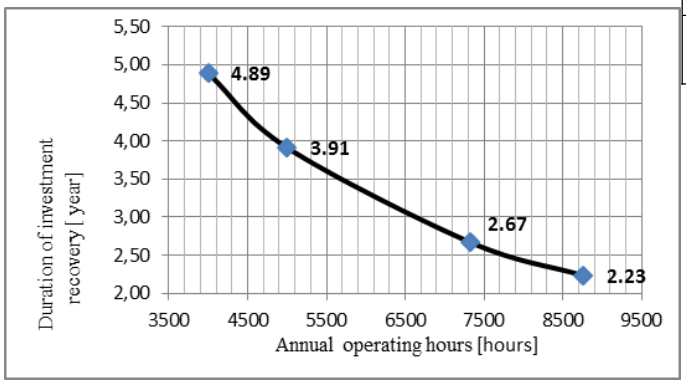

Figure 4. Investment recovery period

Environmental impact reduction

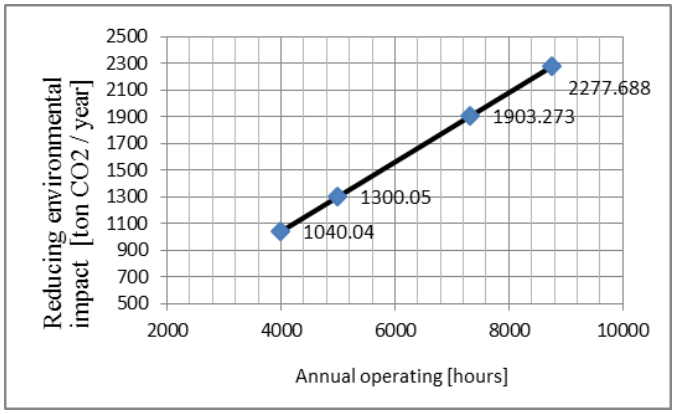

Figure 5. Reducing the carbon footprint

The investment recovery period is in direct proportion to the value of 580000 Euro = 2 702 800 lei, representing the purchase cost of a combustion engine electricity generating group. In order to synthesize the quantity indicators which have been graphically represented in the previous figures and to offer a general image on the opportunity of adopting the cogeneration solution, the significant values resulted from the determinations were centralized in table 6.

Table 6. Values for the quantity indicators

Yearly operation period	Effective energy economy	Expenses for the additionally consumed gas	Maintenance costs	Economies with used electricity	Economies with used heat	Total effective yearly economies	Investment recovery period	Environmental impact reduction
1	2	3	4	5	6	7	8	9
[hours / year]	[kW h/year]	[lei year]	[lei year]	[lei year]	[lei year]	[lei year]	[year]	[tone CO_2/year]
8760	4257360	875124	262800	1597824	749015	1208915	2.23	2277.688
7320	3557520	731268	219600	1335168	625889	1010189	2.67	1903.273
5000	2430000	499500	150000	912000	427520	690020	3.91	1300.05
4000	1944000	399600	120000	729600	342016	552016	4.89	1040.04

Total effective economies result from the difference between the economies with used electricity (column 5), economies with used heat (column 6), and the economies with the additionally consumed gas (column 3) and maintenance expenses (column 4). [(5)+(6)]-[(3)+(4)]. Taking into consideration the measures related to the period of operation 4000 hours / year as reference measures, considered to be minimum for the energetic efficiency of the cogeneration system, the following variations for the values comprised in the table were recorded. According to the technical specifications the efficient use period of the combustion engine cogeneration systems is 10 years.

CONCLUSIONS

The study and the determinations carried out for the assessment of the economic and energetic efficiency concerning the purchase of a combustion engine cogeneration system have highlighted the following:

- the determining factor is given by the constant continuous consumption comprised for an operation period of 4000-8760 hours/year;
- generated electricity may be capitalized in house, comprising all its difficulties or delivered back to the national grid keeping in view the quality of the delivered energy;
- during the summer months when there is a considerable reduction in the need of hot water, the best feasible solution would be to carry out trigeneration (combined cooling heat and power), as a series of baking products require cold conservation;
- according to the data comprised in table 6, in the most unfavorable conditions (4000 hours/year of operation) the investment recovery period s 5 years, while the profit is estimated to be 2760080 lei.

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Importance of Knowledge on Habitat Structure for Wildlife Conservation and Management in Eastern Croatia

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Abstract: The protection of habitats is an integral part of the wildlife and nature conservation in the European Union member states, including the Republic of Croatia. The updated digital Terrestrial Habitat Map of Croatia (delivered in December, 2016), gives the spatial overview of natural and semi-natural, non-forest terrestrial and inland freshwater habitats at scale 1:25 000. The field validation of habitats was carried out in eastern part of Croatia during 2015 and 2016. Total 5,032 field points were collected by using tablet with a GIS/GPS and Habitat Mapper application. The composition and distribution of the main habitat type classes were analyzed in the surveyed area in size of 10,262.02 km^2. Prevailing habitats belongs into categories: Cultivated habitats (47.4%), Forests (40.0%), Constructed and industrial habitats (3.59%), Inland surface water and wetlands (3.54%), Grasslands (2.83%), and Scrubs (2.59%). Knowledge on habitat structure makes an important tool in planning measures for maintaining a favorable conservation status of habitats in eastern Croatia and sustainable management with natural resources in agriculture, forestry, hunting and fisheries.

Keywords: ecology, habitat, nature protection, Croatia

INTRODUCTION

Habitat represents an area in which individual organism or population of plants and animals lives in stable interaction with their environment.

At the European Union level, there are two directives that regulates standards for wildlife, habitat and nature conservation. First, the Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora (The Habitats Directive), and second, the Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the Conservation of Wild Birds (The Birds Directive).

Pronounced diversity of habitats in Croatia is primarily due to the geographical position across three different biogeographical regions: Continental, Alpine and Mediterranean. Ecological network (Natura 2000) of the Republic of Croatia comprising 20,704 km^2 or 37% of the land territory, and includes 779 Natura 2000 sites [1].

Sustainable use of natural resources and wildlife management in Croatia is regulated under the legislation covering the fields of nature protection, hunting, freshwater fisheries, forestry and agriculture.

MATERIAL AND METHODS

A. Study Area

Region of eastern Croatia is located in the north-eastern part of Croatia, and lies on the southwestern edge of the Pannonian Plain. It borders with Hungary, Serbia and Bosnia and Herzegovina (Figure 1). Total land surface amounts to 12,486 km^2, which makes 22% of the land territory of Croatia.

Fig. 1. Map of the Republic of Croatia with indicated position of eastern Croatia

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According to relief features, the western and central parts contain mountains and foothills, while the eastern part is mostly lowland, with loess plateaus. The altitude range is from 78 m above sea level at lowest point, up to 984 m at highest point. Three large rivers: the Drava, the Danube and the Sava Rivers, flow through the region and form alluvial terraces, river valleys and floodplains. Watercourses and canals belongs to the catchment areas of the Danube and the Sava Rivers. The climate is moderately continental, with cold and long winters and dry and hot summers [2].

Regarding the phytogeographical position, this is a transitory region between the vegetation of the *Carpinion betuli* alliance and forest steppe zone of the *Aceri tatarici – Quercion* alliance [3]. The most of the region belongs to the Illyrian province of the Eurosiberian-North American region, which comprise all lowland and mountain continental part of Croatia. Only the northeastern part belongs to the Pannonian sector of the Central European Province.

Eastern Croatia is region with a long tradition of using the natural resources for different purposes, including wild plants and animals living in various terrestrial and aquatic habitats. About 52% of total land surface is agricultural land under intensive crop production, such as oilseed rape, wheat, barley, corn, sugar beet, sunflower and soybean [4]. Tradition of breeding and hunting game animals, such as red deer, roe deer, wild boar, European hare, pheasant and waterfowl dates back more than 300 years [5].

Two most well-known nature protected areas in eastern Croatia are Nature Park Kopački Rit (protected since 1967), and Nature Park Papuk (protected since 1999). Natura 2000 sites of the ecological network covers area of 3,013 km^2, which makes 22% of total land surface of the region, or 15% of total surface of the Croatian ecological network.

B. Methods

The activities in producing digital habitat map of natural and semi-natural, non-forest terrestrial and inland freshwater habitats in the territory of the Republic of Croatia, at scale 1:25000, were carried out from May 2014 to December 2016. The habitat map consists of two types of information; polygonal data describe different habitat types in the area bigger than 1,56 ha, while the punctual data show the location of rare or threatened habitats inside Natura 2000 network, whose area is smaller than 1,56 ha. Final version of the map contained 322,906 polygons and 969 punctual data, and it can be viewed as WFS layer on the web page www.bioportal.hr of the Croatian Agency for the Environment and Nature.

Habitat identification and classification follows the Interpretation Manual of European Union Habitats [6] and the National Habitat Classification, which defines 11 habitat categories, each divided into four level of classification, and

Field validation of habitats identified previously by photo interpretation was carried out from June to August, 2015 and from May to August, 2016. Total 5,032 field points were collected by using tablet with a GIS/GPS and Habitat Mapper application. The correctly delineated and described habitat types had been validated on-site, whereas oversights were corrected, so the new habitat map would match the reality as accurately as possible.

RESULTS AND DISCUSSION

Based on the analyses of data sets on spatial distribution and diversity of habitat types in eastern Croatia (Table I), the dominant habitats belongs into category Cultivated habitats (47.4%), followed by Forests (40.0%), Constructed and industrial habitats (3.59%), Inland surface water and wetlands (3.54%), Grasslands (2.83%), and Scrubs (2.59%).

Table I. Structure and distribution of habitat types in eastern Croatia

Habitat code and description according to National Habitat Classification		**Coverage (km^2)**	**Percentage of area (%)**
A.1	Permanent standing fresh waters	49.34	**0,48**
A.2	Permanent running waters, canals	169.11	**1.65**
A.3	Free-floating and submerged aquatic vegetation	0.30	**0.00**
A.4.1	Marshland and amphibious vegetation	144.89	**1.41**
C.2.2.	Central-European wet grasslands	8.29	**0.08**
C.2.3	Central-European mesophilic meadows	215.32	**2.10**
C.2.4	Wet, nitrophilic meadows and pastures	50.54	**0.49**
C.3.1.	Subcontinental dry grasslands	3.34	**0.03**
C.3.3	Mesophilic calcareous meadows	12.13	**0.12**
C.5.	Woodland fringes and lowland tall herb vegetation	0.92	**0.01**
D	Scrubs	265.83	**2.59**
E	Forests	4,105.87	**40.02**
I.1.	Weed and ruderal vegetation	13.59	**0.14**
I.2., I.5, I.1.8	Cropland, orchards, vineyards Abandoned agricultural land	4,854.65	**47.31**
J	Constructed and industrial habitats	367.89	**3.57**
	Total	**10,262.02**	**100.00**

Rare and threatened habitats that cover small surface are usually very important in conservation of certain animal and plant species. Most of them have protection status at European Union level as habitat types included in Annex I of the Habitats Directive. During the field activities in identification and validation of habitat types in eastern Croatia, rare and threatened habitat types were found and recorded (Table II).

Table II. List of rare and endangered habitat types in eastern Croatia

Habitat code and description according to Habitats Directive	
3130	**Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or *Isoeto-Nanojuncetea***
3150	**Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation**
3270	**Rivers with muddy banks with *Chenopodion rubri* p.p. and *Bidention* p.p. vegetation**
6210	**Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)**
6240	**Sub-pannonic stepic grassland (*Festucion valesiacae*)**
6250	**Pannonic loess steppic grasslands (*Artemisio-Kochion*)**
6440	**Alluvial meadows of river valleys (*Cnidion dubii*)**
6510	**Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)**

High percentage of cultivated habitats (class I) indicates high anthropogenic impact on landscape and biodiversity.

Strong anthropogenic impact is visible on forest habitats (class E), due to clearing of natural forests (deforestation), conversion to agricultural land, construction of settlements, and exploitation of forests in the past. Forests covered 70% of northeastern part Croatia in 1750, 60% in 1850, 28% in 1961, and 30% in 1985 [2].

Each wild animal species has its own specific habitat preferences for food, shelter, nesting or breeding site. Management of game animals in the hunting grounds depends on composition and distribution of aquatic, wetland, forest and grassland habitats, as well as on presence of the artificial habitats, created and sustained by the human activities [7].

In the hunting grounds with dominating forest habitats, there are good conditions for breeding and hunting of red deer, fallow deer, roe deer and wild boar. In the hunting ground with dominating open agricultural land, grasslands, thickets, channels, there are good conditions for breeding and hunting of roe deer, European hare, pheasant and waterfowl.

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Environmental Parameter Monitoring System for Urban Traffic Restriction/Reconfiguration

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Abstract: Transport access is critical for inclusive growth, economic development leading to rising demand for road transport. Although there has been a gradual change in the environment and an increase in the number of cars, emission of pollutants and noise emission, all these have not been measured and documented over the years leading to numerous health consequences described below in the entire Petrosani city area. Road transport is by far the most dangerous source of emissions, with a share of 93% of the amount of greenhouse gases thrown into the atmosphere. The present paper is conducting a study that will enable an urban air quality monitoring system to be set up to efficiently manage the road traffic in order to increase the citizens' life quality.

Keywords: smart city, smart grid, sustainable development.

INTRODUCTION

Air pollution is a very current problem, especially in urban areas. Measuring air quality can tell us what health risks we are exposing to. There are a number of official measurements but they are largely affected by the interests or negligence of those who run the monitoring networks. We can see real-time air quality maps in Romania on different sites, unfortunately in most major cities in Romania the sensors are inoperative. Road traffic is one of the major factors of environmental and quality of life degradation, especially in large urban agglomerations. Air pollution means any artificial contamination of the atmosphere that damages the environment. It is found especially in the lower part of terrestrial troposphere, in large cities, industrial areas, in adjacent stretches. Environmental pollution represents the set of unfavorable changes suffered by the natural qualities of the environment under the influence of the activities of the human society. A great influence on pollution has the geographical position and meteorological factors (temperature, intensity and direction of the wind etc.). It is not a new phenomenon; the scale of harmfulness has become worse due to the industrial revolution. If pollutants reach certain concentrations, they become harmful to the human body. Air pollution reduces the thickness of the ozone layer in the atmosphere, damaging the flora and fauna of the Earth.[1] [2] Increasing the CO_2 content of the atmosphere is one of the important factors (50%) that lead to the global warming of the Earth due to the greenhouse effect. Road Traffic Pollutants are: CO (70%), CO2 (20%), SOx (60%), NOx (5%), ozone (O3), heavy metal powders (arsenic, cadmium, nickel, mercury) 13%), benzene. [2] [3]

Percentages above indicate contribution relative to other sources of pollution. The present state of air quality improvement includes the research and development of new non-aggressive transport modes and technologies, the development of Intelligent Transport Systems (ITS), the development of normative acts related to air quality and reduction of pollutants determining the admissible concentrations of different pollutants according to their effect, determining the level of pollution, limiting the effects of urban pollution, informing citizens about air quality. Monitoring of air quality is done by direct measurements as well as by mathematical modeling of dispersion of pollutants in the atmosphere, estimation / forecast of their level.[3]

SMART CITY AND SMART GRID

Today, more than 50% of the world's population lives in cities that consume more than 70% of the planet's energy resources. We are witnessing a new technological revolution, Smart City being a local development vector alongside or part of the Smart Grid. Smart City is a city that uses the "information" of everything inside and surrounding it to provide community services at higher standards to the benefit of all its inhabitants. Also, smart city means the need to develop sustainably the civilization of the future city and the need to become more competitive locally in an increasingly globalized world. Smart city is an integrated system of systems to provide superior safety, health, education - to deliver sustainable development for future generations.

The term smart city refers to the ability of urban management to find solutions to achieving urban policy goals using the means of information and communication technology to ensure prosperity and support local community development.[3]

In this sense, the smart city has the following attributions:

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• the smart city can be characterized as a system in which organizational structures, functions, processes and policies are made with ICT and effectively and efficiently support and promote the interaction, cooperation and adoption of urban decisions through local partnerships and alliances;
• the smart city focuses on the ability and capacity of local government to work with other organizations (IT companies, local communities, local business environment) to develop and adopt better policies;
• the smart city can be considered a tool to meet the objectives (takes into account the results of actions and their impact);
• the smart city can be considered as an essential tool for modernization and innovation at the local level to increase public value;
• the smart city focuses on collaboration between government, businesses, citizens and the community in order to maximize the benefits of a strategic partnership;
• the smart city is an urban policy option in which the increasing public value is continuously pursued as an essential condition for success.

At the conceptual level, the term SMART GRID, refers to the electrical network, is a symbiosis between the elements of an electrical network in the classical meaning of the word and the elements of the information and communication technology that complement the functionality of that network.

Regardless of the attempt to define the term SMART GRID, we often meet the three aspects:
• the actual network
• devices with intelligence, whether distributed or centralized, representing the numerical computing systems or parts thereof, specific to information technology and controlling the network elements according to various algorithms implemented by numerical programs (firmware or software)
• communication infrastructure that mediates bidirectional information exchange between component elements (also leading to specific cyber security problems).

In this broad concept of the SMART GRID concept (Fig.1), its applicability is at every level: from the production of energy from conventional or renewable sources, to the transmission of the produced electricity, its distribution and, last but not least, its use by the consumer - be it industrial or domestic.[6]

This concept can also be transposed in the case of road infrastructure through the creation of general interconnected frameworks for the purpose of fluent traffic on the road arteries, most prone to traffic jams.

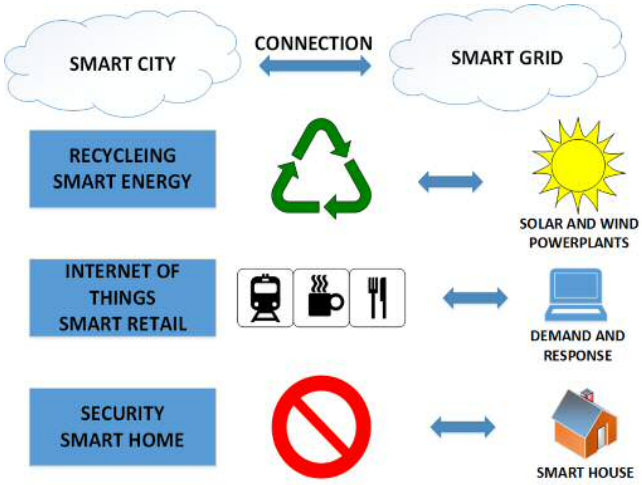

Fig. 1. Smart city – smart grid

GENERAL HEALTH ASPECTS OF CITIZENS IN A SMART CITY

The main health aspects of citizens in a smart city would be mainly those related to road transport, along with the increase in the number of vehicles globally. Transport access is critical for inclusive growth, economic development leading to rising demand for road transport. Although there has been a gradual change in the environment and an increase in the number of cars, emission of pollutants and noise emission, these have not been measured and documented over the years leading to numerous health consequences described below in the entire Petrosani city.

Road traffic accidents

The increase in car density in urban zones offers ascend to unstable condition, clashes amongst vehicles and people walking. Presentation to such unsafe circumstances prompts unfortunate and some of the time deadly impacts on the populace because of street vehicles collisions, street seethe, and so on. Absence of pathways, benefit paths, cycle tracks and activity quieting measures to lessen speed, where non-mechanized method of transport mix with mechanized movement, increment the danger of mischances and their seriousness. [4]

Air pollution

Air pollution is an outstanding natural hazard to wellbeing. Vehicular emanations rely upon oldness of vehicle, outflow rate of various vehicle classes. With falling apart mass transport benefits and expanding customized engine vehicle use, vehicular emanation is expecting genuine measurements in most Romania urban areas. [4]

Urban occupants presented to activity contamination are at conceivably higher danger of wellbeing impacts from introduction to cancer-causing poly-fragrant hydrocarbon (PAH) compounds. [4]

Studies demonstrate that PAH proportion diminishes fundamentally as a component of separation from the road. The new (2018) rules by World Health Organization (WHO) prescribe reconsidered limits for the convergence of chose air poisons — particulate issue, ozone, nitrogen dioxide and sulfur dioxide.[5]

Noise pollution

Community noise incorporates street, rail and air activity, ventures, development and open works. It is caused for the most part by movement and nearby thickly voyaged streets equal sound weight levels for 24 hours can reach 75-80dB. Predominance of hearing misfortune is more in laborers presented to higher street movement clamor contrasted with those less uncovered. [9]

Physical inactivity

Poor accessibility of pathways and cycle paths goes about as disincentive to dynamic transport, likewise person on foot and individuals on bikes are most powerless against wounds if there should arise an occurrence of street auto collision. This builds the quantity of mechanized vehicles use. An examination evaluated that absence of physical movement can be considered in charge of 3.3% passing and 19 million Disability Adjusted Life years (DALYs) around the world, through illnesses including ischemic coronary illness, diabetes, colon disease, stroke, and bosom malignancy. [4][5]

Other health effects

Air contamination because of vehicular movement in urban homes can sharpen inhabitants to dusts and is likewise connected with dermatitis in children. [5] Self-revealed nasal release, blocked nose, sniffling and tingling were firmly connected with living near substantial activity or living in urban communities. Nearness of living arrangement of ladies amid pregnancy to primary street additionally expanded the relationship of determination of asthma and atopic skin inflammation in the newborn children destined to these women.[5]

General Aspects of Monitoring System

Depending on the objectives of monitoring, resources and integration into a global system, monitoring systems (Fig.2) can be developed using several methods:

- method of division by zone: the area under monitoring is divided into relatively homogeneous areas (in terms of pollutant emissions, topography, population density). These areas are measured by specific variables and based on a dispersion model the overall impact is assessed. For the implementation of the method, measuring stations are needed near industrial sources, near high traffic routes and in urban areas in those areas.
- statistical method: the time and space correlations of data measured by a minimum number of existing measurement stations, but providing precise data.
- grid method: a large number of measuring points are implemented, distributed relatively evenly in the area under monitoring.
- analytical method: the measurement stations are located according to the location of the maximum pollution intensity points, a location provided by a mathematical model of the dispersion of the pollutants in the area under monitoring; this method is applied in the vicinity of the sources of pollution, where the model has a higher degree of veracity.
- empirical method: measurements are made on a particular route, for example determined by intensive traffic routes in a certain area.[8]

Data acquisitions and communications are made through local environmental sensors, local display of the monitored environmental parameters, and transmission to dispatcher of average concentrations following a query, local display of messages received from the central station, display local messages received from other measurement points, menu of settings and tests like in Fig. 2.

LOCAL LEVEL: 2 local measuring and display subsystems of CO and NO2, SO2, with local configuration capabilities and concentrations; communication support via GSM / SMS / GPRS.

CENTRAL LEVEL: data communication dispatcher for remote configuration of local subsystems, centralized dispatching of environmental parameters, text message management; data processing dispatcher for calculating average concentrations over standard time periods, data views; free access websites for on-line information on the level of urban pollution at the monitored sites with a restricted area for access by local authorities; system configuration databases, measured values, calculated values, reference values, text messages; reports.

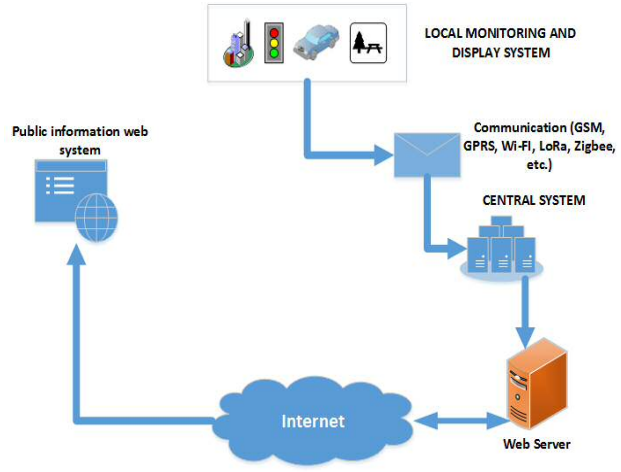

Fig. 2. Conceptual diagram

Defining alert and intervention thresholds for pollutant concentrations in air and ambient air emissions are:

- alert thresholds - concentrations of pollutants reaching values representing 70% of the maximum concentration values allowed by the regulations in force (ORD 592/2002);
- intervention thresholds - concentrations of pollutants exceeding the maximum concentration values permitted by the regulations in force

Identifies causes of exceeded admissible limit values are: PM10 - causes of exceedance of the limit value: industry, city sites and road traffic. Road traffic contributes significantly to the increase in PM10 concentration. [7][10][11]

EXPERIMENTAL RESULTS

There are several indicators that influence air quality. In this project we will use a CCS811 sensor capable of measuring the concentrations of eCO_2 (equivalent carbon dioxide) and tVOC (total volatile organic compounds) in outdoor air. The commissioning of the sensor requires a period of 48 hours of idle operation (first use) and then for 20 minutes until measurements are stabilized (on subsequent system start-ups).

The values provided by the sensor will be recorded in the cloud using the ThingSpeak IoT service. This service is free but requires registration. To send data over the Internet we will use a WiDo-WIFI IoT development board that combines an ATmega32U4 microcontroller (like the Arduino Leonardo or Arduino Uno development board) and a WG1300 WiFi controller (based on the CC3000 integrated circuit). This combination offers the benefit of very simple programming, just like any Arduino board, but also the ability to communicate over a network using a WiFi connection.

The interconnection scheme between the sensor and the development board is in Fig. 3 (the sensor will work at 3.3V and the I2C communication lines are SCL - pin D3, SDA - pin D2).

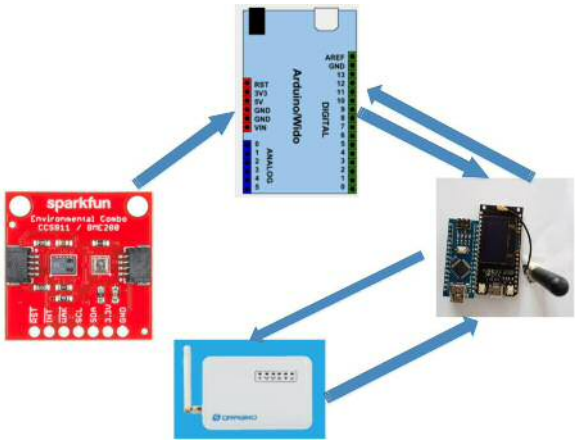

Fig. 3. Hardware design

The program was developed and tested using Arduino IDE 1.8.3 and SparkFun CCS811 1.0.0 libraries and a modified version of the Adafruit CC3000 library - specifically for the WiDo-WIFI development board. The board will be programmed in Arduino IDE as an ordinary Arduino Leonardo board. The data acquired by the sensor will be taken over by the Arduino development board and then sent with the help of a serial connection to an ESP32 Oled development module which in this case will act as a end-node within the LoRa network.[12] The LoRa gateway will retrieve the data and send it to a command and control center. LoRaWAN is a radio transmission protocol capable of forms a smart grid. The setup network uses a star-of-stars topology, with gateways serving as transparent bridges that transmit information between sensors and the central server. LoRa can covers 15-20 kilometers. The compromise for such a distance is a reduced power and a lower bit rate, about 0.3 to 50 kbps.[10] The ESP32 - LoRa - OLED has a 0.96 inch blue OLED display for displaying local information and a Lora transceiver, the SX1276 transceiver for the 868 MHz band. It has a high sensitivity over -148dBm, + 20dBm output power, high reliability and long transmission distance. The onboard Wi-Fi antenna, lithium battery charging circuit, CP2102 interface and USB serial chip, make it the perfect support for Arduino development environment.

Measurement of the two air quality parameters (eCO_2 and tVOC) is affected by ambient temperature and humidity. The sensor library is able to compensate for this by downloading the required values from the program. For accurate measurements, it is advisable to use a temperature and humidity sensor in the system to provide these values dynamically but in our system we will use two constant values. In the loop() section of the program, the data from the sensor will be retrieved and forwarded to the postIoT() procedure that will handle the cloud recording. It is necessary to customize the TOKEN1 and TOKEN2 values in the program, values obtained by defining the two sensors in the ThingSpeak service. Posting will take place within 10 minutes (600 seconds = 600,000 milliseconds). The postIoT() procedure takes the data to be sent to the ThingSpeak IoT cloud service and performs the related HTTP GET communication.

The entire experimental system, composed of the CCS sensor, the Arduino development board, the LoRa communication module (ESP32) and the LoRa gateway equipment, was used to measure the atmospheric pollution caused by vehicle traffic in Petrosani, in front of the Jiul shopping complex, Fig. 4.

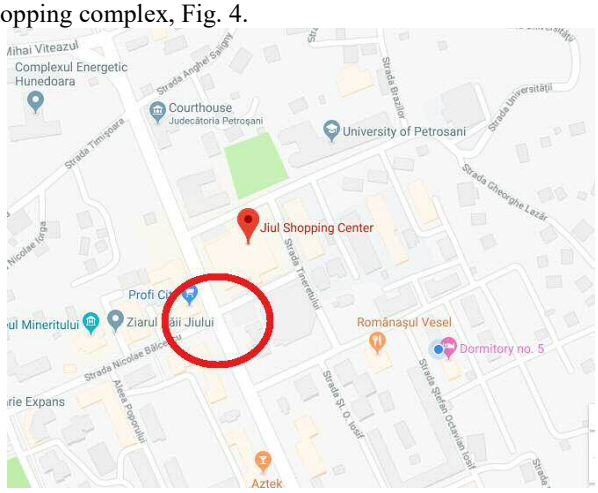

Fig. 4. The monitored intersection in Petrosani (Google Maps)

After setting up the cloud service and uploading the program, we can already see online the recorded data, eCO2 - values between 400 and 8,192 ppm - parts per million, tVOC - values in 0 and 1,187 ppb - parts per billion, Fig. 5 and Fig. 6.

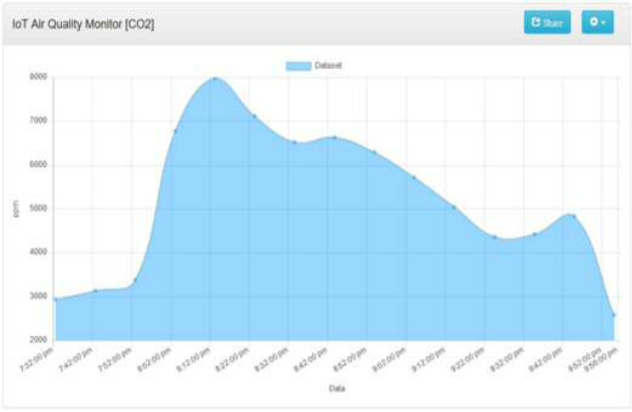

Fig. 5. The eCO_2 graph of the data collected from the intersection monitored

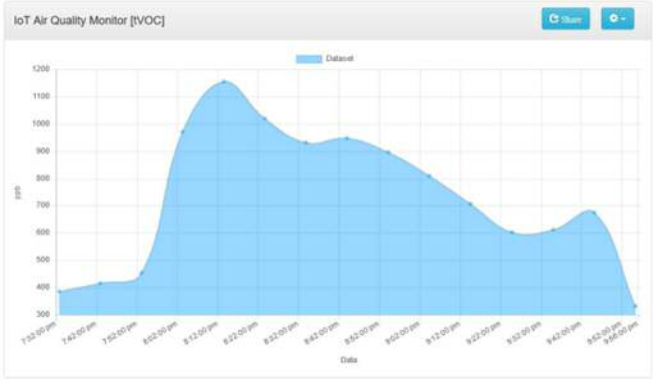

Fig. 6. The tVOC graph of the data collected from the intersection monitored

From the analysis of the data obtained with the monitoring system, it can be noticed that there is an increased level of harmful concentrations resulting from the circulation of vehicles within the measuring range. Higher concentrations of pollutant emissions are observed especially in the time intervals in which time and traffic jams occur. According to all the specialized studies consulted on the measurement of pollutant emissions resulting from the circulation of vehicles on a road traffic road (the level of polluting emissions is well above the maximum admissible values during traffic jams due to incomplete combustion), the results obtained with the implemented monitoring system are validated and can be used in later developments.

Using the data obtained, an interactive map of traffic pollution in Petrosani will be created. The map will be part of a smart application that can be downloaded to any type of phone, laptop or tablet.

The user, with this application, will be able to access any time of day or night all the data on pollutant concentration and can also observe traffic jams. Thus the application user will be able to decide which route to choose, taking into account the fact that the application will reconfigure the route to follow, depending on the traffic jams encountered and the level of pollution on certain traffic routes.

It is also possible to create a system that can automatically control the green traffic light time in order to decongest the road traffic based on the data collected by the air quality monitoring system so that a high level of the concentration of the harmful factors will be reconfigured red or green times downstream and upstream traffic lights monitored area. For example, if system notice a sharp increase in the level of pollution of the intersections monitored, the red traffic light of the downstream traffic lights will increase and the green time at the upstream traffic light will also increase.

V. FUTURE DEVELOPMENTS

In the future, the research also proposes the development of a mobile air quality verification system using the ATV's functional platform.

It is proposed to change the classic gasoline engine of an ATV with an electric motor. It is desirable to implement a driving algorithm of this engine on the mechanical platform of the vehicle. The entire process management algorithm will be managed by a microcontroller like Arduino or Raspberry Pi development boards. Once the ATV's effective driving side has been completed using an electric motor, air quality sensors will be installed to then be used to create an interactive map of environmental pollution in the urban environment.

It has often been observed that motorized air quality monitoring platforms are propelled by conventional gasoline or diesel engines and thus also bring significant pollution inputs.

The use of an electrical monitoring system has as a major benefit the greater accuracy in taking over the pollution detectors because it no longer appears in the data taken and the influence of the pollution of the classic monitoring system using a classic propelled platform.

CONCLUSION

In the context of developing the concepts of smart city and smart grid, the focus is on creating intelligent devices with minimal cost to allow for the monitoring of environmental parameters. In an urban environment, there is an increase in the number of vehicles using road infrastructure, putting a great deal of pressure on the environment and on the health of citizens. This paper presents a low-cost system that allows the acquisition of data on the pollution level in a city. It is also proposed to create an interactive map with the level of harmful concentrations of pollutants in different areas of Petrosani city as well as the realization of a system of auto configuration of green traffic lights in order to decongest road traffic. The experimental system was tested in a traffic light crossing at Petrosani at both peak hours and in some low-traffic intervals, validating the data obtained in accordance with current studies on environmental pollution due to road traffic in a city.

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New Strategy for the Recovery of Rare Earth Elements (REEs) from Hungarian Red Mud

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Abstract: This study focuses on a selective method for the recovery of the rare earth elements (REEs) such as (Sc, La, Y) from the Hungarian red mud which is considered as a waste. Bauxite residue (red mud) is a hazardous waste generated from alumina refining industries. Unless managed properly, red mud poses significant risks to the local environment due to its extreme alkalinity and its potential impacts on surface and ground water quality. Several parameters such as leaching agents, contact time, temperature, and solid to liquid ratio are being investigated in order to achieve an optimum REE recovery from the red mud. The REEs recovery procedure includes using a combination of technological steps acid leaching, solvent extraction and ion exchange adsorption. The acids leaching was investigated in our study. Hydrochloric (HCl), sulphuric (H_2SO_4) and nitric (HNO_3) acids were applied for leaching. The chemical composition of leaching solutions was investigated by ICP-OES techniques. The effect of parameters including different acid concentrations, acid compositions, leaching time were studied.

Keywords: Rare Earth Element, Red Mud, Acid leaching, Scandium recovery.

INTRODUCTION

Red mud is a slimy caustic residue generated from alumina refining of bauxite ores. During the alumina extraction process, about 35 %–40 % of the bauxite ores go into the residue as highly alkaline red mud slurry (pH 10.0–12.5) which contains 15 %–40 % of solid phase in volume **[1, 2].** Depending on the quality of bauxite ores, producing 1 t alumina basically generates 1.0–2.5 t red mud **[3]**. It was reported that the global inventory of red mud reached 2.7 billion tonnes in 2007, and approximately 120 million tonnes of red mud was produced annually in the world **[4].** Red mud is considered a hazardous waste when it has been stockpiled in vast amounts **[5]**. Different disposal methods have been practiced around the world including landfill, deep sea dumping and storage in settling ponds. Despite the harmful impact that these methods pose on our environment, the risks of failure of a poorly engineered storage dam can result in even greater social and economic damage **[6].** Among these applications, using red mud to produce building and construction materials is thought to be a potential way to consume the bauxite residue in large quantities. However, since some valuable metals especially rare earth elements are contained in the red mud, using red mud directly for the production of building and construction materials would lead to a resource waste of valuable metals. Thus, it is thought that recovery of valuable metals from red mud is a necessary and beneficial way from economical and sustainable viewpoints, and subsequently using the residue after metal recovery to develop inorganic materials such as construction and building materials, and ceramics would be a promising direction to effectively utilize this solid waste **[7,8]** Some literature data on the leaching of REEs from bauxite residue are available developed a process for the extraction of REEs from Jamaican bauxite residue using sulfur dioxide, whereby REEs are selectively dissolved while leaving iron and titanium substantially undissolved in the bauxite residue **[9,10,11,12]**. **[13]** found that at a reaction temperature of 90 C and an L/S ratio of 3:1, over 80% of the scandium in bauxite residue could be leached by H_2SO_4. **[14]** recovered 80% of scandium by HCl leaching at acid concentration of 6 mol/L HCl, L/S ratio of 4:1, temperature of 50 C and a reaction time of 1 h. **[15]** studied the extraction of scandium from bauxite residue by using HCl as leaching agent, with an L/S ratio of 5:1, an acid concentration of 6 mol/L, a reaction temperature of 50 C and a reaction time of 1 h. **[16]** leached REEs and radioactive elements from bauxite residue by bioleaching. Determination of the composition of rare earth metals in this work was carried out on samples taken from the slurry reservoirs at Ajka. The red mud disposal facilities in Ajka contain 35 Mt (with 70% dry matter content) of red mud. The objective of the research was to determine the rare earth metal element components of the Hungarian red mud and to compare the efficiency of the microwave digestion with that of the classical

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acid digestion. The solutions obtained during the digestion were analyzed with ICP-EOS method to determine the rare earth metal components in red mud (Nd, Sc, Ce, Gd, Sm, La, Y, Pr, Eu, Dy, Ho). The impacts of the digestion conditions and acid mixture applied on the efficiency of the metal recovery were studied as well.

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Internet of Things Reliability Assessment based on Monte Carlo Simulation

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Abstract: Smart devices are by this time frequently in our daily lives and new ideas of using the internet will be shaped all the time. More than 50 billion devices are expected to become a part of Internet of Things systems in the following decade. These devices will become omnipresent and involved in every aspect of life, ranging from wearable devices to sensors monitoring industrial processes. The goal of today companies is pointing into a sustainable environment, and Internet of Things can assist this acceleration, becoming a game-changer for sustainability.

Keywords: Internet of Things (IoT), reliability, embedded systems, Monte Carlo simulation

I. INTRODUCTION

Internet of Things (IoT) can impact a multitude of systems, such as industries, infrastructure, smart cities, clean energies, healthcare, transportation etc., by impacting areas that older technologies could not [1]. Overall, the impact for the environment and the expectations for sustainable systems is highly considerable. The next step in the computing era is already based on this idea, where the information and communication components are invisibly embedded in the surrounding environment. These systems can be integrated in different entities to make the world a sustainable place [2].

Reliability of systems plays a key role in the developments of an IoT system as it contributes to interoperability, compatibility, security, sustainability and effective operations between common technical solutions [3]. During the past years, following the evolution of computing power, new approaches needed to be found for taking into consideration the importance of different components and the impact to the environment.

The motivation of this paper is driven by fast and continue evolution of the Internet of Things systems and its important position in the context of Information Technology era and the development of the society. Internet of Things devices are extremely sophisticated and for improving intercommunication speeds, they will need to be closer to sensors and would be exposed to extreme temperatures, humidity, mechanical vibrations and shocks or fumes.

This paper aims to present a new idea for estimating hardware and software reliability given uncertain conditions to calculate probabilistic estimates for overall system reliability. The reliability of the system can be computed using Monte Carlo Simulations, simulations that relies on repeated random sampling and statistical analysis to compute the results.

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II. STATE-OF-THE-ART

The concept of "green" IoT was adopted due to increased energy consumption and excessive usage of devices. Further, trying to achieve a sustainable environment for IoT according to [4], different approaches can be adopted for designing energy efficient systems and energy efficient transmission of data from sensors. To the extent that more research is required for developing generic solution for IoT architecture for increasing the reliability and sustainability of different systems, one faster approach is given by usage of recyclable materials for developing sensors and devices.

Different other approaches have been suggested in literature about Internet of Things sustainable applications. Practical examples of potential future systems for a sustainable environment are mentioned in "An IoT based Sustainable Water Management" [5] and "The IoT in Agriculture for Sustainable Rural Development" [6]. These systems can have a direct impact into raising the living standards of people, supporting poverty, facing crisis etc. Green initiatives are fundamental in developing new future systems to succeed keeping the earth clean and sustainable.

III. PROPOSED SOLUTION

The following chapter describes the process for an Industrial Internet of Things service which contains a generalized structure. The system is designed according to the situation demands and user requirements. The entire functionality is based on a fire alarm system inside an industrial plant.

It starts by periodically receiving real time data from different temperature sensors and smoke sensors. A controller is constantly analyzing if the temperature received from the sensors is above the threshold and if the detected smoke is above the normal limits. If the data received by the controller is below the thresholds for both categories of sensors,

therefore there is no problem detected inside the process. Based on the above description, the smart fire alarm detection system can be represented as a common network topology which contains the hardware components (sensors and controllers) and required software to grant its purpose.

The structure above can be used to perform sensitivity studies to determine which factors are most influential in overall reliability and the predictability of this system to affect the environment. This can help identify a specific problem (hardware component or software issue) for meeting reliability target. This can be used also for modifying the requirements if the system is not functioning properly in sustainability terms [7].

By studying different characteristics of sensors and components in the above model, a reliability measure R(t) can be computed, as the probability of the entire system to be in an operational state during the interval [0, t]. The reliability can be measured individually for every component and for the entire system. After computing the probabilities of reliability, a user can forecast the overall behavior of the system [8].

The above process is applied to some representative industrial applications: estimating the impact of various conditions on the reliability of two component types in an industrial system. The methodology can be extended to software applications in a network: different interactions between hardware and software, resource consumption, delay between software and hardware components.

IV. RESULTS

Analytical approach of estimating the reliability of the system, where mathematical formulas need to be used to compute the values for reliability, has its own withdrawals. The Monte Carlo simulation is a probabilistic and a closer approach to real environment. With the support of several test cases, it can be analyzed how reliability is impacting the design of different products. The use of Monte Carlo simulation combined with experimental data for estimations can help to identify reliability problems and requirements.

Creating an Internet of Things system, the reliability of components could be estimated with the solution previously presented in this paper for obtaining an optimal design from different point of view. The resources could be allocated in a smarter and sustainable manner, which is crucial for design decisions made in the IoT world, where cost and performance needs to be in a tight connection with the environment.

V. CONCLUSIONS

Internet of Things gathers new reliability challenges for a new computing era based on sustainability, where the most critical sector is represented by uncertain use conditions and different environments. New methods for estimating the reliability of Internet of Things systems is needed to keep up with the constantly evolution of “green” technologies and the need of a sustainable environment.

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Local Sustainability Strategies by Approaching Urban Resources Consumption

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Abstract: Human economic activities, especially industrial ones have the defined goal to support increasing human quality of life. Nevertheless these can have beside positive direct and desired effects also negative, undesired and sometimes unthinkable impacts on environment and society. With the goal of assuring sustainability of our human society it is therefore needed to assess economic activities, especially industrial processes not only from economic and technical points of view but from environmental and social ones as well. Many actions have emphasized that successful operationalisation of sustainable development means considering different levels, global, national, regional as well as on local level. In this regard resources consumption is relevant to be assessed in the effort of finding future alternatives for renewable resources, based on water, wind, and solar energy to be used in urban areas. General notions regarding sustainability will be presented, as well as application examples with regard to urban resources consumption. Gaining strategies on local level means actually developing strategies for urban sustainability in cities. It will be emphasized that there is still no agreement regarding a general definition for a sustainable city or there is no complete agreement upon paradigm for what components should be included in this concept. Connected to this idea, developing a kind of a "general methodology" to be applied into the practice for real concrete situations by taking into consideration regional differences would represent a major progress in this field. Existing possibilities to assure adequate urban resources consumption for getting local sustainability will be emphasized by guaranteeing minimal environmental and social impacts. Obtained results will be debated and conclusions concerning the usage potential will be drawn.

Keywords: Local Sustainability, Urban Resources, Consumption Patterns, Environmental Impact

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INTRODUCTION

Human economic activities, especially industrial ones have the defined goal to support increasing human quality of life. Nevertheless these can have beside positive direct and desired effects also negative, undesired and sometimes unthinkable effects on environment and society. With the goal of assuring sustainability of our human society it is therefore needed to assess economic activities, especially industrial processes not only from economic and technical points of view but from environmental and social ones as well. Debates about regional and local environmental quality are nowadays especially connected with the concept of sustainable development. After the Conference for Environment in Stockholm 1972 and after the release in the same year of the first report to the Club of Rome „The Limits to Growth" it was understood that besides wanted effects of the technological progress, undesired and negative effects can appear, not only because of developing, but because of using new technological applications [8]. It was clear that the arisen environmental and social problems are very serious and need to be solved. After this time the environmental awareness began changing, currently actually debating about sustainability awareness [6]. The concept of sustainable development, defined for the first time in the Brundtland Report was accepted as a possible solution for the global complex economic, environmental and social challenges [5]. This concept was very large discussed 1992 during the Conference for Environment and Development in Rio de Janeiro, so-called "Rio" - Conference, stated in the closing document „Agenda 21", as well as debated 2012 during the "Rio+20" - Conference. Happenings after this time have emphasized that developments of technical, social and environmental systems has to be analyzed in synergetic relation, in order to succeed the successful operationalization of sustainable development on different levels, on global, national, regional as well as on a local level [2, 6, 10].

GENERAL METHODOLOGY FOR GETTING LOCAL SUSTAINABILITY

Existing interest for concretely applying sustainable development has brought opportunities to debate in various circles necessary steps to be followed in order to correctly operationalize sustainability on various levels if possible by following more or less a kind of unique way [2, 6, 9]. Going

into details, the vision of having in the future *sustainable cities*, by taking into account regional differences, is presently worldwide still a pretty discussed topic in different occasions, also has started to be intensively debated in some Eastern European countries [2].

The vision of having in the future *sustainable cities* on a global level is in the meantime without doubt an important part of national and local development strategies in different countries all over the world [7]. In this context also in Romania debates in this field have already started, firstly on scientific level, then also on adminsitrative level with regard to necessary frameworks for achieving local sustainability, as for instance in the city of Alba Iulia , known as the historical capital of Romania [3].

Anyway these examples in Romania together with other ones in other countries in Europe and also worldwide have brought the idea concerning working out a kind of a *general methodology* for shaping *sustainable cities* [13]. This methodology should be in accordance to the already developed and applied methodologies in other European countries by taking into consideration specific differences especially on social and cultural level [2, 6, 13].

In this context the general methodology for getting *local sustainability strategies,* by applying sustainability systemic analysis on a local level can be obtained [1, 12, 13]. Such a *methodology* for local sustainability could be materialised in the following steps [13]:

- Defining the sustainability problem on a local level;
- Establishing specific space and time scales;
- Establishing concrete aims for the considered case;
- Systemic approach of the region by modelling corresponding interactions, especially in the field of using urban resources;
- Developing concepts/measures by establishing priorities;
- Developing evaluation/control instruments by Sustainable Development Indicators applied on local level;
- Verifying possible results, which could be obtained after introducing the proposed measures for getting sustainable urban resources consumption, by developing some appropriate scenarios;
- Applying into the practice the developed concept.

When analyzing the presented methodology for getting local sustainability strategies, one can recognise that urban sustainability means actually a transformation process under changeable frame conditions, as actually the general debate about sustainability operationalisation [3, 6, 9]. Recognizing existing possibilities for *local sustainability management*, as presented in Figure 1, means actually to emphasise the development direction on local level [12, 13]. This fact is possible to be carried out by simultaneously considering economic, ecological and social aspects and representing them on the axis, as shown in Figure 1, by using relevant indicators for each considered aspect [9]. Assessing various potential development paths is possible, if desired (D) or undesired (U) ranges can be defined for each considered aspect, as emphasized in Figure 1. If got development by applying proposed strategies is situated in the ”sustainable action range”, means that Local Sustainability will be assured. If the development is situated in ”unsustainable range”, the vision is to make corrections by introducing specific measures in order to finally get Urban Sustainability, as emphasised in Figure 1. This concretely means to develop and apply local strategies, not only in technological and economic fields, but also in environmental and social ones, by considering sustainability requirements.

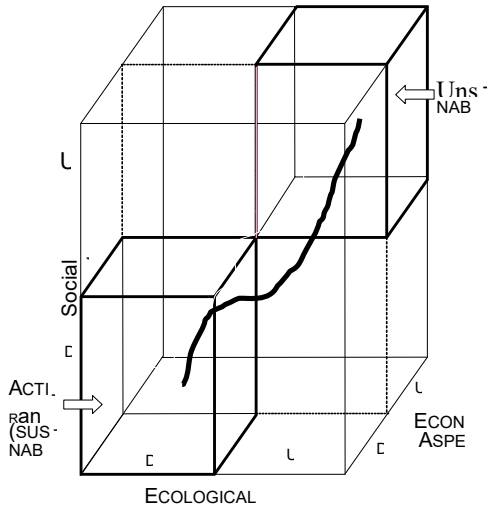

FIGURE 1: LOCAL sustainability management in the context of of a potential local developing path.

URBAN RESOURCES CONSUMPTION AND LOCAL SUSTAINABILITY

The goal was and still is to find the best strategies for assuring the sustainability of our society, by taking into account the multitude of aspects related to economic and social activities. In the meantime there is a general conviction that sustainability of our human society cannot be achieved without assuring an appropriate environmental quality.

For the operationalization of sustainable development appropriate strategies for economic, environmental and social developments have to be applied. This means that resources consumption is very important to be analyzed and assessed in the effort of finding future alternatives for using renewable resources, based on water, wind, and solar energy. The attempt is to develop strategies to be used on urban areas and actually not only, as the application example presented by the European Environment Agency, EEA with regard to getting urban sustainability by shaping a resource-efficient city [15].

The attempt is to take into consideration the negative impacts on environment and society as early as possible because of using certain resources, as fossil fuels and renewable energy resources. In this context several alternatives regarding urban resources consumption, their art and their availability, can be analyzed and debated for

supporting the sustainability assessment process [4]. The relevance of urban resources consumption has been recognized since a while, as these resources could be renewable but also non-renewable ones. Just to mention here electric power plants based especially on fossil fuels which are the main part of the electrical energy supply systems delivering especially electrical energy. Or mentioning water supply systems used in urban areas, which are assuring clean and drinkable water, necessary in different daily human activities [4].

Gaining strategies on local level for sustainable urban resources consumption means actually developing strategies for urban sustainability in cities [1, 4]. The vision of having in the future sustainable cities, by taking into account regional differences, is currently worldwide a pretty discussed topic [1]. It will be emphasized that nowadays there is no agreement regarding a general definition for a sustainable city or there is no complete agreement upon paradigm for what components should be included in this concept [2, 13]. Connected to this idea, developing a kind of *general methodology* to be applied into the practice for real concrete situations by taking into consideration regional differences would represent a major progress in this field, just to come from vision of sustainable cities to reality [6, 13]. Assuring proper urban resources consumption for getting local sustainability means actually to apply developed methodology for real cases by assuring minimal unwanted environmental and social impacts [4].

SUSTAINABLE URBAN DEVELOPMENT IN ROMANIA

In order to emphasize newer activities in Romania in the field of shaping sustainable cities the example of the Alba Iulia Association for Intercommunity Development (AIDA) is used [14]. AIDA is actually representing a Romanian NGO, representing the interest of several communities, 3 urban and 8 rural communities. This association of 11 local administrative units represents the interests of more than 120 000 inhabitants. AIDA has the goal to get a socio-economic development on a regional level, based on different actions [3, 14].

The most important city of the association is Alba Iulia, having about 66000 inhabitants, a city which constitutes a hystorical symbol for Romania. The city Alba Iulia has a Development Strategy that aims to acknowledge the urban mechanisms as a positive force in improving housing standards, as well as equity and sustainability standards [14].

The Strategic Development Plan is to address issues related to improving pedestrian areas quality and public space areas and also to improving accessibility in the historical part of the city, which is pretty relevant for the History of Romania [14]. Environmental policy of Alba Iulia is targeting transport issues, as tourism activities are very developed in this city [3].

The Association AIDA has some Strategic Objectives with the vision of improving all human life aspects, most relevant ones being developing local and regional infrastructure, economic progress by developing new jobs, promotion of “green energies”, promotion of local cultural values and of traditions, improving educational, social and health infrastructure, and building partnerships [14].

AIDAsustainable development strategy is emphasising [14]:

a. Need of Transnational Cooperation for getting Urban Sustainability. This was actually since long recognised, on a global level [1, 6, 12, 13]. By carrying out such cooperations, especially projects in educational field can be carried out;

b. Holistic Education for Urban Sustainability. This field has the goal to change people mentalities. In his book "Continuity, Innovation and Change", HRH Prince Hassan, former President of the Club of Rome, pointed out the need for education as a key issue for achieving the three human goals: *continuity, innovation, and change*, which actually are fundaments of sustainable development;

c. Establishing exact requirements for sustainable urban development in Romania. This is a main aspect because actually sustainability has to be defined for each concrete situation. For applying this concept there is a need to evaluate systems in an integrated way. There are different problems regarding urban sustainability in different parts of the world, each case has specific regional frameworks [1].

From the made presentation it follows the need to develop *a Romanian general profile of a sustainable city*, by taking into account specific frameworks [12, 13].

Among resources needed for sustainable urban development water supply is a relevant topic. In this regard is necessary to develop an appropriate water supply system for assuring needed urban water consumption, calculations being generally made for 25 years time period by considering different developing scenarios with regard to population number, industrial development, services etc. Future water need can be estimated with these considered different scenarios, thereafter the technological flow for water distribution from water supply damkj. to consumers can be established. In this regard main component elements of water supply systems can be recognised, such as at water collection, conduit pipes, water treatment points, water supply dams, water distribution pipes, equipments for water pressure assurance. These elements can be dimensioned according to necessary urban water flows.

Dimensioning water supply networks means using basic relations and knowledges from hydraulics in order to be able to develop appropriate urban water supply systems. Such a system is actually composed of several pipes and hydraulic elements, calculated by using different equations, most relevant being the continuity and Bernoulli equations as well as Torricelli formula [11]. The continuity equation, (1) is used, for instance, for calculating the necessary volume flow rate, Q or the flow velocity, u, when the density of used fluid, ρ, and the pipe surface, A are known:

$$Q=\frac{\Delta m}{\Delta t}=\frac{\Delta(V\cdot\rho)}{\Delta t}=\frac{\rho\cdot\Delta V}{\Delta t}=\frac{\rho\cdot A\cdot\Delta l}{\Delta t}=\rho\cdot A\cdot u \quad (1)$$

Bernoulli equation, (2) is an energy balance equation, expressing that the sum of all energy types during fluid flow, dynamic energy, pressure energy and potential energy, is constant.

$$\frac{u^2}{2} + \frac{p}{\rho} + gz = konst \qquad (2)$$

where: u is the flow velocity
p –pressure
ρ – correspunding density

By using hydraulics background together with urban sustainability strategies it is estimated that in the future urban resources consumption will be got.

CONCLUSION

By making this analysis follows as a main conclusion that nowadays there is not yet clear established what are general requirements for sustainable urban development or there is no complete agreement regarding what components should be included. There is generally agreement on the fact that by respecting the requirements of the concept of sustainable development, a sustainable city should meet the needs of the present without compromising the ability of future generations to meet their own needs. Sustainability vision leads to having the possibility to use several strategies in terms of how cities carry out their attempts to become sustainable. However, a sustainable city should be able to feed itself with minimal reliance on surrounding available resources, should mostly use renewable energy resources and should develop a sustainable water supply system. Presently recognized objective is represented by generally promoting sustainable urban development, by taking into account aspects related to this issue such as technical, economic, social and environmental aspects. For shaping a sustainable city the field of adequate living conditions and housing space has to be taken, together with proper resource use, mobility activities, governance and high social life of city inhabitants. It follows that there is a need for interdisciplinary work among economists, engineers and social scientists. Developing a kind of ”general methodology” to be applied for real concrete situation by considering regional differences is a real advance.

For assuring a sustainable urban development it is appropriate that cities are building partnerships in international networks of sustainable cities. On the other side the foremost goal is represented by finding appropriate ways to establish strategies for sustainable urban development in Romania by considering existing ways for sustainable urban resources consumption, especially considering water supply systems.

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Fishery Composition and Production of Rodopi Lagoons (Xirolimni L., Mavrolimni L., Aliki l., Ptelea L. & Elos L.) Aiming to their Sustainable Management

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Abstract: The five lagoons of Rodopi's Prefecture, as Xirolimni L., Mavrolimni L., Aliki L., Ptelea L. and Elos L., are located in Northern Greece, in the area district of West Thrace, south of Komotini city. The total area of the above five lagoons is 1100 ha. All lagoons communicate separately with the sea through narrow canals, and only between Ptelea and Elos Lagoons, there is a connection. In this paper, the total and the analytical fishery production per fish species through time are presented for more than 33 years (1983-2016). Simultaneously, we examined the composition of the fishery production, which is presented per decade and lustrum. During the period studied, the grey mullets (fam. Mugilidae) were the main catch in all lagoons, as well as the sea bream was one of the most important catches of the Xirolimni and Aliki Lagoons, while the sea bass was the major catch of Aliki, Mavrolimni and Xirolimni Lagoons. Other important fish catches were eels that were mainly fished in Ptelea and Elos Lagoons, at a specific time every year, but their yields had a very small contribution in the total fishery production. The results of this paper can support to understand and propose appropriate solutions for a maintainable fishery in the above lagoons, aiming to their environmental friendly management.

Keywords: Environmental management and sustainable development (EM&SD), Rodopi's coastal lagoons, fishery production, fishery composition, fishery management

INTRODUCTION

This paper focuses on the south area of Rhodopi Regional Unit (Region of Eastern Macedonia and Thrace), where five of the seven lagoons studied in this work are located: Xirolimni (Fanari), Mavrolimni (Karatza or Arogi), Aliki (Messi), Ptelea and Elos. The last two lagoons communicate between them and are grouped together so their productions are examined like a complex lagoon. These lakes joined the "Wetlands of International Importance" with the Ramsar convention. Also are included in the GR1130009 site of Natura (Lakes and Lagoons of Thrace) with total area of 29,455.98 ha [1]. The lagoons are "closed" type and the total water surface of the five lagoons is about 1100 ha and are part of the National Park of Eastern Macedonia and Thrace (Fig. 1).

Fig. 1. Map of Greece and the lagoons of Rhodope (Region Eastern Macedonia and Thrace)

The five lagoons and in detail four ecosystems, as Xirolimni (XL), Mavrolimni (ML), Aliki (AL) and Ptelea – Elos (PT), studied in this study, are located in the southern part of the Rhodope Regional Unit, covering a total area of about 1100 Ha and have a surface from 150 to 400 Ha. The adjacent rural areas are considered the main pressure on the ecological state of the coastal lakes environment along with extreme weather phenomena, pollution, overfishing, other human activities and nuisances, etc [1]. This paper presents the changes in fishery production and the composition of catches in five lagoons of Rodopi over a period of 34 years. This study aims at a sustainable management of coastal lakes in the region.

MATERIAL AND METHODS

The lagoon Xirolimni (Fanari) has an area of 250 ha and is located on the west side within the Fanari settlement. The Mavrolimni (Karatza) has an area of 150 ha and is close to the settlement Arogi. The Aliki (Messi) has an area of 300 ha and is located between Mayrolimni and Ptelea and finally the complex of Ptelea-Elos with a total area of 400 ha located in the eastern part of the lagoons (Fig. 1). Fishing was carried out principally with the fish trap facilities of the lagoons.

These lagoons are characterized by different morphological

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characteristics, (Tab. 1).

The fishing data of the lagoons used in the work derived from the Rhodope Fisheries department of the officially deposited productions from the landholders of the public lagoons and relate to the period 1983 to 2016, except data of the Ptelea-Elos, which covering the period 1983-2011.

Till recently, the fisheries management was done by three different lessors fishing cooperatives for each lagoon: F.C. Maronia (Ptelea, Elos, Ismarida, Limni), F.C. Messi (Mavrolimni, Aliki) and F.C. Fanari (Xirolimni). This has changed in recent years with the revision of the legislation and several entities (persons or firms) have emerged bidders in the lease auctions of public fish farms- lagoons and have become these landholders of lagoons replacing the fishing coops that exploited the lagoons for many decades. This fact has had consequences for the management and the productivity of lagoons in recent years.

Data of species of the family of grey mullets (fam. Mugilidae), concern 5 species: *Mugil cephalus, Liza aurata, Liza ramada, Liza saliens* and *Chelon labrosus* are grouped as "grey mullets" or " Mugilidae". From the annual fishery productions, calculations were made for the cumulative (total) fishery production and for the average production of the Rodopi lagoons, for the entire period of the study. In addition, the analytical productions for the main species of lagoons were calculated and presented in diagrams illustrating the fluctuations of the annual productions. At the same time, the composition of the fishery production was investigated, which is presented for all the years examined and the total production has been assessed. These production data have been grouped in decades and lustrums, yielding cumulative and average production at longer intervals, seeking to make useful conclusions and avoid errors arising mainly by the influence of opportunistic environmental factors or limited management errors.

RESULTS

As shown in Tab. 1, the largest system in area of lagoons studied was Ptelea - Elos and then follows Aliki, Xirolimni and the smallest of them was Mavrolimni L. The ratio of average productions (mean landings, - in kg) per lagoon shows the high contribution of Ptelea - Elos with a 40% in the total of the average production of 5 lagoons and the low of Mavrolimni with 11% (Fig. 2). The annual mean landings (catches) of the five lagoons was 26.5 tons and productivity was 23.5 kg/ha/year. The highest production has Xirolimni with 29.3 kg/ha/year and followed by Ptelea-Elos with 26.2 kg/ha/year, Aliki with 19.6 kg/ha/year and last Mavrolimni with 18.7 kg/ha/year.

These productions and productivities are relatively low compared with other lagoons of the wider region, such as the four lagoons of Nestos (Keramoti, vasova, Agiasma, Eratino) with a similar surface (Rhodope: 1100-Nestos: 1200 ha) in a similar period, had production of almost 5 times more and productivity of 107.6 kg/ha/year [1, 2].

The total production of the five lagoons for the considered period was 848.4 tons with the Ptelea-Elos lagoons having a total production of 303.6 tons, Xirolimni production was 249.4 tons, Aliki 199.9 tons and finally Mavrolimni 95.5 tons (Fig. 3).

Table I. Landings and productivity for most important species of 5 Rodopi lagoons (1983-2016)

Lagoons	Surface Area (ha)	Mean Landings (kg/y)	Mean Landings Productivity (kg/ha)	Mugilidae (kg)	Sea bream (kg)	Sea bass (kg)	Eel (kg)	Various species (kg)
Xirolimni	250	7336	4802	756	348	96	1334	4802
Mavrolimni	150	2808	2046	176	130	29	427	2046
Aliki	300	5879	4160	619	288	34	778	4160
Ptelea-Elos	400	10470	8429	485	95	651	810	8429
TOTAL	1100	26493	19437	2036	861	810	3349	19437

In the five lagoons of Rodopi, the contribution of the main fish species to the total production of lagoons for the period 1983-2016 (*1983-2011 Ptelea-Elos) were: Mugilidae with 619 tons were the dominant fish catch in total production of lagoons, followed by sea bream (*Sparus aurata*) with 67 tons, sea bass (*Dicentrarchus labrax*) with 29 tons and the Eels (*Anguilla anguilla*) with 24 tons.

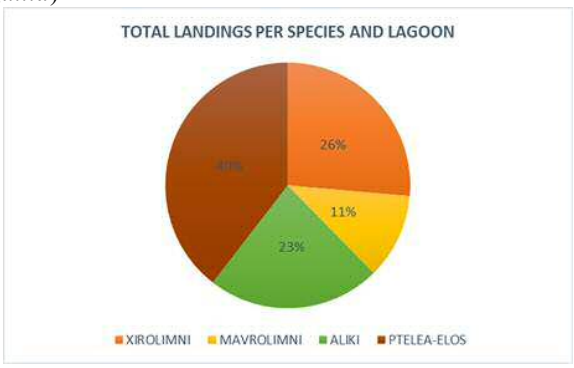

Fig. 2. Percentage of total production per lagoon (1983-2016) Figure 2. Total productions for the main species per lagoon (1983-2016)

Soles catches were just 4 tons, carps have very small yield (17 kg) while the “other” species were 890 kg of total production of the five lagoons.

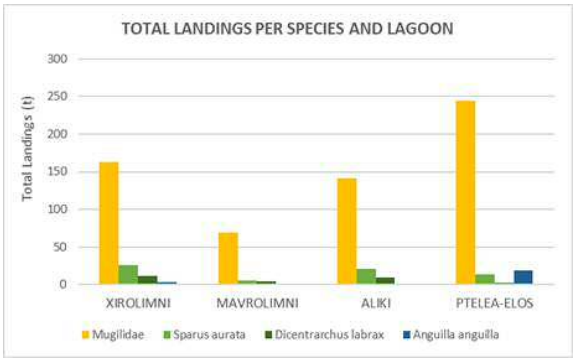

Fig. 3. Total productions for the main species per lagoon (1983-2016)

Comparatively between lagoons (Fig. 4), the contribution of grey mullets to the total production ranged from 65% in Xirolimni to 81% in Ptelea-Elos. Sea bream has 11% of total

production in Aliki, 10% in Xirolimni and only 6% in Mavrolimni and 5% in Ptelea-Elos while sea bass in Aliki, Mavrolimni and Xirolimni, represents 5% of the total production of each lagoon while in Ptelea-Elos has a low rate of 1%. Eels had 6% of the total production in Ptelea-Elos while in the other lagoons they had minor productions (1%). Finally, the 'Other' species had very little contribution to the total production of each lagoon (0.1%). The fluctuations in the production of the main species of the five lagoons (Fig. 3) show that Mugilidae are the largest percentage of fishery production (73%), following by sea bream (8%). and sea bass (3%). In Fig. 4 are presented the fluctuations in the production of the main species of the five lagoons identified by the study.

There is an intense variance in the production of grey mullets, the 1988 was the year with the highest production while in 1993 the production decreased but recovers until 2009 and then decreases continuously until 2016.

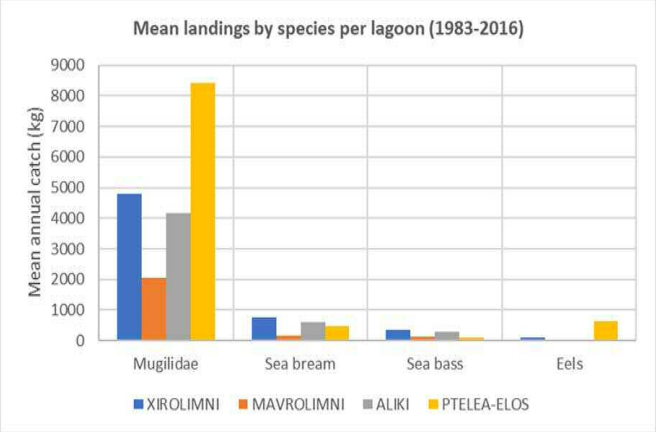

Fig. 4. Mean landings by species per lagoon (1983-2016)

The fish species of lagoons move for breeding to the sea and thus are captured at the exits at the fish capture facilities of the lagoons and therefore their fishing production depends on the abundance of spawn that will enter the lagoons in previous years. The sea bream (*Sparus aurata*) is the highest value fish species in the lagoons of the region with productions up to 1998 fluctuated in low numbers apart 2 years (1986-87) with considerable catches (Fig. 5). Later from 1999 to 2005 increased productions were recorded while in the 2006 presented a decrease in production. Since then, the production of sea bream increased until 2013, when the maximum output is recorded (6006 kg) and then decreases until 2016. The sea bass (*Dicentrarchus labrax*) that is also a high-value fish species in lagoons, until the year 1997 shows low yields in the 5 lagoons and after 1998 the landings increased, and the maximum catches recorded in 2005 (3634 kg) and remained in high yields until 2013 and then decreases until 2016 (Fig. 6). Finally, eels (*Anguilla anguilla*) have very small catches (3%) and increased productions were recorded from the years 1983-1990 main in Ptelea-Elos (80%) while from years 1991-94 the productions are constantly declining and after 1995 the catches disappeared.

Analyzing total catch data per lustrums (Fig. 6), reveals that on the 1st (1983-1987), the 2nd (1988-1992) and the 4th lustrums (1998-2002) the largest catches were in Ptelea-Elos lagoons. Respectively, the 3rd (1993-1997) and the 6th lustrums (2008-2012), Xirolimni was the most important lagoon in terms of catches while at 5th lustrum (2003-2007) the highest catches were recorded in Aliki (Fig. 6).

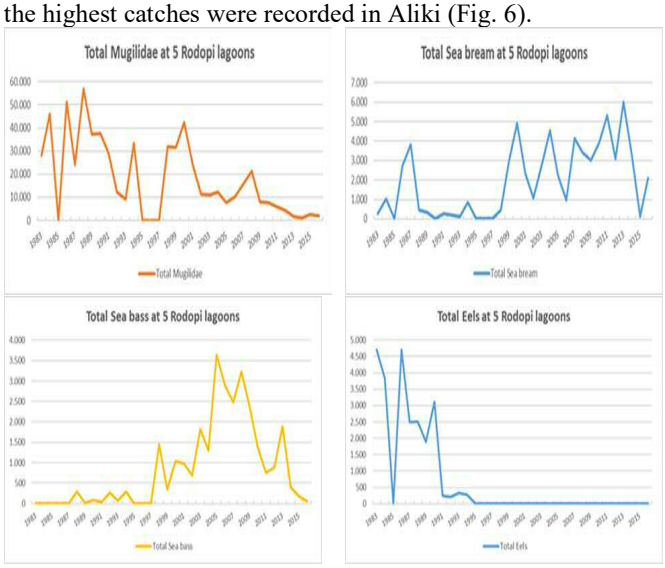

Fig. 5. Annual fluctuations in fish production of the main species of lagoons

At Xirolimni lagoon the production (except 1992-93) was upward up to the maximum of 1998 and then followed downward trend and outbreaks (2007, 2010). Later a dramatic drop in production was occurred and in the last 8 years reaches 40% of the average production of the lagoon. Grey mullets up to 2002 dominated with an average rate of 86%, while subsequent lustrums falls from 77% to 47%. Sea breams occurred with 10% in the five years 1998-2002 and then increase their participation in production to 23% and 37% over the last five years. Sea bass emerged from lustrum 1998-2002 with a fraction of 6% and in the next lustrums have a participation from 22% (2003-2007) to 10% (2008-2012).

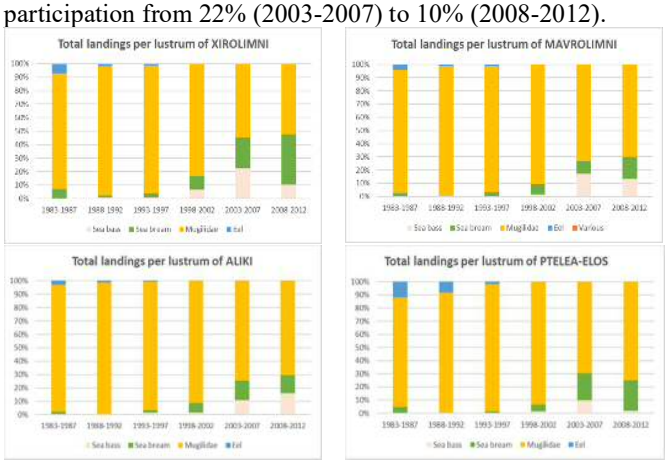

Fig. 6. Total landings by main species per lustrum for the Rhodope lagoons (1983-2016)

At Mavrolimni lagoon, generally low productions were observed compared to other lagoons with augments and declines, but from 2000 onwards we have a solid reduction of already small production. Production decline during the last 8 years was 39% of the average production of the lagoon. Until 2002 grey mullets dominated with 90%, while during next lustrums their participation falls to 73% and 70%. Since 1993, sea bream appeared gradually with 8% during years 1998-

2002 and then the contribution of this species to the total production increased up to 10% and 17% over the last lustrum. At Aliki lagoon there is notable production until 1990 while during years 1991-94 production decreased and increased after 1995 to a maximum production at year 2000. Afterward follows a course with rises and falls (2008). The decline of production in the last 8 years corresponds to 58% of the average production of the lagoon. Also, in this lagoon until 2002 the catches were dominated by Mugilidae with a percentage of 94%, while the next lustrums their participation falls to 74 and 70%. During the lustrum 1998-2002, sea bream gradually appeared (7%) and increased to 14% of the contribution to the catches throughout the last two lustrums. At Ptelea-Elos lagoons increased productions were observed from 1983 to 1993. Year 1998 was the year with the greatest production and then a strongly declining course with the productions of the last 8 years to be the 22% of the average production of 30 years. Up to 2002, Mugilidae dominated with proportion close to 90%, while subsequent lustrums fall to 68% and 72%. From 1998, sea bream appeared gradually (5%) and then increased the participation in production up to 22% in the last lustrum.

DISCUSSION AND CONCLUSIONS

From the analysis of the fish production we have observed that up to 2002 the grey mullets (fam. Mugilidae) dominate with an average rate of 86-94% in all examined lagoons, and then in the subsequent lustrums, the total fishery production following a steadily declining course falls to a lower level at 47-72%, as the production of other species increases at the same time. From the lustrum 1998-2002, sea bream appears in all lagoons with percentages from 5-10% and then increase significantly their contribution to the total production and reaches in the last five years 14%-37% depending on the lagoon and the fishing management applied

Sea bass appear for the first time only in Xirolimni in the five years 1998-2002 with 6% while in the other lagoons they appear from the next lustrum 2003-2007 with percentages varied from 9-17%. In the following lustrums, a significantly increased of their participation was observed in the total production (13%-22%), while especially in Ptelea-Elos, participation decreased dramatically (2%) in lustrum 2008-2012. Therefore, the reduction of the contribution of the grey mullets was directly related to the increase in production of sea bream and sea bass in the same period.

The results of this work show that the trend of the fishing catches over the last 8 years in the lagoons was a dramatic decrease in total production, with numbers of concern: Xirolimni: 40%, Mavrolimni: 39%, Aliki: 58% , Ptelea-Elos: 22% of the average production of each lagoon. If the production data deposited in the fisheries services are accurate, there is a serious question of the future management of these important ecosystems, as if the current management continues, and there is no possibility of improving fishery production and return to the levels of the previous decades. It is proposed to strengthen natural stocks with offspring through enrichment, and the dredging points that accept silting for better recycling of water. Environmental stability and good preservation of an aquatic ecosystem are the most basic principles accepted by the global scientific community, since the management strategies developed in it have the conservation of their biological resources [2, 3, 4].

The reasons for the reduction are many, such as climate change, extreme weather phenomena, overfishing, bird populations, urban and rural pollution, human nuisances, successful reproduction in the marine environment and entrance to the lagoon, the concealment of elements, the increased taxation etc. (4, 5, 6]. Several reasons could be found for the dramatic decrease of fish catches, such as climate change, extreme weather phenomena, overfishing, bird populations, urban and rural pollution, human nuisances, successful reproduction in the marine environment and entrance to the lagoon, concealment of catch data, over-taxation etc. [4, 5, 6]. Should not forget the change in the way in which public lagoons were leased by auctions and the consecutive alteration of many landlords from fishing cooperatives to persons.

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Monitoring of CO_2 uptake by microalgae in indoor environment

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Abstract: Indoor environments are prone to CO_2 accumulation, which is known to affect the comfort parameters. In this study, CO_2 uptake by microalgae in a 2L sparged reactor processing air from indoor environment is evaluated in order to provide starting benchmarks for further biosystem development in the light of a specific environmental application related to air treatment in closed environments (that could address not only CO_2, but also other contaminants removal) such as spacecraft cabins, but not limited to. The study has been performed under dynamic conditions by using *spirulina* (*Arthrospira platensis*) as microalgae model. Biological CO_2 uptake occurs through the photosynthetic pathways. Main results revealing the system response with respect to key aspects such as culture particularities, contact time, substrate concentration and temperature are presented and discussed.

Keywords: novel materials and environmental friendly technologies, microalgae, CO_2 capture, air treatment.

INTRODUCTION

Microalgae are versatile microorganisms with a sophisticated and interesting physiology that allows them to adapt to a variety of environmental conditions. In fact, microalgae played a crucial role in developing of Earth atmosphere, through O_2 production and CO_2 capture during the photosynthesis process, 2.3 billion years ago [1]. Eq. (1) describes the principal reaction of this process [2]. These microorganisms are able to sequester more CO_2 than terrestrial plants [3] and can use N, S and C-based pollutants from gas or water resources, as a source of nutrients [4], [5]. It is well known that microalgae are also rich in proteins, carbohydrates, pigments, fatty acids, vitamins and other valuable products. Therefore, most of the available microalgae studies refer to biomass production for valorization in cosmetics, medicine or as a food supplement or other related purposes, including biomass exploitation for its potential to provide renewable energy [6]. Due all such particularities, microalgae are good candidates for circular economy [7].

$$nCO_2 + 2nH_2O + \text{energy(light)} \xrightarrow{microalgae} C_nH_{2n}O_n + nO_2 + nH_2O \quad (1)$$

Despite the microalgae potential in air treatment, there are only few studies dedicated to this environmental application ([8], [9], [10]). One of the most promising microalgae in the above mentioned context is *spirulina* (*Arthrospira platensis*), which is not only abundant, but also robust and safe [11]. This type of microalgae is subject to investigation for air revitalization in spacecrafts in the context of a mini-circular economy approach [12].

This new research direction related to microalgae-based technologies for gas treatment was recently undertaken at Technical University "Gheorghe Asachi" of Iasi, in partnership with "Petru Poni" Institute of Macromolecular Chemistry Iasi. The approaches of air treatment systems for indoor application are not exactly the same as in the practices related to large biomass production, where significant volumes are specifically managed under non-limiting nutrient and light conditions. A cost-effective small reactor is required for such application, along with a minimum maintenance protocol. In this study, *spirulina* (*Arthrospira platensis*) has been undertaken as a microalgae model in order to be investigated for its performance in CO_2 uptake from indoor environment. CO_2 is always present indoors, as results of at least human metabolism, so it has been selected as a key benchmark for further system development towards other contaminants removal as well. Main results concerning the limits of the CO_2 removal performance in a sparged reactor with respect to key aspects related to the culture particularities, contact time, substrate concentration and temperature are presented and discussed.

MATERIALS AND METHODS

A. Experimental set-up

A vertical cylindrical glass made sparged reactor (UTEX, USA, 10 cm diameter) containing 2 L of acclimated culture

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was used for carrying out the experiments. The reactor is equipped with a medium bubble diffuser for air distribution at the bottom of the solution and access ports at the top of the reactor for different purposes (sampling, feeding, exhausting). The reactor was continuously fed with conditioning air by using an air pump (Tetra, model APS 100) at a flowrate controlled by a flowmeter (Cole-Parmer, model PMRI-010919). The light regime was assured by natural light along with a fluorescent lamp providing 2 Klux light intensity (one-side artificial illumination). The light intensity was measured with a digital luxmeter (Extech, Light Meter LT300).

B. Analytical methods

Dissolved oxygen (DO) and pH of the solution were measured by using a Hach HQ40d multiparameter device equipped with specific electrodes.

Biomass amount was determined by sample centrifugation for biomass separation, washing with distilled water and natural drying of the obtained biomass until constant weight. A good correlation (R^2=99.3%) between the biomass concentration and the turbidity measured with a Hach DR/2000 spectrophotometer .was obtained, allowing further evaluation of biomass development.

Gas analysis was performed by direct coupling of AQ-Expert multifunctional indoor air quality monitor (E Instruments, USA) to the inlet and outlet gas fluxes of the reactor, allowing monitoring of CO_2 uptake from the processed air. Oxygen concentration was also monitored with the same equipment. No emission influenced by the process has been detected by the AQ-Expert monitor ((e.g. NO, SO_2, H_2S, VOCs) nor by occasionally screening through Horiba APNA370, Japan (e.g. NO_x, NH_3). It should be noted that these devices are able to detect very trace levels of such contaminants (fraction of ppm and ppb).

C. Experimental methodology

An acclimated culture of *spirulina* (*Arthrospira platensis*, Algae Research Supply) was supplied at a ratio of 1:1 with Zarrouk medium ([13]) prepared from a stock solution. The reactor containing this culture was operated for about 4 months without solution adjustments, except distilled water addition to compensate the evaporated water and the occasional samplings (creating thus nutrient/substrate-limiting conditions). The typical operating conditions are presented in Table 1. After this period, several tests have been performed in order to evaluate the influence of the operating parameters on CO_2 removal performance [i.e. air flowrate (0.1-1 L/min), CO_2 concentration (300-700 ppmv), ambient air temperature (23-28°C)]. Also, an additional test at a higher CO_2 concentration (4100 ppmv) was perfomed by mixing conditioning air with synthetic CO_2 from a gas tank (Aqua Nova). The tests have been performed in a relative short period of about two weeks (e.g. about two hours in different days), at a biomass concentration of about 2.4 g/L (dry weight). For testing the system response under nutrient/substrate non-limiting conditions, re-conditioning the initial content of Zarrouk medium composition was performed, by adding nutrients from the initial stock solution.

CO_2 uptake performance was evaluated through removal efficiency (RE), loading rate (LR) and elimination capacity (EC), which were calculated as following [14]:

$$\text{RE, \%} = \frac{inlet - outlet\ CO2\ concentration}{inlet\ CO2\ concentration} * 100 \quad (2)$$

$$\text{LR, } \frac{mg}{L*day} = \frac{CO2\ amount\ fed}{culture\ volume * time} \quad (3)$$

$$\text{EC, } \frac{mg}{L*day} = \text{RE*LR} \quad (4)$$

Table I. Typical conditions for long-term reactor operation

Operating conditions	Characteristics
Microalgae type	***Spirulina platensis***
Nutrient solution	**Zarrouk medium based**
Volume	**2 L**
Air flowrate	**0.5 L/min**
Inlet CO_2 concentration, ppmv	**400 (±50)**
Temperature, °C	**24.5 (±1)**
pH of nutrient solution	**10.1 (±0.1)**
Lighting	**natural + artificial (2 Klux, fluorescence lamp)**

RESULTS AND DISCUSSIONS

D. Influence of air flowrate, CO_2 concentration and ambient air temperature on CO_2 uptake by the biological system

It should be noted that a very fast system response and stabilization (minutes) to the change in environmental conditions was observed in all trials. This observation apply not only to the air flowrate, CO_2 concentration and ambient air temperature changes performed in this study, but also to the changes in light colour and intensity as observed in other batch studies (results not shown). No significant retention of CO_2 was observed in blank tests performed with Zarrouk medium only (no *spirulina*). These remarks suggest the important contribution of the biological component to the observed system performance.

Fig. 1 shows the system response to the change in air flowrate for different inlet CO_2 concentrations under nutrient/substrate-limiting conditions for the culture. The performance observed at 0.5 L/min during the short-term test is consistent with that observed at the same flowrate during the long-term monitoring under close inlet concentration, confirming the concordance of the results. As can be seen in Fig. 1, RE increases with the increase of the air flowrate until 0.4-0.5 L/min, after which it remains constant. Also, RE increases with the increase of the inlet CO_2 concentration. The lower performance in the inferior operating range can be due to the CO_2 biological production contribution that competes with CO_2 removal [15]. The process could be subject to a mass-transfer limitation due the contact time at air flowrates higher than 0.5 L/min. Overall, the maximum RE observed in Fig. 1 is about 35%, corresponding to a an air flowrate of 0.4 L/min and an inlet CO_2 concentration of 633 ppmv. The higher CO_2 concentrations under substrate-limiting conditions

favour the process performance by increasing CO_2 availability and its uptake by *spirulina* [16]. This behaviour is also observed in Fig. 2, when further increasing of inlet CO_2 concentration up to 4100 ppmv for a short time period determined an increase of RE up to 82%. Subsequent studies are required in order to establish the system response under long-term operation at higher CO_2 concentrations.

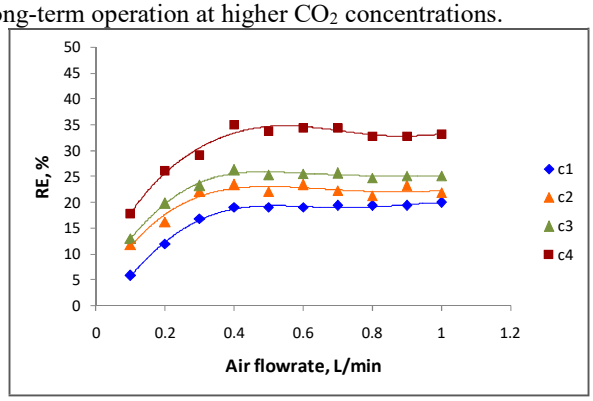

Fig. 1. Variation of RE (%) as a function of air flowrate and inlet CO_2 concentration (± 10 ppmv): c_1=325 ppmv; c_2=474 ppmv; c_3=530ppmv; c_4=633ppmv

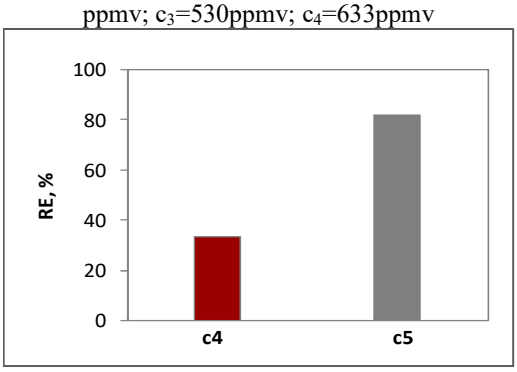

Fig. 2. RE (%) versus inlet CO_2 concentrations (c_4=633ppmv; c_5=4100 ppmv) at the same air flowrate (0.5 L/min)

For technological reasons, the temperature range (23-28°C) undertaken for investigation in this study was below the optimum reported temperature (e.g. around 35°C, [17]). However, lower temperatures might increase the CO_2 absorption in the culture and its uptake by *spirulina*, Also different species, strains or isolates of *spirulina* can exhibit different optimum temperature [17]. Anyhow, no significant effect of temperature ranged between 23-28°C has been observed under the short test performed in this study (e.g. Fig. 3). Same behaviour has been also observed during the other long-term monitoring tests where occasional changes in such temperature range didn't appear to affect the process performance.

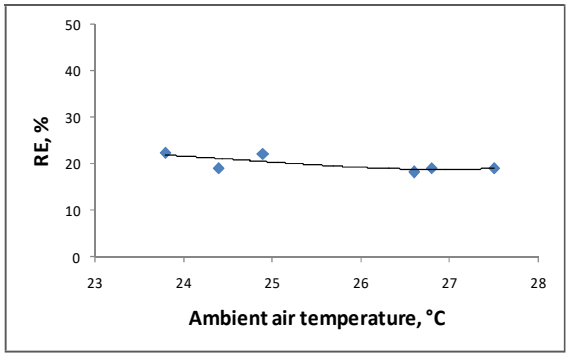

Fig. 3. RE as a function of ambient air temperature, at the same air flowrate (0.5 L/min) and inlet CO_2 concentration (488 ± 10ppmv)

E. Culture particularities

An auto-buffering effect maintained the solution pH at around 10.1 (±0.1) over the entire study period, without the need of pH adjustment, as this pH value belongs to the optimal range (9.5–10.5) for *spirulina* and protects the system against other potential bacterial contamination [17].

Increased O_2 concentration due O_2 production and excessive light intensity can inhibit the CO_2 uptake in microalgae systems ([17], [18]). In this study, the concentration of oxygen in air phase was not affected by the biological component. The solution DO slightly increased (e.g. from 8 to 8.9 mg/L) with the biomass evolving during the long-term operation, thus the investigated system was not inhibited by oversaturation in oxygen. Also, the system was rather subject to some self-shading effect in the dense culture than the excessive illumination [19]. In other order of idea, the increase of O_2 production/capture from such systems, without affecting the CO_2 uptake, can be undertaken as a complementary benefit, thus additional investigations are required in this regard.

Theoretically, 1.83 g of CO_2 is required for the production of 1 g of algae biomass [3]. In this study, a biomass yield (dry weight) of 4.2 g/reactor was recorded after the long-term operation. This value is almost 1.6 times smaller than that corresponding to the average CO_2 amount removed by the system (EC-based estimation), which means that not all of the CO_2 removed was fixed into biomass.

Adding the nutrients in order to re-conditionate the initial content of Zarrouk medium composition after long-term operation and to assure nutrient/substrate non-limiting conditions temporarily affected CO_2 uptake by about three times, which indicates that the system preferentially uptake the substrate from $NaHCO_3$ readily available in the solution, rather than from the gas phase. Also, the presence of salts determines the increase of the osmotic pressure of the medium and the decrease of gases solubility ([6], [19], [20]), which might be also involved in this behaviour.

Fig. 4 shows an microscopy image, illustrating the *spirulina* involved in the presented study.

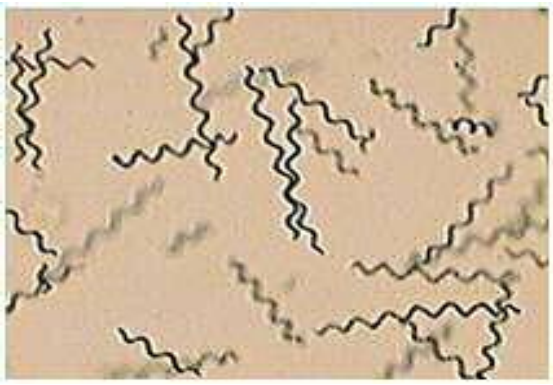

Fig. 4. *Spirulina* microscopy (res.x100)

CONCLUSION

The results of this study show the practical application to control indoor air content in terms of CO_2 by a microalgae-based system. A nutrient/substrate-limiting culture could favour CO_2 uptake from indoor environments by *spirulina* in long-term operated systems. Increase of loading rates through air flowrate and CO_2 concentration favours the CO_2 uptake, but not all the CO_2 removed was fixed in biomass under the conditions used in this study. Adding the nutrients in order to re-conditionate the initial content of Zarrouk medium composition appears to temporally affect the CO_2 uptake from the gas phase. Further research should address the influence of parameters interaction and different light conditions on the process performance. Overall, the results of this study can be used as a benchmark for further development of cost-effective microalgae based systems dedicated to air treatment in indoor environments, including not only CO_2 removal, but also other contaminants removal.

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Environmentally friendly synthesis of noble metallic nanoparticles from aqueous extract of *Paeonia officinalis*

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Abstract: **Noble metallic nanoparticles, especially silver nanoparticles (AgNPs) and gold nanoparticles (AuNPs) exhibit physical-chemical properties that contribute to a continuous development of the researches in this field. Peony (*Paeonia officinalis*) has multiple therapeutic effects: fights acne, dermatitis or various skin inflammation as well as diminishes stomach aches. This plant contains tannins, alkaloids, oligoelements (calcium, magnesium, iron), vitamin C and flavonoids, phytocomponents that gives the aqueous extract obtained from leaves of *Paeonia officinalis* excellent properties to obtain metallic nanoparticles. This paper presents the eco-friendly synthesis of both AgNPs and AuNPs from aqueous extract of peony leaves. To prove that AgNPs and AuNPs are obtained, UV-Vis, FTIR and DLS spectra are recorded and the results confirm the biosynthesis of metallic nanoparticles. The results are presented in comparison with the chemical obtaining of AgNPs via sodium citrate method.**

Keywords: environmentally friendly synthesis, noble metallic nanoparticles, *Paeonia officinalis*

INTRODUCTION

Metallic nanoparticles represent an important part of nanotechnology, an ever-growing scientific field, especially due to their unique physical and chemical properties, high surface area and nanoscale size [1]. Nanoparticles are not just simple molecules and can easily be considered as a three-layer structure that consist of:

(a) a surface layer that can be functionalized with different small molecules (i.e.: ions, surfactants, polymers);

(b) a shell layer that is chemically different from the core;

(c) a core layer, the central part of the nanoparticle that usually refers to the nanoparticle itself [2].

Noble metallic nanoparticles, especially silver nanoparticles (AgNPs) and gold nanoparticles (AuNPs) are widely known for their antimicrobial, antifungal and antimycotic properties that make them excellent candidates for numerous applications in medicine such as: bio-sensors, bio-assays, tumor imaging and gene delivery [3-5].

Both AgNPs and AuNPs can be synthesized by conventional or unconventional methods, using two approaches: "top-down" and "bottom-up". Although numerous conventional methods are used to obtain noble metallic nanoparticles (e.g.: solution, chemical/photochemical reactions in reverse micelles, thermal decomposition of different metallic compounds) they involve toxic chemical compounds, low conversions, high energy consumption and wasteful purifications [6, 7].

Unconventional methods, especially green chemistry, are constantly becoming more and more attractive routes to obtain both AgNPs and AuNPs. Green chemsistry methods uses alcoholic, hydroalcoholic or aqueous plant extracts [8] and has multiple advantages: cost effective, environmentally – friendly and do not require high pressure and temperature or the use of toxic chemicals [9].

Peony (*Paeonia officinalis*) is considered by many specialists a "super flower" because of its capacity to help ease numerous medical health problems (the word "peony" originates from the Greek god Paean, the god of healing) [10]. Although the health benefits of peony's petals are scientifically recognized, not much is known about its leaves (Fig. 1).

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Fig. 1. Leaves of *Paeonia officinalis*

This paper presents the environmentally-friendly synthesis of both AgNPs and AuNPs from aqueous extract of peony leaves. To prove that AgNPs and AuNPs are obtained, UV-Vis, FTIR and DLS spectra are recorded and the results confirm the biosynthesis of both metallic nanoparticles.

EXPERIMENTAL

F. Materials

Silver nitrate ($AgNO_3$), tetrachloauric acid ($HAuCl_4$), sodium citrate, DPPH (2,2 – diphenyl – 1 – picryl – hydrazyl – hydrate stable free radical), hydrochloric acid (HCl), sulphuric acid (H_2SO_4), Folin-Ciocalteu reagent were purchased from Sigma – Aldricht while ethanol (C_2H_5OH) and methanol (CH_3OH) were purchased from Scharlau. The distilled water used in all our experiments was prepared in the laboratory using a Liston distiller. The peonies were bought from the local market and their leaves were collected and dried at room temperature for 5 days.

G. Preparation of aqueous extract from leaves of Paeonia officinalis

The peonies used for the eco-friendly synthesis of metallic nanoparticles (AgNPs and AuNPs) were bought from the local market and their leaves were collected, thoroughly washed twice with tap water, thrice with distilled water, dried at room temperature for 5 days, finely grinded and further used to prepare the aqueous extract using the following protocol:

- 25 g dried peony leaves were transferred into a "French press" type extractor (Fig.2) and 250 mL distilled water were added and was left 24 hours in a refrigerator, at 4^0 C, to infuse;
- the resulted aqueous extract was thoroughly filtered until a clear liquid is obtained;
- the aqueous extract is stable at 4^0 C for more than 12 weeks.

Fig. 2. "French press" type extractor used to prepare aqueous extract from peony leaves

H. Green synthesis of AgNPs and AuNPs

We freshly prepared a 10^{-3} M aqueous solution of silver nitrate ($AgNO_3$) that was further used to biosynthesize AgNPs from peony leaves using the following method: 5 mL aqueous extract were mixed with 50 mL 10^{-3} M $AgNO_3$ solution and left for 24 hours in the dark, at room temperature. Then, the resulted AgNPs were agitated for 30 minutes in an ultrasound bath, at 50 rpm.

AuNPs were prepared as follows: 5 mL aqueous peony leaves extract were mixed with 5 mL 10^{-3} M $HAuCl_4$, heated at 50^0 C under continuous stirring (~ 450 rpm) for 30 minutes. After the 30 minutes passed, the heat was turned off and the solution was further agitated at room temperature for 1 hour and left 24 hours in the dark. Then, the AuNPs solution was agitated in an ultrasound bath, at 50 rpm, for 30 minutes.

I. Physical-chemical characterization of the aqueous peony leaves extract, AgNPs and AuNPs

All the absorption spectra were recorded with a M 400 Carl Zeiss Jena UV – Vis spectrometer in the wavelength range of 250 – 800 nm, at different time intervals to determine the stability of the green synthesized AgNPs and AuNPs. Fourier transformed infrared spectroscopy (FTIR) spectra were recorded using a Vertex 80 FT-IR spectrometer equipped with high-resolution Hyperion 3000 microscope, in the range of 8000 – 400 cm^{-1}. Dynamic light scattering (DLS) spectra were recorded using a Zetasizer Nano SZ – Malvern instrument connected to a computer that has Zetasizer software preinstalled.

To determine the antioxidant activity, a DPPH solution was prepared in ethanol and 0.5 mL aqueous extract were mixed with 1 mL 0.02 mg/mL DPPH solution and we recorded the absorbance at 517 nm. Separately, a blank was prepared by mixing 0.5 mL distilled water with 1 mL 0.02 mg/mL DPPH solution [11, 12]. The antioxidant activity (AA %) was calculated according to the formula:

$$AA\ \% = [A_{Control} - A_{Sample} / A_{Control}] \times 100,$$

where: $A_{Control}$ is the absorbance of the blank DPPH solution while A_{Sample} represents the absorbance of the aqueous peony leaves extract mixed with 0,02 mg/mL DPPH solution.

The quantitative determination of phytochemicals was used to evaluate the total content of tannins (TCF), total content of flavonoids (TCF), total content of polyphenols (TCP) and total content of terpenoids (TCTp) [13-15].

Table I: Quantitative methods for the determination of phytochemicals

Crt. No.	Assay	Reagents	Reaction parameters	Recordings
1	Total Tannins Content	0.5 mL extract+3 mL 4% vanillin-MeOH and 1.5 mL HCl	15 min. incubation at room temperature	Absorbance at 500 nm (catechin curve)
2	Total Flavonoids Content	1 mL extract+4 mL distilled water and 0.3 mL 5% $NaNO_2$; after 5 minutes: 0.3 mL 10% $AlCl_3$; after other 5 minutes: 2 mL 1M NaOH and 2.4 mL distilled water	30 min. incubation at room temperature	Absorbance at 510 nm (catechin curve calibration standard)
3	Total Polyphenols Content	1 mL diluted extract and 5 mL Folin-Ciocalteu reagent; after 8 minutes: 4 mL Na_2CO_3	60 min. incubation at room temperature	Absorbance at 765 nm (gallic acid curve calibration standard)
4	Total Terpenoids Content	2 mL extract and 1 mL 2% vanillin-H_2SO_4	Heated at 60^0C for 20 min., cooled at 25^0C for 5 min.	Absorbance at 608 nm (linalool curve calibration standard)

RESULTS AND DISCUSIONS

J. Quantitative determination of phytochemicals

Total tannins are described as mg catechin/L and the peony leaves aqueous extract was analyzed in triplicate. To determine the total content of flavonoids, catechin was used as standard while total content of polyphenols uses gallic acid. Linalool was used as standard calibration curve for the determination of total content of terpenoids.

Table II: Results of the quantitative screening of phytochemicals

Aqueous extract	TCT (mg/L)	TCF (mg/L)	TCP (mg/L)	TCTp (mg/L)
Peony leaves	289,45	94,23	120,69	100,64

K. Antioxidant activity of AgNPs and AuNPs

Antioxidant activity (AA) (%) was measured using the method described above and the results show that both AgNPs and AuNPs exhibit good antioxidant properties.

Table III: Antioxidant activity of the metallic nanoparticles

Aqueous extract	AA (%) aq. extr.	AA (%) AgNPs	AA (%) AuNPs
Peony leaves	70,33	81,56	80,09

L. Characterization of AgNPs and AuNPs by UV-Vis spectroscopy

The first confirmation that the metallic nanoparticles are obtained is the visual change of color of the peony leaves aqueous extract as follows: the solution turned yellow-brown in case of AgNPs and dark-red in the case of AuNPs.

UV-Vis spectrum was recorded for the aqueous extract prepared from peony leaves as well as for the green synthesized metallic nanoparticles at well-established time intervals: 0s, 5 min, 30 min, 60 min, 120 min and 24 hours. The bioreduction of both AgNps and AuNPs was analyzed between 220 and 800 nm.

The UV-Vis spectrum recorded for AgNPs shows an absorption peak at 455 nm (Fig.3) and the one recorded for the AuNPs has an absorption peak at 535 nm, clearly proving the bioreduction of the metal ions therefore confirming the formation of both metallic nanoparticles.

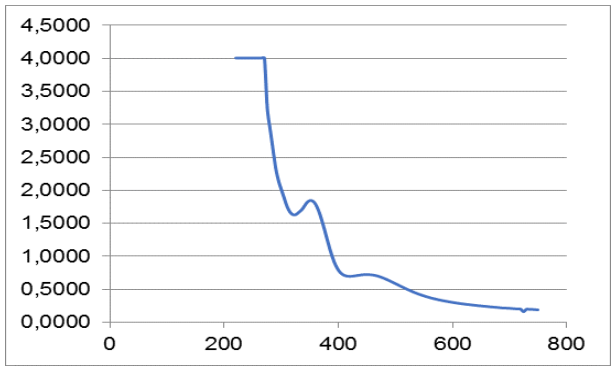

Fig. 3. UV-Vis spectrum of the green synthesized AgNPs from peony leaves

M. Characterization of AgNPs and AuNPs by FTIR spectroscopy

FTIR spectra were recorded for the aqueous extract as well as for AgNPs and AuNPs after being previously dried. FTIR is a spectroscopic technique used for the precise indication of the functional groups that can be found at different wavelengths in the recorded spectrum.

The specific peaks at 3335 are assigned to hydroxyl (- OH) groups while the band that appears at 2945 cm^{-1} is specific for methine (-CH) groups. The bands C = C and C = O were identified at 1588 cm^{-1} and 1455 cm^{-1} The aromatic amide I and amide II were found in the range of 1388 cm^{-1} and 1323 cm^{-1}. The C – O groups characteristic for esters, catechins and/or type III amides were found between 1262 – 1125 cm^{-1}. Specific bands between 1500 – 1297 cm^{-1} were attributed to amides, proteins and enzymes that ease the reduction of metal ions. All the eco – synthesized metallic nanoparticles exhibited specific FTIR bands attributed to polyphenols in the range of 1650 cm^{-1} and 1659 cm^{-1}.

N. Characterization of AgNPs and AuNPs by DLS spectroscopy

Size of the eco-friendly prepared metallic nanoparticles was determined by means of dynamic light scattering (DLS) measurements. Zeta potential was also determined for all the studied samples (Fig. 4).

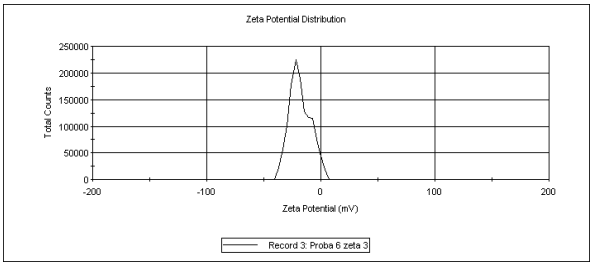

Fig. 4. Zeta potential for AgNPs – peony leaves

CONCLUSION

This research paper describes the environmentally-friendly synthesis of two noble metallic nanoparticles, silver (AgNPs) and gold (AuNPs) nanoparticles from the aqueous extract prepared from peony leaves. The eco-friendly synthesis of AgNPs was carried out at room temperature, without stirring, over a 24-hour interval and the UV-Vis spectrum showed a maximum absorption peak at 455 nm. AuNPs were prepared from the aqueous extract of peony leaves after a 30-minutes reaction at 50^0 C under continuous stirring, confirmed by the UV-Vis absorption peak situated at 535 nm. FTIR spectra highlighted all the functional groups at their characteristic wavelengths and DLS measurements confirmed the nanometric size of the eco-friendly synthesized metallic nanoparticles.

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Silver and gold nanoparticles from *Cucurbita maxima*: an eco-friendly alternative

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Abstract: **Silver nanoparticles (AgNPs) and gold nanoparticles (AuNPs) have physical-chemical properties due to their size and structure that contribute to a continuous growth of the researches in this scientific field. Different methods are used to biosynthesize AgNPs and AuNPs and in the last decade more and more importance are gaining the ones based on aqueous plant extracts in the presence of metallic salts (silver nitrate and tetrachloauric acid).**

Squash (*Cucurbita maxima*) is a plant with numerous therapeutic applications: antiparasitic, antioxidant, can help in cancer prevention, etc. Squash contain mostly carbohydrates, little protein and almost no fat and is full of provitamin A, beta-carotene, as well as calcium and potassium.

This paper presents the "green synthesis" of both AgNPs and AuNPs from aqueous extract of squash peel. To prove that AgNPs and AuNPs are obtained, UV-Vis, FTIR and DLS spectra are recorded and the results confirm the biosynthesis of metallic nanoparticles. The results are presented in comparison with the chemical obtaining of AgNPs via sodium citrate method.

Keywords: environmentally friendly synthesis, silver nanoparticles, gold nanoparticles, *Cucurbita maxima*

INTRODUCTION

Silver nanoparticles (AgNPs) and gold nanoparticles (AuNPs) are scientifically recognized for their proven antimicrobial, antifungal and antimycotic properties and, therefore, are especially suited for medical applications such as: bio-sensors, tumor imaging, gene delivery, etc. [1-3].

AgNPs and AuNPs can be obtained using conventional and/or unconventional methods, by two different approaches: "top-down" and "bottom-up". Conventional synthetic methods have numerous drawbacks: involve toxic reagents, require low conversions, high energy input and multiple purification steps [4].

Green chemistry methods are more and more preferd routes to prepare AgNPs and AuNPs from alcoholic, hydroalcoholic or aqueous plant extracts [5]. Among the numerous positive facts of green chemistry methods used to prepare AgNPs and AuNPs, some are clearly distinghuished: cost effectiveness, environmentally – friendliness, the lack of high pressure and/or temperature and the absence of hazardous chemicals [6].

Squash is one of the most interesting and versatile fruits (although it is often identified as a vegetable) that belongs to the genus *Cucurbita* [7]. Squash is packed with health and nutrition benefits as it contains small amounts of fat and is full beta-carotene, calcium and potassium [8]. Some of the most important health benefits are: boosts immunity, manages diabetes, has anti-inflammatory capacity, improves lung health, etc. [9].

This paper presents the "green synthesis" of AgNPs and AuNPs from aqueous extract of squash peel. To prove that AgNPs and AuNPs are obtained, UV-Vis, FTIR and DLS spectra are recorded and the results confirm the green synthesis of silver and gold nanoparticles.

EXPERIMENTAL

O. Materials

Silver nitrate ($AgNO_3$), tetrachloauric acid ($HAuCl_4$), sodium citrate, DPPH (2,2 – diphenyl – 1 – picryl – hydrazyl – hydrate stable free radical), hydrochloric acid (HCl), sulphuric acid (H_2SO_4), Folin-Ciocalteu reagent, Benedict and Millon reagents were purchased from Sigma – Aldricht while ethanol (C_2H_5OH), methanol (CH_3OH) and acetone (CH_3COCH_3) were purchased from Scharlau. The distilled water used in all our researches was freshly prepared in the laboratory using a Liston distiller. The squash was taken from a local homemaker and its peel was dried at room temperature for 10 days.

P. Preparation of aqueous extract from Cucurbita maxima

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The squash used in our research study for the eco-friendly synthesis AgNPs and AuNPs is Valenciano (Fig. 1) and was taken from a local homemaker from Gradistea, Giurgiu that grew the Valenciano squash using no chemical additives. The peel was carefully separated from the core, thoroughly washed twice with tap water, thrice with distilled water, dried at room temperature for 10 days, finely grinded and further used to prepare the aqueous extract as follows:

- 25 g dried squash peel were transferred into a "French press" type extractor and 250 mL distilled water were added;
- the mixture was kept 24 hours in a refrigerator, at controlled temperature (4^0 C), to infuse;
- the resulted aqueous extract was thoroughly filtered until a clear light-orange liquid is obtained;
- the aqueous extract thus obtained is stable at 4^0 C for more than 10 weeks.

Fig. 1. Valenciano squash

Q. Green synthesis of AgNPs and AuNPs

A 10^{-3} M aqueous solution of silver nitrate ($AgNO_3$) was prepared and it was further used for the eco-synthesis of AgNPs as follows: 5 mL aqueous extract obtained from squash peel were mixed with 50 mL 10^{-3} M $AgNO_3$ solution and kept in the dark, at room temperature, for 24 hours. The next day, AgNPs were stirred for 30 minutes in an ultrasound bath, at a constant speed of 50 rpm.

AuNPs were prepared according to the following protocol: 5 mL aqueous extract obtained from squash peel were mixed with 5 mL 10^{-3} M $HAuCl_4$, heated at 50^0 C vigorously stirring (~ 450 rpm) for 30 minutes. Then the heat was turned off and the solution was agitated at room temperature for 1 hour and then kept 24 hours in the dark. The AuNPs solution was agitated in an ultrasound bath, at 50 rpm, for 30 minutes.

R. Physical-chemical characterization

The absorption spectra were recorded using a M 400 Carl Zeiss Jena UV – Vis spectrometer at a wavelength range of 250 – 800 nm. Fourier transformed infrared spectroscopy (FTIR) spectra were recorded and analyzed with a Vertex 80 FT-IR spectrometer equipped with high-resolution Hyperion 3000 microscope, in the range of 8000 – 400 cm^{-1}. Dynamic light scattering (DLS) measurements were carried out using a Zetasizer Nano SZ – Malvern instrument equipped with Zetasizer software.

The antioxidant activity (AA, %) was also investigated and, for that, a 2,2 – diphenyl – 1 – picryl – hydrazyl – hydrate (DPPH) solution was prepared in ethanol and 0.5 mL aqueous extract were mixed with 1 mL 0.02 mg/mL DPPH solution. The following step was recording the absorbance at 517 nm. A blank was also prepared: 0.5 mL distilled water were mixed with 1 mL 0.02 mg/mL DPPH solution [10, 11].

The antioxidant activity (AA %) was calculated according to the formula:

$$AA\ \% = [A_{Control} - A_{Sample} / A_{Control}] \times 100,$$

where: $A_{Control}$ is the absorbance of the blank DPPH solution and A_{Sample} represents the absorbance of the aqueous squash peel extract mixed with 0,02 mg/mL DPPH solution.

The qualitative screening for phytochemicals was carried out following standard analytical methods that are based on the color change reaction for a positive response [12, 13].

Test for saponins: 2 mL aqueous extract is mixed with 2 mL distilled water and vigorously shaken lengthwise, using a graduated cylinder, for 15 minutes. The formation of a 1 cm foam layer confirms the presence of saponins

Test for carbohydrates: 1 mL aqueous extract is mixed with 5 mL Benedict reagent and heated for 5 minutes. The change in color from blue to mustard yellow, brick red or green confirms the presence of carbohydrates.

Test for tannins: to 1 mL aqueous extract, 2 mL of 5% ferric chloride was added and the formation of a dark blue or greenish black solution confirms the presence of tannins.

Test for alkaloids: to 2 mL aqueous extract, 2 mL of concentrated HCl was added followed by few drops of Mayer reagent. The formation of green solution or white precipitate indicates the presence of alkaloids.

Test for flavonoids:2 mL aqueous extract was mixed with 1 mL 2N NaOH. The formation of a yellow color confirms the presence of alkaloids.

The quantitative determination of phytochemicals was also carried out to determine the total content of tannins (TCF), total content of flavonoids (TCF), total content of polyphenols (TCP) and total content of terpenoids (TCTp) [14-16].

RESULTS AND DISCUSIONS

S. Qualitative screening of phytochemicals

The results of the qualitative screening for phytochemicals of the aqueous extract prepared from squash peel are presented in Table I and it clearly indicates the presence of saponins, carbohydrates, hexose sugars, etc.in the aqueous extract while tannins, alkaloids and flavonoids are absent.

Table I: Results of the qualitative screening of phytochemicals

Aqueous extract	Saponins	Carbohydrates	Tannins	Alkaloids	Flavonoids
Squash peel	+	+	-	-	-

Quantitative determination of phytochemicals

Total tannins are described, in accordance with the literature, as mg catechin/L and the aqueous extract was analyzed in triplicate. A standard catechin solution was used to determine the total content of flavonoids while total content of polyphenols uses gallic acid as standard calibration curve. Linalool was used as standard calibration curve for the determination of total content of terpenoids. The results are presented in Table II.

Table II: Results of the quantitative screening of phytochemicals

Aqueous extract	TCT (mg/L)	TCF (mg/L)	TCP (mg/L)	TCTp (mg/L)
Squash peel	96,56	100,39	128,47	101,05

T. Antioxidant activity

Antioxidant activity (AA) (%) was measured and the results show that AgNPs and AuNPs have considerable antioxidant properties, above that of the aqueous extract. The results are presented in Table III.

Table III: Antioxidant activity of AgNPs and AuNPs

Aqueous extract	AA (%) aq. extr.	AA (%) AgNPs	AA (%) AuNPs
Squash peel	72,64	82,36	81,44

U. Characterization of AgNPs and AuNPs by UV-Vis spectroscopy

The first confirmation that AgNPs and AuNPs are obtained following this eco-friendly method is the change of color of the aqueous extract: the solution turned yellow-light orange in case of AgNPs and light-violet in the case of AuNPs.

UV-Vis spectrum was recorded and analyzed between 220 and 800 nm for both aqueous extract and resulted AgNPs and AuNPs.

The UV-Vis spectrum recorded for AgNPs shows a strong absorption peak at 438 nm and the one recorded for the AuNPs has an absorption peak at 525 nm, clearly showing that the bioreduction of the metal ions was achieved.

V. Characterization of AgNPs and AuNPs by FTIR spectroscopy

FTIR spectra were recorded using the dried samples of AgNPs and AuNPs to determine the functional groups present in the recorded spectrum at different wavelengths (Fig. 2).

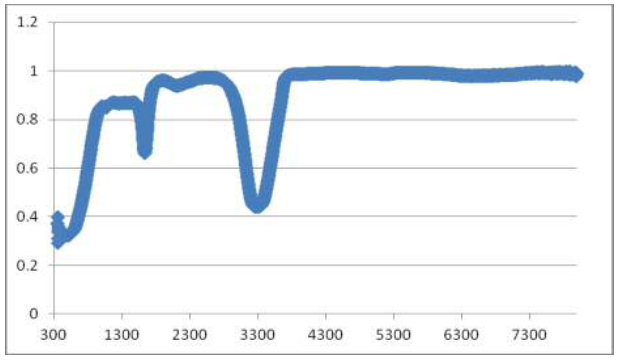

Fig. 2: FTIR spectra for the green synthesized AgNPs

The peaks at 3328 cm^{-1} are characteristic to hydroxyl (-OH) groups while at 2924 cm^{-1} methine (-CH) groups are present. The bands specific to C = C and C = O were identified at 1583 cm^{-1} and 1460 cm^{-1}. The aromatic amide I and amide II were found in the range of 1386 cm^{-1} and 1322 cm^{-1}. The C – O groups characteristic to esters, catechins and/or type III amides were found between 1260 – 1125 cm^{-1}. Specific bands between 1500 – 1297 cm^{-1} were attributed to amides, proteins and enzymes that contribute to the reduction of the metal ions. All the eco – synthesized metallic nanoparticles showed specific FTIR bands characteristic for polyphenols in the range of 1651 cm^{-1} and 1659 cm^{-1}.

W. Characterization of AgNPs and AuNPs by DLS spectroscopy

The size of the eco-friendly AgNPs and AuNPs was determined using dynamic light scattering (DLS) measurements (Fig. 3). Zeta potential was also determined (Table IV).

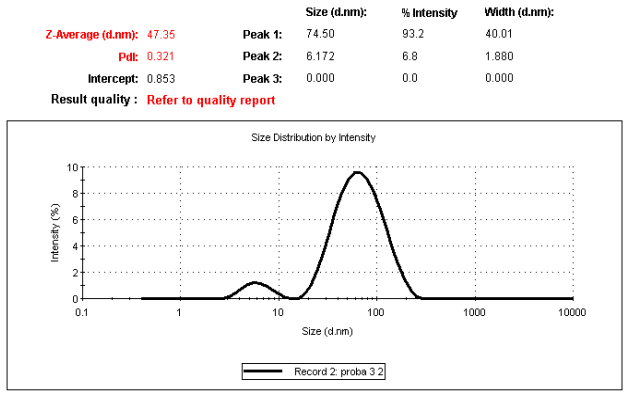

Fig. 3. DLS spectra for the green synthesized AgNPs

Table IV: Particle size for the green synthesized AgNPs

Crt. No.	Dm (d.nm)	$P_{1..i}$ (d.nm)	PdI
AgNPs - squash peel	129.7	P_1 = 74.50 P_2 = 6.172	0.321

CONCLUSION

This experimental study presents the environmentally-friendly synthesis of two silver (AgNPs) and gold (AuNPs) nanoparticles from the aqueous extract prepared from *Cucurbita maxima*, namely the peel of Valenciano squash. The eco-friendly synthesis of AgNPs was carried out at room temperature, no stirring, for 24 hours and the UV-Vis spectrum clearly presented an absorption peak at 438 nm. AuNPs were prepared from the aqueous extract of squash peel after a 30-minutes reaction at 50^0 C with continuous stirring, confirmed by the UV-Vis absorption peak at 525 nm. FTIR spectra showed all the functional groups with their specific wavelengths and DLS measurements confirmed the nanometric size.

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This research paper was prepared with the financial support of the project PN 18.22.04.01.03.

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Energy consuption and GHG reducting in objects with complext energy systemsferenc

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Abstract: A heat pump is a device that transfers heat energy from the heat source to theconsumer-heat sink.Heat pumps are designed to transfer the heat energyinan opposite direction of a spontaneous heat transfer through absorbing the heat from a cold place and freeing heat to a warmer place. The heat pump uses a small amount of external power to achieve the transfer of energy from the heat source to the heat sink.

In this paper, a model of calculating the expenses of energy is displayed, as well as expenses on fuel, saving energy and reducing the emission of greenhouse gases in systems where it is planned an implementations of heat pumps.

The complexity of the building, the energy system and the outside conditions influence the process of GHG production and emission. The possibilities to utilize the waste energy and to use it in the object energy needs are shown and analyzed.

Keywords: Energy balance, GHG, Heat pumps, energy conversion.

INTRODUCTION

In this paper, analysis to the consumption of energy, fuels and green gasses emission of heating systems, systems for sanitary hot water, ventilation and climatization is made in case of replacement of conventional energetic technologies that use fossil fuels, with renewable energy sources [4]. The object of this analysis is a hotel complex located in un-urban area at 1437 [m] altitude, with total heating area of 2850,91[m^2]. The hotel has 53 rooms and 3 apartments spread on 4 floors with orientation of the front of the object toward East, and the rear side of the object oriented toward South-West. The heating of the facility is with oil boiler. Ventilation and climatization is obtained with electrical compressor.

In fact, the heating system existing oil boiler with heating capacity of 579 [kW] is substituted with natural gas (nat. gas) boiler with heating capacity of 366 [kW] and three heat pumps with capacity of 44.82[kW]. At the ventilation and climatization system the existing compressor with capacity 265.2 [kW] is substituted with compressor with capacity of 206.7 [kW], and the remaining capacity is remunerated with the mentioned three pumps, whose cooling capacity is 59.76[kW]. With substitute of the equipment and the fuels, we aim to reduce the consumption of fuel by 25% (10% of electricity consumption and 15% of oil consumption).

The calculations are made with RETScreen Expert software platform for managing with clear energy, that allows identification, evaluation of sustainability of potential projects for energy efficiency, renewable energy and cogeneration, and to measure and confirm the actual ongoing energy efficiency of the facilities, based on which a decision of starting the project is made. The software platform also allow the managers to measure and confirm the real characteristics of the facilities, and help identify additional energy savings/possibilities for energy production, to reduce financial and time costs in relation with identifying and evaluation of potential projects for renewable energy and energy efficiency.

Case of analysis – energy and fuel saving: Based on the climate circumstances and the façade of the building, with help of the software package, the yearly consumption of the basic existing system is calculated and it equals: 518 562[kWh/god], which means 316 [kWh/m^2] (minimal consumption of 183 [kWh/m^2] and maximal consumption of 431 [kWh/m^2]).

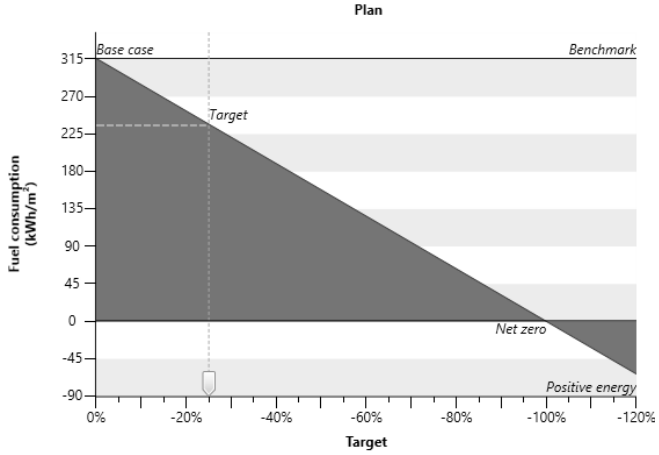

Figure1. Energy consumption plan

Figure 1: Shows the consumption of fuel of the basic-existing system, and the planned consumption of fuel of the

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proposed system according the set goal- reducing of fuel consumption by 25%.

In tables I and II simulation of the energy consumption is shown, together with the fuel consumption and the savings of energy and each type of fuel of the existing and the planned fuel consumption of the proposed system according to the set goal of reducing the fuel consumption by 25%.

*Table **I**. Energy savings of the system*

ENERGY SAVINGS				
	Heating	Climatization	Elec	**Total**
Fuel consumption	[kWh]	[kWh]	[kWh]	[kWh]
Basic system	857,208	538,199	830,692	2,226,099
Proposed system	584,206	444,156	450,888	1,479,250
Energy savings	273,002	94,043	379,804	746,849
Energy savings [%]	31.8	17.5	45.7	33.5

From the results about the consumption of electricity (elec) and oil we can conclude the following:

The fuel consumption for heating in the proposed system would reduce by 32.6%, consumption of fuel for ventilation and climatization reduces by 22.4%, or total for the system we would have savings about 37.1%.

The oil consumption of the basic system at yearly level is 95,440 [l] which means that the expenses for the fuel with the price gained from the conducted research for the last three years (2015, 2016 and 2017) which is 0.61 € per liter, would be 58,660.68 €. In the proposed system where we switched the fuel with natural gas, the consumption would be 49,171 [m³] which means that for the price gained from the conducted research in the period of year 2017 and the first six months of year 2018 that is 0.53 € per 1m³ would be 25,992.67 €.

Total consumption of electricity (needed for ventilation, climatization, sanitary hot water, lightning and auxiliary energy) of the basic system is 1,001,483 [kWh] which means the costs for electricity would be 76,536.10 € with the price gained from the conducted research in the period of years 2015 to 2018 according the market price of electricity that was 0.08 € per 1 kWh. The amount of fuel saving would be 51,779.36 € yearly.

*Table **II**.Fuel savings of the system*

FUEL SAVINGS				
	Heating	Climatization	Elec	**Total**
Fuel consumption	[kWh]	[kWh]	[kWh]	[kWh]
Basic system	1,017,470	170,791	830,692	2,018,953
Proposed system	685,681	132,595	450,888	1,269,164
Fuel savings	331,789	38,196		749,789
Fuel savings [%]	32.6	22.4	45.7	37.1

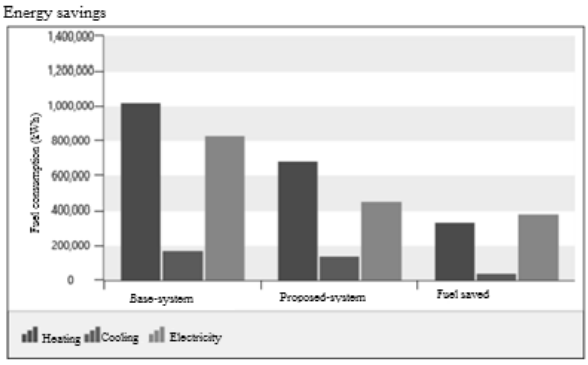

Figure 2. Graphic of system's energy savings

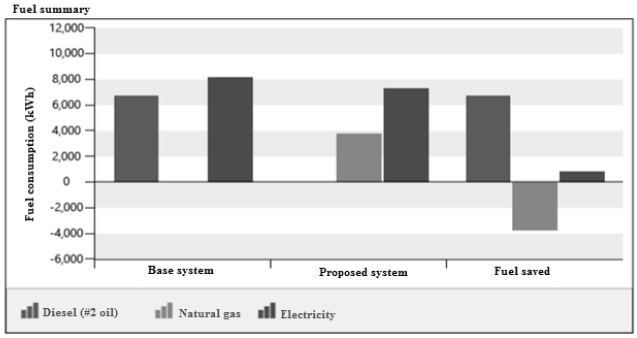

Figure 3. Graphic of system's fuel savings

Analysis case- green house gasses emission of the syste

Table III. System's emissions analysis

Basic system-Green house gasses emissions (GHG)						
	Fuel ratio	Factor of CO_2 emission	Factor of CH_4 emission	Factor of NO_2 emission	Factor of GHG	GHG
Fuel type	[%]	[kg/GJ]	[kg/GJ]	[kg/GJ]	$[\frac{tCO2}{MWh}]$	[tCO2]
Elec.	49.6	130.1	0.0096	0.0024	0.472	472.6
Oil	50.4	69.3	0.0019	0.0019	0.252	256.2
Total	100	99.5	0.0057	0.0021	0.361	728.8
Proposed system-Green house gasses emissions (GHG)						
	Fuel ratio	Factor of CO_2 emission	Factor of CH_4 emission	Factor of NO_2 emission	Factor of GHG	GHG
Fuel type	[%]	[kg/GJ]	[kg/GJ]	[kg/GJ]	$[\frac{tCO2}{MWh}]$	[tCO2]
Elec.	46.0	130.1	0.0096	0.0024	0.472	275.3
Nat. gas	54.0	69.3	0.0019	0.0019	0.252	172.7
Total	100	97.3	0.0054	0.0021	0.353	448.0
Summary decrease of green house gasses emission						
GHG emission						
Basic system					[tCO2]	728.8
Proposed system					[tCO2]	448.0
Gross yearly reduction of the green house gasses emission					[tCO2]	280.8
Income from the decrease of green house gasses emission						
GHG reduction credit rate					[€/tCO2]	0.66

GHG reduction credit duration	[years]	15
GHG reduction credit escalation rate	[%]	1.0
Net annual GHG emission reduction	[tCO2]	280.8
Reduction of net air emissions of GHG	[tCO2]	279.4
GHG reduction revenue	[€]	184.37

From the gained results out of the analysis of the green house emission of the system, we can conclude the following:

The basic system uses two types of fuel during exploitation: 50.4 % oil and 49.6 % electricity, during which the factor of emission of CO_2 is 99.5 [kg/GJ], the factor of emission of CH_4 is 0.0057 [kg/GJ], the factor of emission of NO_2 is 0.0021 [kg/GJ] that on yearly level, emission of green house gasses is 0.361 [tCO_2/MWh], meaning 728.8 [tCO_2], out of which 472.6 [tCO_2] from electricity and 256.2 [tCO_2] from the oil.

The proposed system for heating and sanitary hot water, during operation uses two types of fuel: 54.0 % natural gas and 46.0 % electricity, during which the factor of emission of CO_2 is 97.3 [kg/GJ], the factor of emission of CH_4 is 0.0054 [kg/GJ], the factor of emission of NO_2 is 0.0021 [kg/GJ] that on yearly level, emission of green house gasses is 0.353 [tCO_2/MWh], meaning 448.0 [tCO_2] out of which 275.3 [tCO_2] from electricity and 172.7 [tCO_2] from the natural gas. As result of fuel substitution in the system and implementation of heat pumps, gross yearly decrease of green house gasses emission 280.8 [tCO_2] which means that the green house emission in the proposed system have decreased by 39% compared to the basic system (figure 4). The decrease of net yearly emission of green house gasses is a 279.4 [tCO_2]. The gained gross yearly decrease of green house gasses emission of 280.8[tCO_2] is equivalent to 653.0 not consumed barrels of crude oil (figure 5).

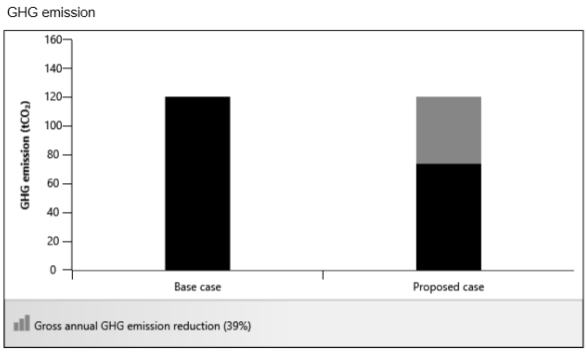

Figure 4. Graphic of gross yearly decrease of green house gasses emission

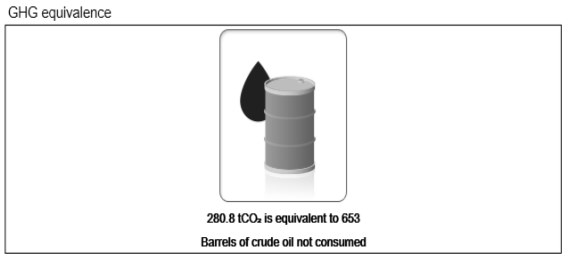

Figure 5. Equivalence of green house gasses emission

Conclusions: From the above mentioned and the given results, it's evidently that with changing the fuel from oil to natural gasses and with energy replenishment with devices that save energy, such as heat pumps, the energy efficiency of the building is improving, resulting in decreasing the waste of fuels and emissions of green house gasses. The fuel savings of the system are about 35% annually, the annual gross decrease of green housegasses emission is 280.8 [tCO2] and the annual net decrease of green house gasses is emission279.4 [tCO2]in relation to the Basic sistemit is due to: The high level of efficiency of natural gasses. Natural gasses, while they combust, do not release carbon monoxide, sulfur compounds, there is no ash or smoke, and the only product of combustion is steam [2]. Also, heat pumps are the only solution for heating, conditioning and using hot water,by using other conventional heating sources there is no possibility for conditioning, additional investments are needed for colling sistems. Heat pumps have low expences, high usage of energy and saving heat expencs, little space for the device, quiet work, without emission of green house gasses, no direct emmission of CO_2, fewer energy expences in comparisson to gass boilers, electricity and solid fuel.

The current development of renewable sources of energy is limited on a global level, especially on a local level, but their use should be promoted intensely, after serious research in every developing country to determine the potential of renewable sources of energy available on a local level, that can be used to achieve the energetic needs, both in urban and rural areas, as well in non-urban locations [3].

In our daily lives, we're witnessing the growing usage of renewable energy sources that provide many advantages regarding the decrease of using fossil fuels, as well as the ecological contribution of these systems [1].

The technical aspect of most energetic solutions are significantly well-known, with a few exceptions of some new technologies that are still being developed. Hopefully, this thesis will stimulate the development and adoption of practical energetic solutions of renewable energy sources in order to achieve the indicative goals for preserving energy.

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Strategic bio-economical and eco-economical management applied in the approach of the main objectives of the romanian aquaculture within the European Union

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Abstract: **The strategic bio-economical and eco-economical management applied in the field of fishing has the aim to develop entirely the potential of the aquaculture in Romania and in the European Union, according to the objectives of the Europe 2020 Strategy: sustainability, food security, economical growth and social inclusion. An improved setting for aquaculture will contribute to production growth and to fish supply in Romania, will reduce the import dependence and will push up the development of the rural areas. These present for their producers, implications connected to the cost management, which can develop into a competitive advantage if the customer's attention is directed towards quality, which may contribute to the acceptance of aquaculture at local level.**

Keywords: sustainability, food security, economic growth, social inclusion.

INTRODUCTION

The strategic bio-economical and eco-economical management applied in the aquaculture field, contributes more and more to the global production of aquatic food, taking into consideration that, in most of the wild environment fish supplies, the limits of the sustainable exploitation are, at present, almost reached and even overtaken. In Romania, as well as in the member states of the European Union (EU), aquaculture is an important economic activity.

Its purpose is the support of a long term growth of the fishing department, the making of new working places on the shores, and finally, the EU citizens' healthy and sustainable fish supply.

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There were about 100,025 ha of aquaculture farms in Romania, in 2005, structured in 84,525 ha farms (84,5%) and 15,500 ha nurseries (15,5%). Practically, almost all this area was used by cyprinids'farms, excepting an area of 25 ha, consisting of salmon fish farms [2].

In conformity with the Registry of Aquacultural Units (RAU), there are 518 units registered in the aquaculture department, that have 575 aquacultural farms (ponds, lakes, etc.) [4].

The 518 registered units are divided into:

- ✓ 19 nurseries (that have only a nursery license)
- ✓ 324 farms (that have only a farm license)
- ✓ 175 farms and nurseries (that have both farm and nursery licences)

Aquaculture develops in Romania, at this moment, exclusively in freshwaters, practically, and is technologically characterized by two directions:

- ✓ Intensive eco-economical growth (especially salmonids)
- ✓ Extensive bio-economical growth and semi-intensive growth of cyprinids in polyculture, in earth basins (ponds and lakes) [5].

MATERIALS ND METHODS

By ensuring a bio-economical and eco-economical management in order to breed cyprinids in polyculture, in earth basins, and by using an extensive or semi-intensive system, it gives the advantage to preserve the quality of the water in the case of the extensive growth system, or to generate a minor, negligible risk in the quality of the water, in the case of the semi-intensive growth system. Most of the aquaculture farms have a relatively long history, and have fitted very well in the natural landscape, having an important role in consolidating the ecological stability, by taking over the water excess, ensure and preserve large wet areas.

RESULTS AND DISCUSSIONS

Between 2006 – 2013, this structure of species remained almost the same, the tendency being slightly growing to cyprinids (carp, caras, Amur Carp, novac carp, Amur), representing 87% on average, as it can be seen in figure no.2. The rest of 13% represents all the other species, of which the most important is the trout.

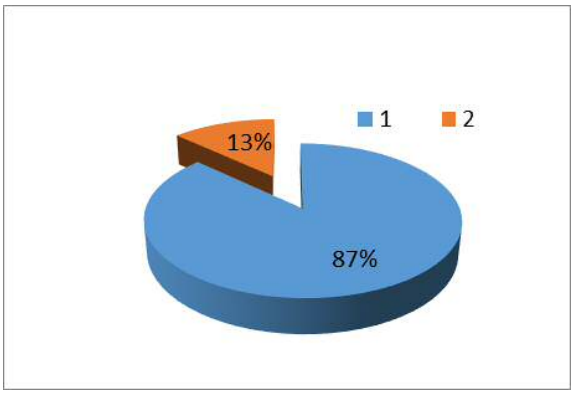

Figure 2. The species structure of fish production in Romanian aquaculture (1 cyprinids, 2 other species)

In the Danube Delta, there is only one station of artificial fish reproduction (phyto-zoo planktonofagus species) at Sarinasuf, which, according to the number of orders, can produce 50-100 million juvenile fish of about 3-5 days, and the rest of the other 10 stations (Caraorman, Maliuc, Perişor, Rusca, Enisala, Lunca, Iazurile, Chilia I, Chilia II Hreblea, Stipoc), built for artificial reproduction, are, at present, disposed of.

A part of the aquaculture farms produce their carp juveniles in basins of naturally-ruled reproduction, with unitary areas varying from 0.5 to 1.0 ha, a remarkable example being represented by Babadag nursery, with an area of 106 ha, built by FOP (*The Fishing Operational Program 2007-2013*), being funded by EFF (*The European Fishing Fund*).

Beginning with 2012, the production grew with 12% in 2012, as compared to 2011 and with 1.4% in 2013, as compared to 2012.

Table 1. Production volume in aquaculture, in species (tons) 2006-2009

Species	2006	2007	2008	2009
Carp	3.136	3544	3.977	4.142
Caras	1.268	1.653	1.462	1.623
Amur carp	2.091	1.696	2.959	2.971
Novac carp	894	2.056	2.228	2.352
Amur	256	41	426	283
Catfish	19	26	149	133
Zander	30	93	49	45
Pike	80	27	14	22
Perch	7	5	1	6
Trout	123	725	1.037	1.238
Sturgeons	0	0	0	0
African catfish	0	0	0	0
Other species	184	446	230	316
Mussels,oysters	0	0	0	0
Crayfish	0	0	0	0
TOTAL	8.008[a]	10.312[a]	12.532[a]	13.131[b]

Sources [a]FAQ

Table 2. Production volume in aquaculture, in species (tons) 2010-2013

Species	2010	2011	2012	2013
Carp	2.888	2.652	3.266	3.395
Caras	934	1.048	868	1.004
Amur carp	2.016	1.323	2.087	2.031
Novac carp	1.020	1.289	2.110	2.110
Amur	84	62	182	190
Catfish	164	33	43	44
Zander	57	42	56	43
Pike	31	34	31	28
Perch	6	4	7	2
Trout	1.400	1.710	1.074	1.106
Sturgeons	39	19	11	16
African catfish	0	72	150	94
Other species	342	64	112	68
Mussels,oysters	0	1	9	18
Crayfish	0	0	1	0
TOTAL	8.981[b]	8.353[b]	10.007[b]	10.147[b]

Sources [b]ANPA

In the Romanian aquaculture, cypriniculture and salmoniculture represent the most important branches in the aquaculture field.

From the 1960's to the 1990's, a lot of aquaculture farms were built, in order to breed cyprinids in the plains and hills, and a limited number of salmon farms existed in the mountains. Thus, in the counties of Constanza, Calarasi, Braila, Ialomita, Dolj, Botosani, Iasi, Vaslui, some important salty areas, with a low productivity in agriculture, and some wasted pastures, were developed into cyprinids'farms.

At the end of 1989, the areas built for fish breeding, comprised almost 100,000 ha, out of which 15,500 ha were nurseries, 84,500 ha were farms, in which about 37,000 tons of fish were produced for food and about 7,000 tons of juveniles were kept for restocking.

The investments in aquaculture, starting with the year 2007, were directed towards the consoli-dation of aquaculture farms and materialized themselves in: area arrangement, technologic roads, buildings, installations, machineries and equipments, means of transport, software, monitoring systems. Because the socio-economical conditions of this domain got worse, and the private business department was poorly developed, the FOP 2007-2013 practically implemented itself, starting with the year 2010. The Operational Program mostly recovered the initial delay, belonging to the years 2008 and 2009, generated by frequent changes of political opinions and institutional organizing.

CONCLUSIONS

By implementing a strategic bio-economical and eco-economical management system, the only purpose was the sustainable development of aquaculture in Romania. In conformity with the E.U. development strategy, there are:

1. The simplification of the administrative procedures. Romania must undergo a series of stages at present, in order to simplify the administrative procedures in general, and those connected to the aquaculture department in particular.

2. The ensurance of the sustainable development and the increase of aquaculture, by the coordinated endowment of the area.

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Implementation study of the concept of Passivhaus in Canada

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Abstract: Passive House were made for the first time in Germany, this concept is used later in other different climates of the south, west and southwest Europe. To determine whether an area is suitable for this concept of the passive house will use software Passive House Planning Package (PHPP) 2007 by which we determine the needs for heat and total consumption of primary energy of a home preset depending on latitude, longitude and climatic conditions. For a home to be considered passive house it must be within the maximum allowable on heating requirements is 15 kWh / m² year nor the total primary energy consumption of 120 kWh / m² year. In this paper we will determine whether such Passive House concept according to German requirements for passive houses a predetermined pattern can be implemented in Canada. To achieve this experiment, we calculate the amount of heating and total primary energy consumption to seven cities located in Canada placed at different latitudes and climates. From these results we can determine whether these areas can be used such houses and buildings and which modifications can be made to the houses to be implemented in these areas.

Keywords: Passive House, heating requirements primary energy, climatic areas.

INTRODUCTION

Passive house concept was first introduced in Germany. Passive building has been defined by Wolfgang Feist, Passivhaus Institut, as being the building that demand for heating must not be more than 15 kWh/m² year, and total consumption of primary energy should not be more than 120 kWh/m² year. [1],[3],[4]

The concept has been extended to other latitudes and climates in southern, western and southwestern Europe.

We ask ourselves if this passive building concept also applies to diferent latitudes than those of Germany. In this paper we propose to study the possibility of implementing the concept of "Passivehaus" in cities located at different latitudes on Canada territory. [2]

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PRESENTING THE CONCEPT OF "PASSIVE HOUSE"

"Passive buildings" are categorized as "low energy buildings". The term of "passive house" has its origin in the fact that due to its special construction, the building is less sensitive in terms of thermal comfort to changes of meteorological parameters. The solar energy incident on the outer surface of the building, which penetrate through various mechanisms for transfer, plus the energy generated by the tenant and by the operation of electrical equipment or other, it is normally sufficient for keeping an inner temperature comfortable during the cold season.

Passive buildings are those buildings that provide a comfortable indoor climate in summer and winter, without the need for a conventional heating.

The passive house concept is a peak in energy efficient construction; Heating energy savings of 75-80% compared to a newly built house after current standards (European standards). The need for energy for heating is below 15 kW/h/m^2/year, we have cost € 10-25/month for heating which makes a passive house to be relatively indifferent to swings in energy prices. These houses reach enormous energy savings thanks to some particular components of an effective and intelligent ventilation. However, comfort is enhanced, not diminished, and considerably increased. [1],[3],[4]

AREA DESCRIPTION

Canada is a state located in the northern part of the American continent. As a surface, Canada is the second country of the world as a stretch after Russia, its territory being organized like a federal state in ten provinces and three territories. It is bordered to the east by the Atlantic Ocean, north of the Arctic Ocean and west of the Pacific Ocean. To the south, it is bordering the United States of America.

Fig. 1 Amplasarea geografica a orașelor pentru Canada

On the territory of Canada we chose 7 cities for which we studied the possibility of implementing the concept of the Passive House. Selected cities are located across Canada. The cities are: Edmonton, Fart Mc Murray, Iqaluit, Saskatoon, Whitehorse, Winnipeg, Yellowknife

In order to study the implementation of the concept it is necessary to know the latitude, longitude, altitude for the studied cities.

Table 1 - Cities for which the viability study of a passive house is conducted, its geographic data and the climate.

Nr. crt.	City	Latitude/ Longitude	Altitude	Climate according to Koppen
1	Edmonton	53,55/-113,5	668	Dfc
2	Fort Mc Murray	56,73/-111,38	242	Dfc
3	Iqaluit	63,73/-68,5	40	EF
4	Saskatoon	52,13/-106,66	501	Dfb
5	Whiteharse	60,71/-135,05	809	Dfb
6	Winnipeg	49,88/-97,16	235	Dfb
7	Yellaeknife	62,45/-114,35	205	ET

Climate data on average monthly humidity and monthly average temperature for cities to be studied from Canada are shown in Figures 2 and 3.

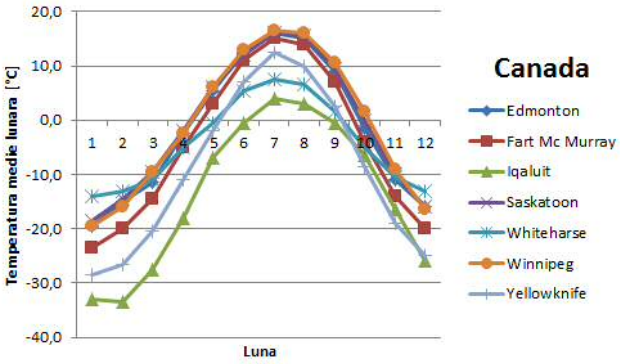

Fig. 2 - Monthly average temperature for Canada (^{0}C)

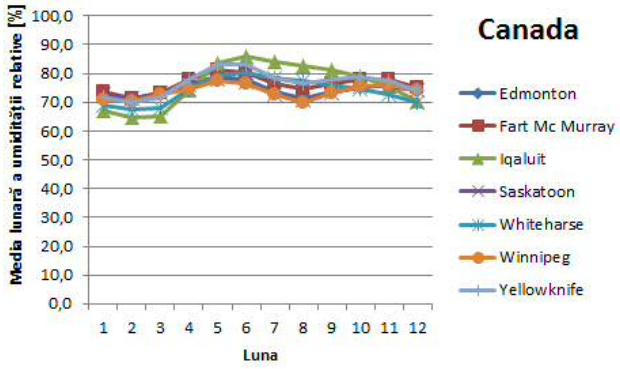

Fig. 3 Monthly relative humidity mean for Canada (%)

EVALUATION AND INTERPRETATION OF DATA OBTAINED FOR THE CONSTRUCTION OF PASSIVE HOUSES IN THE AREAS STUDIED

For the certification of a building as a passive building, it must meet the requirements for the heating demand, is not to exceed 15 kWh/m^2. [2]

The winter weather features provide information on the main interactions between the building and its environment. The average winter air temperature is estimated using data for December, January and February in the northern hemisphere.

Following the processing of climatic data using the PHPP 2007 program designed for the AMVIC passive office building, we obtained the heating needs for the studied cities.

The maximum permissible ceiling for heating demand according to the definition of passive houses is 15 kWh/m^2, this limit being exceeded in many of the studied cities.

The results obtained for the heating demand are shown in Table 2.

The need for heating varies depending on latitude and climatic zones. Thus, for Canada, the heating requirement for the PHPP concept is exceeded in all cases. In towns located at low latitudes, building modifications can be made to the building so that it can be lowered to the maximum allowable heating demand.

Table 2. – Values obtained for heating needs and primary energy consumption in the case of the AMVIC

Nr. crt.	City	Required heating kWh/m^{2}year.	Primary energy consumption kWh/m^{2}year.
1	Edmonton	26	93
2	Fort Mc Murray	32	97
3	Iqaluit	54	112
4	Saskatoon	24	91
5	Whiteharse	28	96
6	Winnipeg	23	90
7	Yellaeknife	44	106

In periods of high temperature to maintain optimal comfort of the home it is necessary to have a temperature of 21^{0}C inside. To maintain this temperature it is necessary to use special installations for this - air conditioning.

To determine the cooling demand of a building, ambient temperature data is used. The average summer air temperature is assessed using climatic data for June, July and August. In the case of the cities studied by us, it is not necessary to implement the cooling systems because the average annual temperatures in the summer months do not exceed 21^{0}C

The PHPP 2007 handbook defines primary energy as the "sum of all energy demand for heating, domestic hot water, auxiliary and household electricity" brought to the same denominator. Primary energy demand is implemented in the PHPP program through two stages. In the first stage, the electricity supplied to PH by the national electricity grid is evaluated. In the second step, the electricity obtained in the first stage evaluation is multiplied by the "primary energy factor" specific for each region.

The standard requires that a building can be considered passive, it should not have a total primary energy consumption of more than 120 kWh / (m^2/year).

To determine the total primary energy consumption in the studied areas, we used the PHPP 2007 program designed for this building for the AMVIC passive office building.

The results obtained are shown in Table 2 where it can be seen that the maximum admissible limit of 120 kWh/(m^2/year) has not been exceeded in any of the areas studied for the AMVIC passive office building.

In order to be able to implement the concept of passive building, it must comply with all the requirements imposed by the definition.

CONCLUSIONS

Passive buildings are those buildings that provide a comfortable indoor climate in summer and winter, without the need for a conventional heating.

The possibility of implementing the PHPP project has been studied for 7 cities across Canada.

As a result of the analyzes, it has been shown that in no studied city the minimum criterion for heating needs is not respected.

In areas with lower latitudes in Canada, constructive changes can be made to buildings so that the heating demand falls below the maximum allowable.

The rest of the criteria necessary to be declared a passive building are indelible.

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Cultural ecosystem services as a bridge to future challenges in sustainable development

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Abstract: When featured in management plans, cultural ecosystem services tend to lack adequate integration and quantification. One usually finds them grouped under non-consumptive direct use values. It is envisaged that the demand for cultural ecosystem services in industrialised countries will increase, since more emphasis will be placed on recreational activities and this shift will be backed by higher spending on this segment. This does not mean that such services are not valued in traditional societies; however, here their importance is for the most part attributable to their contribution to cultural identity and even to the survival of such societies. It is regrettable that cultural ecosystem services tend to be marginalised by decision makers, either due to economic or even to ecological considerations, and this in spite of the importance attributed to them by diverse stakeholders in society and indeed by the public itself, as evidenced by the results of numerous exercises carried out to assess public perceptions about such services. This paper reports the results of research aimed at assessment of the recreational value (in the content of cultural value) of Pembroke Garigue Heritage Park (NATURA 2000 site in the Maltese Islands), which is visited by about 22,000 tourists per year. This region has great potential in terms of tourism and is unique especially because of presence of cultural and natural heritage in the same place. The questionnaire survey was conducted from January to October in 2018 by direct contact with visitors in the area and its surroundings. The return rate of the questionnaire was 75.54% (491 respondents) out of a number of 650 distributed copies consisting of 24 questions each. Following the processing of the results using the method of travel costs, with an average duration of stay of 1.87 day and respondents' costs of € 127.47 per person / per stay, the total value of the recreational value was calculated at 5,244.115.8 €. The overall ecosystem assessment services of the evaluated protected area are resulting from recreational activities estimated at € 87,401.93 when converted to 1 ha of total area of Pembroke Heritage Park. Recreational value (VTR) just setting off costs directly linked to visits of the protected area is 634,790.2 € and in recalculation on 1 ha of the total area the value of 10,579.84 € was obtained.

Keywords: ecosystem services, recreational values, Pembroke Garigue Heritage Park, WTP, VTR.

I. INTRODUCTION

Over the last decade, the concept of 'cultural services and goods' linked to ecosystems has been adopted by many academics and environmental policy makers to describe what are experienced as meaningful interactions between people and nature. As such, cultural goods and services represent the newest way of interpreting human environment relations: a 21st Century framing in a sequence covering millennia through which societies have expressed the centrality of the natural environment in supporting human life and well-being. Moreover, there are clearly articulated individual and social values which arise from human interaction with nature. Cultural analysis explores the production, circulation and reception of shared meanings and practices, including those with the natural world. [1] The idea that we can meet human needs and simultaneously conserve and even enhance the natural environment is an attractive one. Since the Brundtland report popularised a definition of sustainable development based on the concept of needs, there has been a widespread belief that it should be possible to achieve a good quality of life without compromising natural ecosystems. [2, 3] Ecosystem cultural services make a significant contribution to achieving people's key needs. In the 21st Century the cultural life across the World is diverse and dynamic. Yet encounters with the natural world maintain their fascination for very substantial numbers of people, as reflected for example, in the membership of a very wide range of civil society organizations embracing landscape and nature interests, the numbers of people who use urban parks and green-spaces on a daily basis, and the massive popularity of gardening throughout the World. Daily contact with nature is part, still, of being human. Sustainability and Wellbeing fills a gap in sustainable development studies by drawing on a range of case-studies to discuss the challenges and opportunities of using Human Scale Development (HSD) framework in practice developed by Manfred Max Neef. HSD indicates how both existence needs (being, having, doing, interacting) and value needs (subsistence, protection, affection, understanding, and value needs (subsistence, protection, affection, understanding, participation, creation, leisure, identity and freedom) can be met through nature. [2, 4, 5, 6, 7]

The Common Ground (The environmental education charity) provides a case study of an organisation that has campaigned to protect what it calls 'local distinctiveness', not only because of the value of ecological diversity, but also because of the enriching social and spiritual value of sense of place: "*…many of us have strong allegiances to places, complex and*

compound appreciation of them, and we recognise that nature, identity and place have strong bonds. We sometimes forget that ours is a cultural landscape. It is our great creation: underpinned by nature, it is a physical thing and an invisible web… Places are process and story as well as artefact, layer upon layer of our continuing history and nature's history intertwined. Places offer an exposition of their evolution, given sensitive development and barefoot education, everyplace is its own living museum, dynamic and filled with sensibilities to its own small rich nesses. These are places we know when we are in them. Meaning is entrapped in the experience of change, symbolisms and significance cling to seemingly ordinary buildings, trees, artefacts" [8]. Communicating the cultural significance of nature in everyday life especially in ways which emphasise its positive benefits rather than resorting to the clichés of destruction and despair which have marked environmental discourse over the last decades is very important for the mobilisation of wider public support for sustainable environmental management. [1]

II. Materials and methods

Main objective of presented article is a valuation of selected ecosystem services (especially cultural services) in Pembroke Heritage Park (NATURA 2000). The protected area (PA) covers an area of 60 ha, it is specified coordinates by 35.932746 N and 14.478551 E.

Used methodology is based on guidelines for rapid assessment of Ecosystem Services Valuation [9, 10] and Millennium Ecosystem Assessment [11, 12, 13].

A questionnaire survey directly on-site was conducted from January to October in 2018 at the most frequent localities of the Pembroke Heritage Park (MT0000002). The questionnaire (24 open, half open and closed questions) is focused on finding preferences of the visitors and their willingness to pay (WTP) an entry fee to the protected area (PA), and a willingness to accept (WTA) certain restrictions for the development and for a brand of the Pembroke Heritage Park. The questionnaire was developed to ascertain also visitor´s demographic and socio-economic information. We have calculated the recreational value (VRT) of the Pembroke Heritage Park through the scheme VRT = Sm * DM * NV, where Sm (EUR) - average value of expenditures per person per day, DM - average length of stay and NV - average number of visitors.

A total of 491 respondents participated in this survey. The return rate of the questionnaire was 75.54% in the number of 650 distributed copies. Participants came from various grade levels of education (37.3% Tertiary, 31.3% Post-Secondary, 27.5% Secondary and 3.9% Primary school graduates) and various jobs (23.62% students, 13.24% self-employers, 2.44% housewife/parents on „mother care", 7.94% Skilled/technical, 9.98% pensioners, 0% unemployed and 26.27% others). Male participants were predominant (57%). Average age of participants was 37.8 (Median=34, SD=14.15, CV=44.05%).

For final evaluations, we used statistics: Descriptive Methods – Summary Statistics (M = Mean, SD = Standard Deviation, Median, cv = coefficient of variation) by software STATGRAPHICS Vers. 5.0.

III. Results and discussion

3.1 Main tasks and activities of visitors

Important factors affecting the tourism in the area are activities that visitors can provide during their stay, and they are often a reason of its visit. According the survey, Pembroke Heritage Park is mostly visited because of educational activities focused on natural and cultural heritage (28.76%), recreation (18.54 %) and relax (16.53%). AMENT *et al*. [14] found that the most-valued cultural services of protected areas were spread over all cultural ecosystem services (CES) subcategories (MA, 2005) in South African national parks: (1) "natural history", (2) "recreation" and (3) "sense of place". Our results confirmed conclusions of KRUGER and SAAYMAN [15] and AMENT *et al*. [14] that visitors to protected areas have distinct travel motivations and managers of protected areas have to know and understand visitors base (socioeconomic backgrounds). ERTAŞ, SADIKLAR, KOÇ and DEMİREL [16] state that in the context of the sustainable development management of each touristic area is necessary to provide the use of environmental and cultural values in a holistic way and respect very close relationship between cultural heritage and natural heritage resources or values.

In terms of duration of stay, Pembroke Heritage Park is mostly visited for one-day recreation and tourism, because 82% of respondents didn't plan to stay overnight. In 69 cases (14%) visitors came for 2 days stay and 4% of them used the area as a long weekend stay that means 3 to 4 days stay (max 1 week).

3.2 Recreational value

To calculate the recreational value of the area is required an estimate of total travel costs of visitors spending for individual services or activities; therefore, we could calculate the average costs for services per visitor (Table I.).

Based on presented, mean value of recreational costs of visitors is 127.47 € per person/day, with including all categories. We only take into account the costs particularly related to a visit of the area to calculate a recreational value of assessed area, that means transport, local taxes and other cultural costs (museums); a mean value approximately represents 15.43 € per person and per day.

Recreational value (VTR) in Pembroke Heritage Park

VRT = Sm * DM * NV = 127.47 * 1.87 * 22,000 = 5,244.115.8 €,

(VTR – into account all costs)

VRT = Sm * DM * NV = 15.43 * 1.87 * 22,000 = 634,790.2 €

(VTR – into account transport costs only)

Notes: Sm (€): average value of expenditures per person per day, DM: average length of stay, NV: average number of visitors.

Despite the fact that the total area is the smallest and one-day tourism is dominated, recreational values of our assessed area are not the lowest (Table II.) and average costs per person/per day (€) is the highest in comparison with comparison with others studies in Slovakia (Fig 1.).

Malta is typical of multiculturalism, especially because of the influx of tourists from different parts of the world. According to the national composition, Maltese (28%) forming the largest group of visitors to the park. Our sample of respondents is very diverse in terms of national composition and consists of up to 26 different nationalities (UK 16%, Ireland 11%, Australia 7%, Netherlands 6%, Poland 5%, Spain 4%, Czech Republic 3%, Turkey 3%, Germany 2%, Slovak Republic 2%, Lithuania 2%, Hungary 2%, India 2%, Latvia 1%, France 1%, Italy 1%, USA 1%, New Zealand 0.5%, Japan 0.5%, Portugal 0.5%, Belgium 0.5%, Mexico 0.25%, China 0.25%, Russia 0.25%, Iceland 0.25%). According to the calculations illustrated in Table III., more than half of the respondents are Post-Secondary and Tertiary educated.

3.3 Willingness-to-pay (WTP) for management in Pembroke Heritage Park

The last question of the questionnaire was hypothetical and focused on willingness to pay an entrance fee to the protected area, which would be used for ensuring particular management measures for sustainability of Pembroke Heritage Park; while respondents were explained that financial contribution by government are reduced and they are often inadequate, so their willingness to pay entrance fee would go beyond other expenses. Percentage of the amount for entrance fee that visitors would be willing to pay for supporting the development and nature conservation in our assessed protected area is presented in Table IV.

Table IV. Comparison of average WTPs in the assessed area with other European PAs

Evaluated area	Willingness to pay	Unwillingness to pay	Don`t know
Pembroke (Malta)	95.65%	4.35%	-
Salini (Malta) [20]	33%	44%	23%
Beigua (Italy) [21]	42.6%	57.4%	-
Nestos (Greece) [21]	42.2%	52.13%	5.67%
Abisko NP (Sweden) [22]	61%	-	-
SCI Vtacnik (Slovakia) [17]	89%	11%	-

In our study, we found out the positive linear relationship between higher education level and willing to pay for the use of the park. The results showed that the higher education of respondents actually increased their willingness to pay entrance fee (Table III. and Table IV.).

Table V. Comparison of the overall willingness to pay in the assessed area with other European PAs

Evaluated Area	Average of WTP (EUR)
Pembroke (Malta)	**8,69**
Salini (Malta) [20]	**0,84**
Beigua (Italy) [21]	**1,91**
Nestos (Greece) [21]	**1,78**
Abisko NP (Sweden) [22]	**22.33**
SCI Vtacnik (Slovakia) [17]	**2.56**

IV. CONCLUSSION

A very important socioeconomic factor was definitely the environment and how important people regarded it in their lives. The study tried to assess and analyze the importance that respondents gave to environment in order to see how this could affect the willingness to pay entrance fee. The questionnaire thus had a section dedicated to the subject of environmental importance as perceived by respondents. Participants were asked if they thought the environment was important for the quality of their lives and if so, to give reasons for their answers. Environment appeared to bear importance to many people since nine out of ten respondents (90%) stated that they considered the environment to be either important or very important. Ecosystems are vulnerable to local and global impacts due to human well-being, human activities and climate change. In this study, an economic valuation of the main CES generated in the Pembroke Heritage Park were identified and tourists were chosen as main stakeholders in the protected area. We found out the positive linear relationship between respondents` perception on CES and their WTP for supporting conservation activities capable of preserving the functionality of the assessed area to provide different goods and services. The connection of natural areas with cultural heritage has a long and distinctive history in The Maltese Islands. Environmental settings also function as a generator of a vast range of local identities based around a more local and everyday sense of heritage. Heritage goods, therefore, can be a source of community empowerment, as well as potential conflict between different interests.

The average amount that visitors would be willing to pay as an entrance fee to the Pembroke Heritage Park is 8.69 € per person, which is the highest result in comparison with other PAs in the Mediterranean (Table V.). The relationship between the choice of whether to accept to pay entrance fee or not and income level was a significant albeit a negative one indicating that when income levels increased, the willingness to pay for the use of the park tended to decrease. One would have expected persons that have more disposable income to be more willing to pay entrance fee, however this was not proven to be the case since the correlation was a negative one. Such a relationship is in agreement with the previous similar study in the Maltese Islands which have been reported by PARASCANDALO [20]. These results contrast with those reported by NIKODINOSKA, PALETTO, FRANZESE and JONASSON [22], where increased income levels tended to increase the total mean WTP per respondent in Swedish National Park. The highest total mean WTP per respondent was found in Abisko National Park (Sweden), where the mean individual WTP were found to be 6.20 € for the provisioning services, 5.69 € for the regulating services, 6.35 € for supporting services and 4.09 € for cultural services [22].

These outcomes could support local decision makers in charge for the implementation of adaptive conservation management strategies in the protected area.

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Increasing Building Energy and Environmental Performance for Sustainable Cities

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Abstract: Recently was remarked that desired effects of the technological advance could be attended by undesired and negative impacts. Registered events have shown that the arisen environmental and social challenges are pretty stringent and need to be seriously discussed and solved. After many debates, the concept of sustainable development, defined for the first time in the Brundtland Report was accepted as being a possible way for solving complex global technological, economic, environmental, and social challenges. The goal is to find the best strategies for assuring the sustainability of our society, by taking into account the multitude of aspects. Gaining strategies on local level means actually developing strategies for getting in the future sustainable cities. For this it is important to firstly analyze and evaluate existing cities infrastructure, one most important element being represented by existing buildings in and around cities. Buildings energy and environmental performance is one relevant concern in the efforts of shaping sustainable cities. It is to be mentioned that in the European context related to buildings energy performance, there are several efforts for improving it. In our country specific authorities are promoting measures for increasing buildings energy performance. This is especially made by designing new buildings with low energy consumption, by thermal rehabilitation of existing buildings and by correctly informing building owners and administrators about the state of the art. In this regard the energy performance certificate is playing an important role, finally meaning a decrease of electric and thermal energy consumption on a local level in the direction of getting local sustainability.

Keywords: Sustainable urban planning, buidings energy performance, buildings environmental performance, sustainable city, energy consumption, local sustainability

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INTRODUCTION

After the second World War tremendous technological developments started to take place on a global level. The positive impacts of technological applications on the population quality of life have been soon recognized through the got support in carrying out diverse human activities. Simultaneously the world began but to realize the dangers and undesired effects of some human activities, not only of industrial ones, being possible to be carried out because of many technological applications. At latest after the *Conference for Environment* in Stockholm in 1972 and after publication of the first report to the Club of Rome *„The Limits to Growth"* in the same year it was understood that besides wanted and positive effects of technological progress, undesired and negative effects can also appear [5, 6]. It was clear that the arisen regional and global environmental problems are very serious and need to be solved. Nowadays we confront us with a series of global problems, which can be grouped in three categories: increase of natural resources and energy consumption, environmental pollution and increase of world population [5] (Figure 1).

In order to find solutions for the problems shown above, which could be applicable to the developed as well as to the developing countries with respect to regional differences, worldwide began discussions some time ago on political, scientific and social levels [7]. The *Brundtland Report* of the World Council on Environment and Development represented a result of these worldwide political discussions, where 1987 for the first time the concept of *sustainable development* was defined [4]. This concept has been soon accepted as a possible solution for the global complex ecological, economic, and social problems. The concept of sustainable development was very much discussed thereafter, as for instance in 1992 on the *Conference for Environment and Development* in Rio de Janeiro, being strongly emphasized in the conference closing document *Agenda 21*, as well as 2002 in the follow-up Conference *Rio+10* in Johannesburg, Southern Africa and 2012 during the Conference *Rio+20* in Rio de Janeiro [11]. Many actions after this time have emphasized that the evolution of technical, social and ecological systems has to be analyzed in synergetic relation [5]. Sustainable development has nowadays become a widely used term. In order to make this concept more understandable, rules, strategies and principles of sustainable development have in the meantime been defined [7]. The general Brundtland definition has been

accepted, but together with strategies, it does still not deliver a methodology for applying the concept of sustainable development to real concrete situations, especially on regional and on local levels [10].

VI. URBAN SUSTAINABILITY - METHODOLOGICAL ASPECTS

Applying sustainable development on a local level, this means on the level of cities in order to get the so-called urban sustainability, does represent a pretty young direction for some countries in South Eastern Europe [1, 10]. Nevertheless the field of urban sustainability is starting to achieve important advance in Romania, as some city councils in the country are generally recognizing the advantages of following the sustainability direction [10]. An appropriate way for developing strategies for urban sustainability could be represented by using analytical instruments of Technology Assessment, because very often questions are related to the possibilities to best integrate new technologies on a local level into environment and society [9]. These questions are in the present conditions of the Eastern European countries from dominant importance, in the process of modernization of old technologies and implementation of new ones. From this reason Technology Assessment should play a central role in the next technical, economic, environmental and social development of these countries [3, 9].

In order to get in the future *sustainable cities*, also in Romania have already started discussions in this field, especially on scientific level, regarding the establishing way of a general methodology for developing *sustainable cities*, in accordance to the already developed and applied methodologies in other European countries by taking into consideration specific differences especially on social and cultural level [1, 2, 8].

In this regard, by applying the sustainability systemic analysis on a local level, it can be obtained the general methodology for getting *urban sustainability,* which can be materialised in the following steps [7]:

- Defining the sustainability problem on a local/regional level;
- Establishing specific space and time scales;
- Establishing concrete aims for the studied case;
- Systemic approach of the region by modelling the interactions;
- Analyzing available city infrastructure, inclusively buildings;
- Carrying out buildings energy and environmental performance analysis;
- Developing concepts and measures by establishing priorities;
- Developing evaluation and control instruments;
- Verifying potential results, which could be obtained after introducing proposed measures, by developing some appropriate scenarios;
- Applying into the practice the developed concept.

When analyzing the presented methodology for shaping sustainable cities one can recognise that urban sustainability means actually a transformation process under changeable frame conditions, as actually the general discussion regarding sustainability operationalisation [2, 5. 9]. The so-called *urban sustainability management* as the process of shaping sustainable cities means actually to emphasise the development direction on the local level, not at last by carefully analysing buildings energy and environmental performance [12]. This is possible to be done by simultaneously considering economic, environmental, technical and social aspects.

VII. BUILDINGS ENERGY AND ENVIRONMENTAL PERFORMANCE

Many actions after this time emphasize that the evolution of technical, environmental and social systems has to be analyzed in synergetic relation, in order to succeed the successful operationalization of sustainable development on different levels, on global, national, regional, and on local level. The goal was and still is to find best strategies for assuring the sustainability of our society, by taking into account the multitude of aspects related to economic and social activities.

Gaining strategies on local level means actually developing strategies for urban sustainability in cities. The vision of having in the future only sustainable cities, by taking into account regional differences, is worldwide a pretty discussed topic, also in some Eastern European countries. For this it is important to analyze and evaluate the existing cities infrastructure, one most important element being represented by existing buildings in and around cities. It was recognized that urban sustainability is among the most critically important global issues of the 21st century. It is estimated that over 50% of the world's population is currently living in urban areas. Some developed scenarios for the future urban development estimate that by 2050 the proportion of the global population living in cities will rise to 70% [5]. The big challenge is that cities nowadays consume about 75% of all world's energy and emit around 80% of all greenhouse gases [5]. Therefore the fight against climate change will be won or lost in cities, so it is crucial that urban habitats will become more efficient, not only for themselves, but for future generations and the Earth's diverse ecosystems.

Actually to improve environmental performance of buildings it is essential to involve all parameters which control its energy efficiency. Article 5.9 of the Building decree 2012 specifies that the environmental performance of the building must be quantified using the Environmental Performance Determination Method for Buildings and Civil Engineering Works. The calculation method for determining the environmental performance of buildings and civil engineering works during their entire life span is based on the life cycle analysis method [13]. In this regard buildings energy and environmental performance should be one relevant concern in the efforts of gaining sustainable cities. It is to be mentioned that in the European context with regard to buildings energy performance, there are several efforts in the direction of its

improving. Firstly the process of assessment of building energy performance should be started, as emphasized in Figure 2. The goal of the assessment is to promote measures to increase the buildings energy performance by taking into account energy performance requirements, improving urban aspect of localities, external climatic conditions, location, interior comfort requirements. Building energy performance is expressed mainly by the following performance indicators: energy class, total specific energy consumption, and CO_2 equivalent emission index, as stated in the Government Ordinance No. 432/2010 regarding green investments [14].

Issues related to improvement of buildings energy performance are mainly regulated under the Directive 2010/31/UE on the energy performance of buildings [12]. In this regard it can be stated that in our country specific authorities try to promote measures in the direction of increasing buildings energy performance. This is made especially by designing new buildings with low energy consumption, by thermal rehabilitation of existing buildings and by correctly informing building owners and administrators about the state of the art. Taking this into consideration means that the energy performance certificate is playing an important role in order to improve the built-up urban framework. Not negligible is its decisive role played with regard to developing strategies on a local level for proper environmental protection. Buildings energy performance should be taken into consideration when referring to existing possibilities of getting sustainable cities. This could improve building affordability for customers, and also improve the dwellings energy performance. This fact would finally mean a decrease of electric and thermal energy consumption on a local level, what would assure progress in the field of improving environmental quality in cities and implicitly in the direction of getting local sustainability [11].

VIII. RESULTS AND DISCUSSION

From the made presentation it is more than clear that for shaping sustainable cities existing city infrastructure has to be approached and by this analyzing buildings energy and environmental performance is very important in this regard.

The presented correlation between buildings energy and environmental performance and shaping sustainable cities is an innovative one and consists in finding possibilities for increasing these buildings performances as a condition for getting sustainable cities.

IX. CONCLUSION

Regarding sustainable urban development it is to be mentioned that currently there is still no agreement regarding general requirements for shaping sustainable cities or there is no complete agreement regarding what components should be included. Generally there is agreement that a sustainable city should meet the needs of the present without compromising the ability of future generations to meet their own needs. This means that actually there is a substantial variation in terms of how cities carry out their attempts to become sustainable. Nowadays the goal is to generally promote sustainable urban development, by taking into account all aspects related to this issue such as technical, economic, social and environmental aspects in the field of adequate living conditions and housing space, proper resource use, mobility, governance as well as social life. This means that there is a real need for interdisciplinary work among economists, engineers with social scientists.

Developing a kind of a ”general methodology” to be applied into the practice for real concrete situations by taking into consideration regional differences would represent a major progress in this field, just to come from the vision to the reality.

However, a sustainable city should demonstrate several initiatives for increasing buildings energy and environmental performance. To achieve this main goal in the field of assuring sustainable urban development it is useful that cities infrastructure is analzyed and assessed by applying buildings energy and environmental performance analysis

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Some issues regarding evolution of wind turbines

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Abstract: The paper highlights the relevant aspects of trends towards the future of wind energy. The aspects concerning the form, the dimensions of the wind power plants in order to widen the area of use, the choice of a compact structure, the possibility to develop the process of implementation of on-shore and off-shore power plants with minimal costs, the elimination of the disadvantages signaled during the operation of wind power plants to the new types of power plants. They will highlight the aspects regarding the logistics of the equipment implementation of the dimensions and the shape of the blades, the solutions chosen for the location of the generators, and the advantages deriving from the widening of the field of the new generation plants. These power stations are maximizing and streamlining the wind potential and transforming it into a high level of electricity production. All this at a minimum level of impact on the environment. Here is also the placement of new types of power plants in urban environments, taking into account the fact that the issues related to the operating noise of the centers are eliminated while at the same time eliminating / minimizing the effects of the shadows.

Keywords: renewable energy, standard wind turbines, wind turbines, the environment.

I. INTRODUCTION

Energy is essential for economic growth and the socio-economic development of the world economy. As a result of this, and taking into account a number of factors aimed at general economic efficiency, the use of renewable energy is growing. Wind energy, one of the renewable energy sources that can be developed at the level of regions with an intense wind map, could contribute to mitigating dependence on fossil fuels [1]
At present, about 87% of the world's total energy is produced using traditional fossil fuels (coal, oil and natural gas), while 6% -8% is generated from nuclear power plants and the remaining 7% is generated from renewable sources (especially hydropower, wind and solar) [2].

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Due to the fact that fossil and nuclear fuels are very dependent on energy production, there are environmental and safety issues, which are now becoming dominant in society and in the international world. The fact that the energy issue has become a global issue is also confirmed by the agreement (the Paris Framework Convention), which states inter alia that climate change at the beginning of the third millennium in the world stems from the imbalance generated by the use The Agreement is part of the United Nations Framework Convention on Climate Change (UNFCCC), which addresses the reduction of greenhouse gas emissions [3, 4].

The terms of the agreement were deliberated by 196 representatives at the 21st UNFCCC Conference in Paris and 12 December 2015, and were adopted by consensus. The world is drastically concentrating on clean and safe renewable energy sources, due to the effects of environmental pollution on global warming. In the long run, the resulting climate change has disastrous consequences on the planet.

II. ONSHORE WIND TURBINES/ WIND FARMS

The modern wind turbine industry was born in the Netherlands and was quickly adopted by Denmark and other states. It soon became the most reliable form of non-polluting power generation from hydro power.

Modern wind turbines have an average efficiency of up to 35%, varying depending on the wind conditions where they are mounted. There are relatively small differences between the different types of wind turbines of the various manufacturers.

The first wind turbines started from power of about 75 kw / hour. Over time turbine power has grown to 10,000 kw / h in the case of offshore wind turbines. In order to be able to reach such power, all of the components were re-enriched and optimized in terms of cost-effectiveness for the energy produced (lei / megawatt). In essence, all these developments, structural improvements, turbines

and related equipment are aimed at reducing the cost per unit of measure of the energy processed and implicitly reducing the costs of the whole turbine assembly. On the other hand, the operating and maintenance costs of wind turbines / wind farms have increased. So the gauge of the entire structure is directly proportional to the power generated at the turbine exit.

These time transformations are suggestively presented in figure no. 1.

In the 1980s, the world's wind energy market grew exponentially. Between 1990 and 2007, global wind power capacity worldwide increased 50 times and is projected to increase above the 2008 level ten times by 2030 and twenty times by 2050 [5]. In order to achieve the expected expansion in this area, it is necessary to develop new, lighter materials that allow the manufacture of larger rotor blades. The larger the surface through which the turbine can extract the wind energy, the more power can be captured (Figure 1) [5].

On the other hand, experts in the field of wind (wind intensity) predict that the winds for onshore wind turbines would rise by 24% by 2030, which would allow the location of wind farms in a wider area, given the technological improvements. According to a survey by Berkeley Lab, the National Renewable Energy Lab (NREL) Massachusetts in November 2016, technological improvements will be divided into two distinct directions (Figure 2):

Increasing the height of the pylon of the wind farm, with all its consequences.

Increase blade diameters in order to increase production capacity (outputs

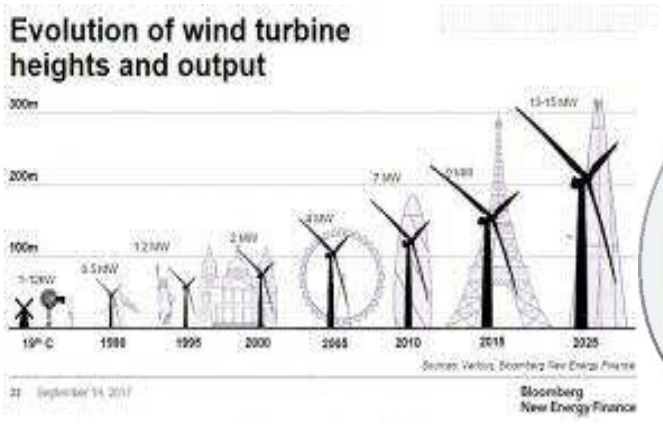

Fig. 2. Evolution of pole height and production capacity of wind turbines. [6].

Deploying higher and better wind farms will open up new market opportunities for developers.

III.SMALL WIND TURBINE (SWT)

SWT -Smoll Wind Turbine is one of the community-based solutions to meet the need for energy in smaller quantities. They constitute a distinct and separate group of devices, developed in the wind energy sector, according to IEC 61400-2 standard, the SWTs are characterized by a rotor with a surface area of less than 200m2 and a rated output of less than 50kW [7]. Wind power plants in this category are generally intended for small and individual customers such as households, farms, weather stations, road signs and advertising systems. SWT uses are considered beneficial, both as independent applications and in combination with other types of energy, using conversion technologies such as photovoltaic motors, small hydro motors or diesel.

The amount of SWT operating worldwide is growing annually. In 2012, the total number of people using such devices was around 800,000 worldwide [8], with an increase of about 10%.

Most SWTs (around 70%) are located in China, where the highest number of new installations was registered in 2012. The second largest SWT market is the US, where about 155,000 SWTs are currently in operation. In Europe, the UK is home to 23,500 units, followed by Germany with 10,000 units, Spain: 7020 units and Poland: 3,200 units. The total capacity currently installed in the world reaches 600 MW, distributing the three major manufacturers.

An interesting design solution for SWT turbines is to add a circular nozzle in which the rotor is encapsulated. . Such turbines have a number of commercial and scientific names such as DAWT, windscreens, compact wind turbines (CWAT)

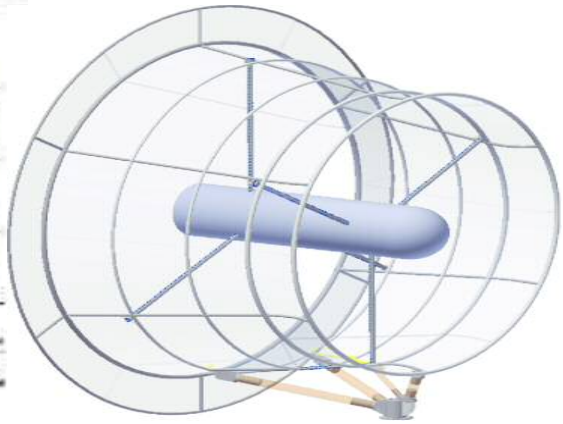

Fig. 3. Model of a SWT turbine with encapsulated rotor [9]

The Shell Light Shell Speaker Concept (Figure 3) was created as an attempt to ease the diffuser made of glass fiber composites which are the most commonly used materials for such applications nowadays. The geometric shape of the diffuser has

been developed on the basis of CFD simulations in order to optimize turbine efficiency for low wind speed conditions.

IV. CONCLUSION

In the paper were presented some directions of development of wind turbines, which the authors consider by perspective :

• Correlation of investments with regard to the assimilation of wind power plants with the specific costs (lei / kW) generated by the exits from the power plant.

• Correlation of the power of the wind power plants with their constructive dimensions, but also with the possibility of expanding the location areas with lower wind speeds, taking into account the technological development, the quality of the new materials used, the construction of the power plants and the effects of the preventive / corrective maintenance on the overall economic efficiency of the operation of wind power plants

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Perspectives of using biomass: Evidence from Romania

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Abstract: The energy generated from biomass is of particular interest; The various types of existing waste - which are raw materials in producing this type of renewable energy - make this form of energy a remarkable potential. In Romania, the development of this green energy niche has long remained behind other renewable energy projects. The main factor that has impeded a similar development is the considerably higher costs involved by biomass projects. In Romania, many companies only have collection targets without monitoring and recording biomass and the population is not sufficiently involved in the process. Romania has lagged behind in implementing these policies because of limited financial resources, particularly due to a low interest in these decision-making factors. To analyze the effectiveness of the biomass policy in identifying recycling measures, at the level of the eight regions of Romania, we used an econometric approach to estimate a model. The average biomass price is the key factor for a sustainable resource management program.

Keywords: energy, waste, biomass, price.

INTRODUCTION

In recent decades, environmental policies have moved from a qualitative approach to protect water, air, and soil to a quantitative approach centred on polluting emissions and to the integration of the concept of sustainable development[1]. Moreover, biomass is, in most countries, a pollutant to the natural ecosystem [8], [12],[14]. For this reason, the European Union's new biomass guidelines include measures aimed at greater recycling and reuse during the life cycle of products to benefit both the environment and the economy[2], [13].

It also presented a financial support platform for the circular economy, a set of guidelines for member states on energy recovery of biomass, and a proposal to improve the recycling rules on certain hazardous substances in electrical and electronic equipment[8], [14], [16]. This set of guidelines for the energy recovery of biomass will maximize the benefits of the national energy mix [3]. It will support member states in optimizing their contribution to the Energy Union and exploit opportunities for creating cross-border partnerships, where appropriate and only if environmental objectives are respected [5].

Specialized studies have highlighted the importance of the social aspect in the efficiency of biomass systems[17]. Consumer behaviour and public participation in the planning and implementation of these systems are as important as the technical and economic aspects of biomass [4],[15],[18].

At the same time, biomass generation is influenced by family size, education level, and monthly income [6],[11]. From this perspective, same authors drew attention to the importance of product design stages but also on the fact that the authorities need to consider their recycling rate and encourage the development of recycling [7]. Even with regard to the implementation of the recycling strategy of biomass, progress is slow in Romania [19], [20].

In this context, we evaluated the effectiveness of the biomass policy in Romania in identifying recycling measures, starting with an analysis of the current situation. To achieve this goal, the present study raises the following question: Can the current strategy of Romania ensure the sustainability of biomass at prices that allow for the protection of the environment for present and future generations?

This article is structured as follows: the first section analyses a series of previous studies on how companies understand the need to adapt to the recycling practices wish in view of the tax impact of biomass as well as the coercive measures taken to impose recycling. The second section presents the research methodology and the results of the study. In the final section, we discuss the conclusions.

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MATERIALS AND METHODS

To analyse the effectiveness of the biomass policy in Romania, we used an econometric approach to estimate a model based on the following equation:

$$VDM_{n+1} = k + a_1P_{n-1} + a_2\ GCE_{n-1} + a_3\ NG_{n-1} + a_4ERR_{n-1} + a_5IPC + \varepsilon \quad (1)$$

where
VDM – volume of biomass
k, a1, a2,..am – the estimation parameters of the models to be determined at the regional level
P – average price of biomass
GCE – education level
NG – household size (number)
ERR – evolution of recycling rate
IPC – linear index of the losses registered in biomass

The model is developed to support the decision-making process one year before (n + 1), assuming that biomass planners make decisions during year n using data from year n - 1. The data analysis process takes into account the entire time frame of the available data (2000–2015). Study data include all variables obtained from the 2015 SOER multi-sectoral environmental governance statistics [9] and the multifunctional environmental impact study to better implement EU legislation on the environment [10].

The annual data on the volume of biomass was made available to the European Committee of the Regions by Romanian authorities [10]. The average price of biomass refers to the charges for domestic sanitation—collection, transport, and storage—in each region of Romania[10]. A priori, the NG variable has a significant and positive effect on the volume of biomass. This result can also be observed for the ERR variable. The data were processed using the statistical and mathematical software package EViews 8, resulting in a multifactor regression model for the estimation parameters k, a1, a2, ... am. The Pedroni panel co-integration statistics were constructed from regression residues that can be standardized and normally distributed asymptotically.

RESULTS AND DISCUSSION

Applying the Pedroni co-integration test led us to a co-integration relationship between the various variables in the study, which was justified by the results showing six statistics confirming the co-integration versus four statistics with only a statistical significance of a 99% confidence level. Further, even with the existence of this co-integration relationship, it is possible to estimate an error correction model. This results may explain the existence of a long-term equilibrium relationship between the volume of biomass and other variables.

According to the results, an estimate of a short-term equation provides an insignificant coefficient of the ERR variable. In other words, the positive coefficient of this variable does not justify an efficiency measure in biomass management. However, from a long-term perspective, the coefficient of this ERR variable becomes largely significant, with a confidence level of 99%. The positive sign of the coefficient indicates that the biomass policy in Romania can reach a high efficiency level in a future projection. Additionally, the short-term negative coefficient of the NG variable is not significant. However, from a short-term perspective, NG evolution has led to an increase in the volume of biomass. In other words, the negative and significant coefficient of 5% of the NG variable explains that in the long run, this variable is not a decisive factor in increasing the volume of biomass.

It should be noted that the average biomass price is the key factor for a sustainable resource management program. Thus, in the long run, the negative and significant 1% threshold indicates that the price may be a recycling incentive. In the short term, the price does not have a significant and positive effect on biomass management models.

The situation regarding the biomass at the level of the eight regions of Romania indicates that indeed, in some regions, the coefficient of the EER variable is sometimes negative and sometimes positive. Thus, for the regions of Sud–Muntenia, Sud-Vest Oltenia, and Nord-Est, the coefficient of the EER variable is negative, but not significant. The effect of the variable in the evolution of the number of households is positive in the Centru, Sud–Muntenia, Sud-Vest Oltenia, Nord-Vest, București–Ilfov, Sud-Est, Vest, and Nord-Est regions. This means that as the number of households grows, the volume of biomass will also increase. Further, in the regions of Sud-Vest Oltenia, Vest, and Nord-Est, the coefficient of the linear index of losses in the biomass is negative, which may mean there is environmental degradation in these regions.

In a sustainable biomass policy, the price variable is considered to be the determining factor in any regulatory program. For the regions of Centru, Sud–Muntenia, Sud-Vest Oltenia, Nord-Vest, București–Ilfov, Sud-Est, Vest, and Nord-Est, this coefficient is positive and significant. This result can be explained by the fact that in these regions, the price does not remain a factor influencing short-term recycling.

CONCLUSION

Some progress has been made, such as that in the legal field and in the launch of recycling projects and programs. However, in Romania, many companies only have collection targets without monitoring and recording biomass. Too few companies pursue selective collection for recycling/reuse of generated biomass, and the

population is not sufficiently involved in the process.

From this point of view, Romania has lagged behind in implementing these policies because of limited financial resources, particularly due to a low interest in these decision-making factors.

Among the underlying causes of the poor results obtained by Romania in this field, we highlight the deficit of economic information, the absence of ecological education and environmental protection, low differentiation of tariffs, and poor sanctioning measures for those who do not respect these rules.

Additionally, the biomass strategies must involve a better correlation with environmental strategies and with educational and employment strategies so that Romanian authorities can generate several more ways of action to achieve results.

The public and the decision-makers must be aware that recycling brings benefits to both the environment and the economy by providing raw materials to create new products and fostering innovation and job creation. From the consumer's point of view, repackaging and separate collection for recycling could help increase the efficiency of biomass through purchasing of organic products. In Romania a strategic reflection should be made to build an efficient sector because even the privatization of the biomass sector has led to social and urban problems.

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Considerations regarding the identification of high potential materials for biogas production

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Abstract: The presentation highlights the need to use organic waste and waste water in anaerobic fermentation processes as a source of biogas production.
The conclusions present the environmental benefits of energy recovery of waste to biogas, in line with the European commitments on circular economy, waste management and the promotion of energy from unconventional sources.

Keywords: greenhouse gas emissions, biogas, anaerobic fermentation, waste management

1. Introduction

The research aimed at analyzing the possibilities of using organic waste in combination with wastewaters for the production of biogas. At present, 4.95 million tons of municipal waste is produced in Romania, household and similar waste, garden and park waste, market waste and street waste [1]. The energy use of biodegradable household waste by anaerobic digestion in biogas plants and energy production in CHC can be a waste management solution .

The EU strategy encourages the promotion of carbon neutral energy solutions. CHP is a "mature technology that already provides low-carbon heating and cooling for many cities ." [2] Thus, a "network for the efficient use of low-carbon and zero-carbon renewables" can be achieved [2].

The anaerobic digestion process of organic waste has been continuously improved as a result of experimental research to improve the methane concentration in the biogas.

Improvement of the anaerobic digestion process of organic waste can be intensified by applying different substrate pretreatment methods [3], such as mechanical (solid state disintegration / cutting), thermal (chemical application), chemical (the use of substances for decomposition of organic compounds) or biological.

Biogas production may increase significantly depending on the treatment method applied but also on the characteristics of the substrate used and the type of digestion system.

Another factor influencing the anaerobic digestion process is the total solids content of the organic fraction of municipal waste. Research has been carried out [4] showing that the amount of methane produced is inversely proportional to the total solids content of the organic fraction of municipal waste

Also, the addition of trace elements improve the digestion process[5], this it can even lead to an increase in biogas production by 24%.

2. Experimental

For this purpose, different types of recipes have been tested in order to identify materials with high potential for the production of biogas, qualitative and quantitative. The tests were carried out on the pilot installation used for the experimental part, which is apatented invention ,,,process and installation for obtaining biogas from biomass"[6] and on the small installation in the multifunctional laboratory of the Timisoara Faculty of mechanics''.Determination of the actual potential for biogas production in suitable quantities and with the highest methane content in its composition was carried out in the pilot facility.

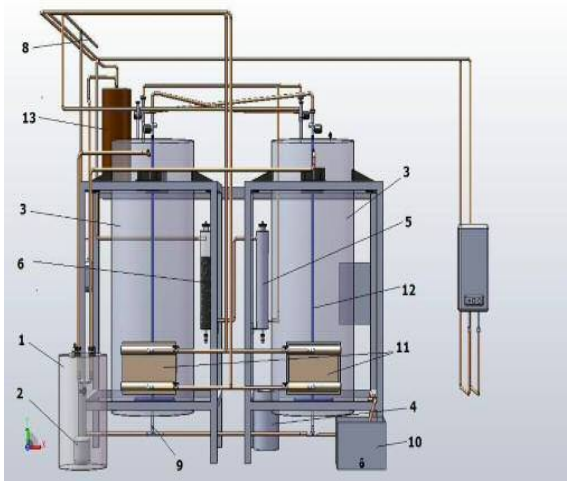

Figure 1. Diagram of the principle of the pilot installation [6], [7]

From the reservoir where biomass is deposited, it passes through a mill, and then it is sent to the reservoir where it is homogenized with water (1). The homogenized matter is transported with the submersible pump (2) and sent to the fermenters (3). This installation shall also be fitted with a tank containing a correction agent (4) that ensures the pH. The biogas result passes through a filter (5) for the retention of H_2S (hydrogen sulfide) and then through a system (6) that partially withholds CO_2 (carbon dioxide), after which it can be compressed into the adjacent system (7) and the resulting biogas is collected through pipelines (8) to be used. The material used is downloaded through a gravimetric system (9), and part of the resulting liquid is separated (solid by the liquid by decanting) through the system (10) and sent to the sewage. The reactors are heated by the heating system (11), and the homogenization is achieved by a bubbling system (12). In order to keep small quantities of biogas for analysis purposes, the plant is also equipped with a smaller-sized supply tank (13).

3. Experimental results. Results interpretations

The laboratory determinations consisted of two parts related to the obtaining of biogas: analysis of physical and chemical properties for different materials in order to further use them in processes of anaerobic fermentation and laboratory determinations on the pilot installation with the drawing of related conclusions related to the potential for use of these residual materials. Wastewater from the wastewater treatment plant in Timisoara, in combination with different materials it was tested in order to identify the potential for the recovery of wastewater through anaerobic digestion[8].

The tests considered the use of a mixture based on wastewater from the sewage plant and as cereal material degraded maize and degraded barley. This was done for about 45 days, at a mesophilic temperature regime of about 33 – 36°C.

During the tests, the monitoring of pH was considered, the pressures obtained on the installation, respectively the quality and quantity of the biogas produced. The quantity was monitored using gas meters and the partial composition of the obtained biogas was quantified as regards the content of methane and carbon dioxide. Variation of pH for the materials studied is presented in figure 2

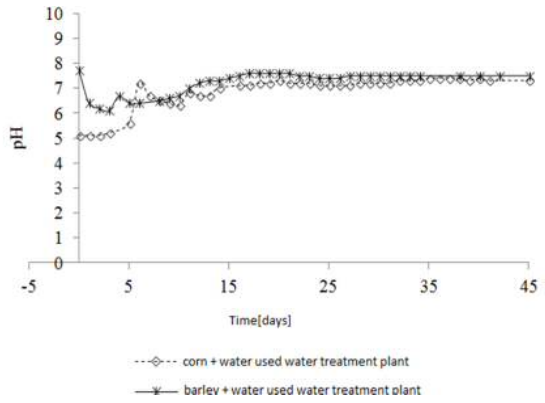

Figure 2. – pH variation for tested materials [8]

In the figure.2. it can be observed that the initial pH for maize was in the acid field, while for barley, the initial values were relatively atypical in the alkaline field. This can be explained by the fact that an initial correction of pH was made at the loading of the plant, using a caustic soda-based suspension. The initial values were in the field of 5 – 5.2 and 8, respectively, for the two ounces. Thereafter, after about 5-8 days of the process, the pH stabilization was taken on the neutral field, this remains unchanged until the end of the anaerobic fermentation process.[8]

Regarding the variation of the concentration of CH_4, it can be seen that for the two materials studied, the variation of the methane concentration has similar behavior, charge containing degraded maize having a higher speed of increase in the value of biogas methane.

At the end of the process, the charge with degraded barley presents a value of about 80% of the volume of methane in biogas, while the charge with degraded maize has a value of about 78% density percent.

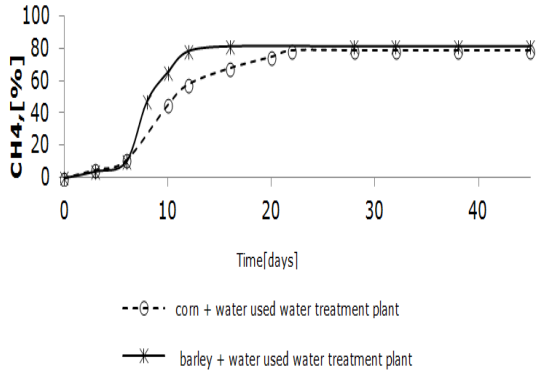

Figure .3. - Variation of CH_4 concentration [8]

Similarly, as the percentage of methane increases, there is a proportional decrease in the percentage of carbon dioxide to values reaching a minimum of

19-20% for the degraded barley batch and 21-22% for the degraded maize batch[8].

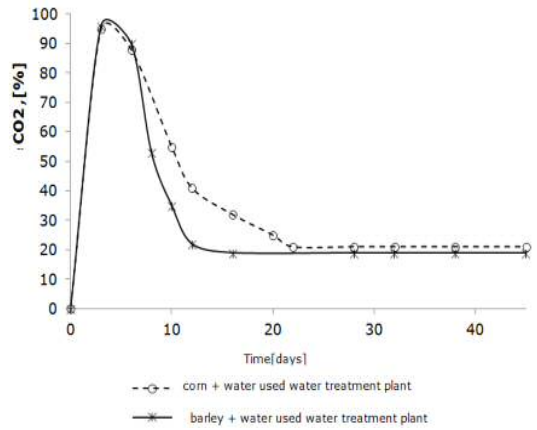

Figure .4. -CO_2 concentration variation [8]

The quantities of biogas produced for the two materials in this first scenario are about 8.2 m^3 for charge containing degraded maize and approximately 11 m^3 for charge with degraded barley.

After completing the material test, the substrate analysis after the process took place.[8]

4. onclusions and personal contributions

Organic waste can be successfully used for anaerobic fermentation in combination with sewage from municipal wastewater treatment plants.

The production of biogas through anaerobic digestion offers significant advantages over other waste treatment methods. The most important advantages are the following [9]:

- results in a lower amount of residue produced by comparison with aerobic treatment technologies;
- the treatment of wet waste with less than 40% dry weight is successfully achieved;
-provides a more efficient pathogen removal - this is true for multi-step digesters or if a pasteurization step is introduced into the process.
- there is a reduction of odorous emissions because 99% of the volatile elements are oxidized by the combustion of biogas;
-digestate resulting from anaerobic digestion (as a residue) is considered an improved fertilizer and can be used as such on agricultural land [9].

Another advantage is that anaerobic digestion of wastes in biogas plants avoids the elimination of greenhouse gases in the atmosphere resulting from the disposal of waste in landfills.Biogas obtained through anaerobic digestion of organic waste can be used energetically by producing electricity and heat in CHP.Biogas can also be improved and used in biomethane transports.

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Conclusions and perso

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Contributions to the sustainable development of the areas affected by the operation in Oltenia basin. Study of case Rovinari city

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Abstract: Abstract: The basic economic activity of Rovinari is the mining industry, an activity on which almost all other activities are based within the city, with a great influence on the economic situation in the area. Rovinari's development strategy is based on the principle of sustainable development. The paper aims to present solutions for the sustainable development of the Rovinari area, an area affected by mining.

Keywords: Environmental management and sustainable development (EM&SD), development, strategy, sustainable development, mining.

I. THE GENERAL PRESENTATION OF THE ROVINARI CITY

From the administrative point of view, the town of Rovinari is part of Gorj County and is located 25 km southwest of the county seat of the county, Targu Jiu.

Regarding the classification of this city in the development sub-areas of the county, it is included in the development sub-area 5B, alongside the town of Turceni and the localities of Bălţeni, Băneşti, Câlnic, Fărcăşeşti, Ioneşti, Plopşoru, Ţânţăreni and Urdari. (fig. 1) [2]

The natural setting of a locality is described by the relief, the climatic conditions, the fauna and flora of the area, the water network, the soil and the subsoil of the area as well as the main geographic and tourist attractions. [1]

The most important mineral and surface mineral resources are lignite, natural gas, petroleum, anthracite, dolomite, graphite, limestone and granite.

Even if the city is quite young, it also presents some geographic and tourist attractions, being built on the hearth of other localities, where there were discovered signs of dwelling in the time of the Geto-Dacians and the Roman castles.

II. PRESENT SITUATION OF THE CITY ROVINARI

As we have seen before, the total area of Rovinari is 26.32 km^2, or 0.4% of the total area of Gorj County, which is divided according to use. [4]

The surface of Rovinari is occupied by:

- land that represents roads and construction approx. 46.3%;
- non-productive land on an area of 29.3%;
- agricultural land occupies 13.9%;
- forestry land and forests approx. 7.8%;
- lands occupied by waters and lakes (ponds) approx. 2.7%.

Fig. 1. Location of city Rovinari

The urban area of Rovinari is 4.46 km^2, which represents approximately 19.9% of the total administrative area of the city.

In Rovinari there are 5,095 dwellings, of which 404 are owned by the state and 4,689 are privately owned and compared to the city's population we have found that the habitation index is 16 m^2 per inhabitant, the density of the living area being 10.40 m^2 / inhabitant at a building density of 0.31 dwelling / km^2 and the number of people / dwelling is 3.1 persons / dwelling, which is due to the fact that there are enough multi-room apartments occupied by one the person. [3]

The current dwellings do not satisfy the market demand, being insufficient, and the construction of new dwellings would require land, which is quite limited at the city level especially for the construction of private houses. However, there is an urbanization plan, the extension of the city to the North, but also the abolition of the Poiana colony due to the extension of the exploitation perimeter of the Rovinari quarry.

The town of Rovinari has a population of 11,816 inhabitants, being the second city after Târgu Jiu municipality, which has 82,504 inhabitants, and the total county of Gorj is 154,514 inhabitants. [5] The population density is 4.48 inhabitants / km^2, which is well below the density per county, which is 59.6 inhabitants / km^2. [1]

At city level there was a trend of population growth, from 11,816 cents in 2011 to 13,556 inhabitants in 2015, of which

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6,920 were females and 6,836 were male gender, there is, as we can see, a gender balance, but the number of inhabitants has fallen much in recent years, but as a reference in the present study will be the population set at the last census as 11 816 inhabitants. [6]

The number of inhabitants of a locality is also influenced by population migration, which in the case of Rovinari is currently declining.

III. SUSTAINABLE DEVELOPMENT STRATEGY OF THE CITY ROVINARI

Sustainable development means progressive improvement and maintenance of the well-being of the population in line with the requirements of rational use of natural resources and ecosystems conservation.

Rovinari's development strategy is based on the principle of sustainable development, respecting economic, ecological and social strategies and meeting the requirements of the European Union and the National Strategy on Sustainable Development. [2] This strategy aims to increase the competitiveness of local government, economic and social progress by setting goals and finding opportunities for economic and social development and the continuous improvement of the quality of life of citizens living in good harmony with the environment. (Fig. 2)

The sustainable and efficient use of mineral resources in the Rovinari basin ensures the long-term supply of raw materials at national level. Preconditions for economic development are created in a global environment with opportunities for international business generating activities. The concept of sustainable development is based on three pillars of growth

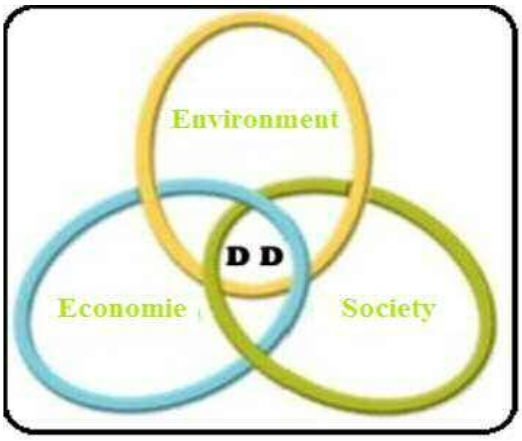

Fig. 2. The principle of sustainable development with respect to the three pillars.

and development: economic, environmental and social. The fourth pillar - governance - was later added, based on the premise of the critical need for powerful, capable, democratic and prompt institutions to act on behalf of the common good.

The main objectives proposed for the period 2016 ÷ 2020 will be presented at a later stage; these objectives are based on a thorough analysis of the existing social and economic situation, but also on the financial needs and financial possibilities available. [2] Taking into account both the challenges and the favourable moments offered by the internal and external environment, they take into account:

1. Increasing urban quality, but also protecting and capitalizing on the modest cultural heritage. [9] For this purpose, certain actions should be taken aiming at improving the living and recreational conditions, as well as greening the lands affected by extractive activity in view of their use for other purposes. It is also necessary to restore and preserve the historic monument church Saint John the Baptist dating back to 1848. To achieve this goal:

- modernization of the two parks in the city;
- layout of green spaces around blocks;
- as well as cycling tracks.

Funding for these works can be done either from local funds, government funds or from European funds that are accessible to such objectives during this period.

2. Increasing energy efficiency and improving the appearance of housing blocks.

This objective implies building external insulation in residential buildings and administrative premises, hospital, educational units, dormitories, works that besides the fact that they will change the exterior appearance of these buildings will increase the energy comfort. To achieve this, funds can be used, local funds, government funds, and European funds.

3. Equipping the European Emergency Services Emergency Service with the purchase of a car, this can be made from local or governmental funds or from European funds.

4. Increasing the use of coal-fuelled thermal and electric energy in both the public and private sectors. This implies citizens' awareness of the local heating of local heating, as well as the modification and modernization of the city's thermal network. Public lighting also needs to be modernized by using modern equipment and long-life lamps, but also expanding it throughout the city to the more distant neighbourhoods. This can be done through local, governmental funds or by accessing European funds.

5. Major investments in the local and social medical system, which must lead to the increase of the population's health, to a much easier access to the medical services, to the quality and efficiency of the hospital care, but also to a larger coverage of social services. In order to do this, the city hospital should be rehabilitated and modernized, or a new one built with state-of-the-art facilities. It also needs to rehabilitate and modernize the emergency receiving unit that is part of the integrated hospital in the city. These works can only be done by accessing European funds because the local budget can not cover this investment.

6. Significant investments are needed in the education system and increased professional performance at all levels. This implies increasing the participation rate to compulsory and low education early school dropout rate of up to 10%. For this, better conditions for carrying out educational activity should be offered, which can be materialized through the rehabilitation and modernization of existing schools, or by the construction of a new school. Assistance and counselling should also be provided for the social integration of that part of the population who is predisposed to school dropout. These

goals can only be achieved with government help or accessing non-reimbursable European funds. [9]

7. In addition to the ones shown above, a nursery for children and a care centre for the elderly should also be built. These can only be achieved by accessing European funds or a significant capital contribution from the government.

8. It is also necessary to modernize the stadium in the city by setting up stands and by constructing locker rooms with the necessary equipment. Two courts for field tennis should also be arranged, one with slag and one with synthetic carpet, as well as modernized and equipped with the necessary Club of students. These objectives can be achieved with funding from the local budget or through government funds.

9. At least two new housing blocks should be built in order to cover housing needs and also to improve household comfort, either in private or through the National Housing Agency, and the local council to provide free land for their location. The construction of individual houses in Vîrţ district should also be supported.

This can be done from private funds, as is the case in big cities, or with money from the local budget.

10. One of the most important objectives should be to support the development of the sustainable extraction of fossil fuels by day-to-day works, even if this will entail the relocation of Poiana and the concession of the land occupied by this locality. The land affected by the mining activity and replicated to the agricultural or forestry circuit, as well as the negative effects of this activity on the environmental factors (soil, water and air), must also be rehabilitated and ecologized. [10]

11. Making investment in agriculture and moving from subsistence farming to a competitive agri-food sector that at least meets local needs.

Analyzing the proposed strategy, we find that it is not easy to achieve especially because it involves significant financial funds, but through joint efforts, a local community council and governmental support, these objectives can be fulfilled, thus contributing to economic and social development of Rovinari.

The process of restructuring the mining activity was predominantly in the closure of the activity and the mass lay-off of the personnel with compensatory payments, so that the mining areas severely diminished their economic potential as a result of numerous social disintegration processes.

Unemployment, with fewer rebounds through own efforts, exposes this community to a much higher poverty risk than the national average.

Currently in the Rovinari area mining is facing the following challenges generated by:

- reduction of accessible deposits suitable for mining, due to insufficient or short-term planning of land developments or due to poor use of geological knowledge;
- burdensome administrative tasks and costs for obtaining extraction permits, determined by additional regulations and long-term preliminary studies;
- difficulties in obtaining extraction permits for both quarries and new mining activities and for expanding existing ones.
- the difficulties in acquiring the land needed to develop the technological process.

IV. CONCLUSIONS

This paper presents a case study on the applicability of sustainable development in areas affected by mining.

For this we first made a presentation of Rovinari, after which were highlighted the reference indicators that characterize the current situation of the city, namely:

- surface,
- demographic data,
- infrastructure,
- access and communication routes,
- existing utilities,
- health services and social assistance,
- educational system,
- cultural and leisure infrastructure,
- economic and industrial situation, and agriculture,
- helping us to create a clear picture of the locality regarding the economic and social situation.

Develop a system for monitoring the dynamics of socio-economic system and natural capital components including quality of life, air and water in line with the rest of sustainable development indicators.

Next we presented the current situation of environmental components, natural and technological risks, and the form of organization in case of risk situations.

We also presented the administrative organization of the city with the structures it contains, and the main indicators showing the revenues and expenditures made by the mayoralty.

Based on the data obtained, I managed to do more SWOT analyzes, respectively for each public activity: territorial development, infrastructure, social - demographic development, economic development and urban management.

The human development index was also determined, and the result shows that the city of Rovinari has a low development.

Finally, there are some solutions that I believe will contribute to the sustainable development of Rovinari.

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Evolution of Energy Supply in the food industry based on Modularization

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Abstract: The food industry has a big demand for energy due to the thermal processes needed for the food production and preservation. Normal a boiler plant is used for heat supply and a refrigeration plant for cold supply. These plants are big enough for all demands. Beside solutions like solar heat are not for, because they reduce the efficiency of the other system. The new approach is to have a lot of different energy supply modules acting together in a cybernetic network.

Keywords: (TNR, 9 points, bold, justify), Environmental management and sustainable development, renewable energy sources, network, modules

INTRODUCTION

A. Decarbonisation as a need of the society

Decarbonisation means changes in the energy supply towards to less carbon dioxide output without changes in product or productivity. This is especially a great challenge for the food industry. Food and beverage production together with climate protection are basic needs, defined in several convention of the United Nations Organization. The necessity of energy consumption for the food production is obvious. There are many processes with cooling, heating, drying or cooking, often combined in production chains.

B. History of energy management

The industrial revolution was a specialization based on specific knowledge and purpose build equipment. Initial production, processing and distribution were separated with the aim to produce more and cheaper for a growing population. The energy supply of processing was ensured be easy scalable facilities like steam boiler plants or cooling devices. These solutions are, up to now, easy solution for a hugh range of applications. In the food industry, for example, heat and cold are required at different temperature levels; from freezing (approx. -20 °C) to cooling (approx. 0 °C), tempering (30 °C), cleaning (80 °C), cooking (100 °C) and sterilising (120 °C). The solution was and still is a steam boiler at approx. 140 to 160 °C for all heat requirements and a refrigeration system designed for -25 to -40 °C for all cold requirements. This results in considerable efficiency losses. Co-utilization of renewable energies was possible, but the efficiency of both energy supply systems were reduced by shortened runtime of the machines.

C. Combination of single solutions as modules for a comprehensive solution

Single solutions, connected in a cybernetic system, can act forward and reverse. E.g., waste heat can be used for provision of cold. Depending on the requirements, the modules may also be removed from the comprehensive solution if the overall target so requires. The overall goal is to minimize the use of fossil fuels per product. The decisive factor is not the individual efficiency of a module, but the overall efficiency of the system. In a networked system, the overall efficiency is not the product of the individual efficiencies, but the result of the degree of cross-linking.

MODULARIZED ENERGY SUPPLY IN A BREWERY AS EXAMPLE FOR THE FOOD INDUSTRY

A brewery as pilot factory was chosen due to wide range of thermal energy use: heating, cooking, cooling, storing at constant temperature, and storage of heat or coldness for the next process steps. Also very interesting is the combination of batch processes with continuous processes in a brewery (see Fig. 1).

D. Aims of the modularized energy supply

All modules for the energy supply deliver a certain amount of energy in for of heat or coldness, but any module is big enough to deliver the entire demand of energy. Overall aims are: reduction of primary energy, usage of renewable energies, use of waste water for the energy supply, Conversion of heat into cold, usage of natural coldness in form of snow, reduction of energy demand peaks.

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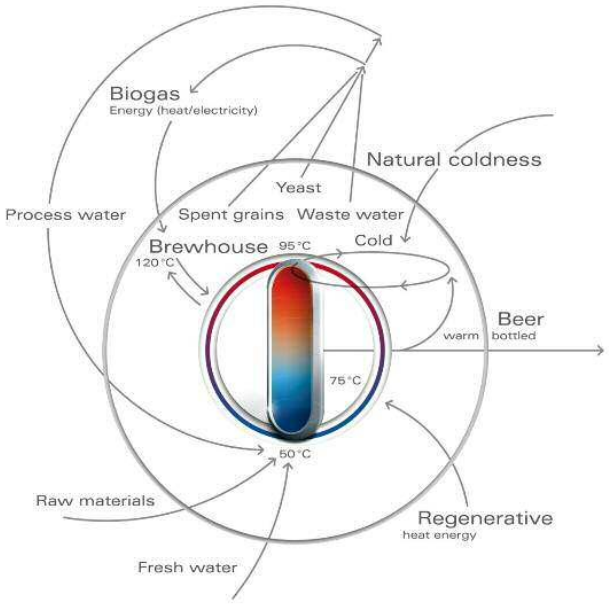

Fig. 1. Energy and mass flow streams in modularized energy supply network

E. Modules of the networked system

Cardinal point is heat storage system with different temperature level in combination with a circular flow system to the energy sources or sinks. Tasks of the heat storage systems are: heat management, supply of heat on different temperature levels, heat storage at different levels and, heat storage during none production times.

Used modules are a high pressure hot water boiler plant, a micro gas turbine, a refrigeration plant with compressor, a snow gun (see fig. 2), an ice storage, absorption chiller and a photovoltaic system. Planned modules are the biogas production from the waste water and a solar collector with Fresnel lenses. The higher level control combines the weekly production plan with the energetic demandes of processes, the data from the data acquisition system and the weather data prediction for the regenerative systems.

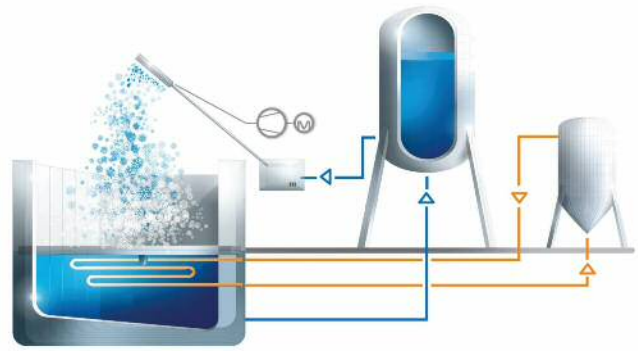

Fig. 2. Snow gun for coldness provision

RESULTS

Up to now the energy savings are 60 %. Calculated as natural gas equivalent the energy network saves 1.4 mio kWh per year equivalent to 280 to of CO2 per year. With the planed moduls we predict 99.6 % reduction of the former used fossil fuels.

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Leaching investigation of a new concept of landfill disposal for waste incineration residues on environmental conditions exposure. Part 1: Scenario and disposal model setup

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Abstract: Disposals for waste incineration residues are connected to the subsequent release of potentially harmful substances like inorganic salts and metal trace into environment, due to the leaching phenomenon that occurs by the exposure of the landfill on environmental conditions. Present article deals with investigation in the field for such type of landfill, that is build up through a new concept for landfill residues stabilization by encapsulation into ash rock crystallization matrix. The protocols for the leaching behavior investigation are specifying by EN standard 12920+A1 2008. In this regard, present paper emphasis on the scenario conditions and disposal model setup, in order to investigate a leaching behavior for a small scale landfill disposal exposed into environmental conditions.

Keywords: disposal, leaching, residues stabilization, environmental exposure.

AIMS AND BACKGROUND

Waste itself, and its management, are themselves a significant environmental issue. One of the worldwide most applied technologies for municipal solid waste treatment is incineration by mass. The target of thermal treatment is to provide for an overall reduction in the environmental impact that might otherwise arise from the waste.

Under the framework of integrated waste management, thermal treatment represents a valid option for reducing the amount of waste to be landfilled, at the same time allowing for waste hygienization.

The thermal treatment of waste may therefore be seen as a response to the environmental threats posed by poorly or unmanaged waste streams.

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Incineration is used as a treatment for a very wide range of wastes. Incineration itself is commonly only one part of a complex waste treatment system that altogether, provides for the overall management of the broad range of wastes that arise in society. Basically, waste incineration is the oxidation of the combustible materials contained in the waste.

Waste is generally a highly heterogeneous material, consisting essentially of organic substances, minerals, metals and water. Temperature range of oxidation process is generally between 600 and 1450 °C. The most common thermal treatment process for MSW is incineration by mass-burn technology with temperature range between 600 and 800°C. [1]

Fluidized bed incineration and refuse derived fuel systems are less common in municipal solid waste treatment. Aside from combustion, other thermal processes exist, including pyrolysis, gasification, sintering, vitrification and melting. [2]

Present papers focus on the solid residues arisen from mass burn incineration of

A..Incineration residues mass streams

Emissions resulted after the MSWI are distributed to air, to water and as solid residues that usually are used for land filing disposals. A mineral residue fly ash (dust) and heavier solid ash (bottom ash) are created.

Solid residues arise after incineration process is included the residues resulted from the flue gas treatment (FGT) and waste water treatment, and can be summarized as [1], [3]:

- bottom ash or slag – mainly the incombustible fraction of the waste;
- boiler ash – the ash that accumulates and is removed from the boiler;
- fly ash – the light ash that travels with the flue-gas and is then removed by FGT equipment;
- air pollution control residues accumulated, reacted and un-reacted that are accumulated in the FGT equipment;
- waste water treatment.

Table I below, gives mass streams of solid residues for various substances per tonne of MSW incinerated. The data given is average data for 12 MSWI in the Flanders Region of Belgium in 1999:

Table I. MSWI mass streams of solid residues expressed per tonne of waste incinerated

Types of solid residue	Percentage (%)
Bottom ash	**21**
Fly ash + gas cleaning residue + sludge from wet scrubbers	**4.2**
Scrap recuperated from bottom ash	**1.2**

F. Incineration residues characterization

The emissions to air and water are very dependent of the flue-gas cleaning performance. As from environmental concerns, the flue gas clean residues and fly ash encompass volatile pollution substances found in the composition of incinerated waste, which render this type of residue as hazardous that demand for special landfill techniques.

The arisen bottom ash is a vitrified material, which raises no problem for landfill, being very stable on environmental conditions.

Depending on the composition of the material incinerated and on the operating conditions, smaller amounts of CO, HCl, HF, HBr, HI, NOX SO2, VOCs, PCDD/F, PCBs and heavy metal compounds (among others) are formed or remain. These substances are transferred from the input waste to both the flue-gas and the fly ash it contains.

Directive 2000/76/EC (Art. 6.1) includes an operational condition requiring that incineration plants achieve a level of incineration such that, in slag and bottom ashes, the loss on ignition is ≤5% or the TOC is ≤ 3 %. In modern well-operated MSWI plants the TOC in bottom ashes can be below 1 wt %. Combustion trials have demonstrated that an increase in heating value of the waste feed and resulting higher bed temperatures improve the burnout of bottom ash. [1]

Typical concentrations of organic compounds in the various solid residues are compiled in table II:

Table II. Concentration ranges of organic compounds

Parameter	Bottom ash	Boiler ash	FGT residues
PCDD/F (I-TEQ)	< 0.001 – 0.01	0.02 – 0.5	**0.2 – 10**
PCB	< 5 – 50	4 – 50	**10 – 250**
PCBz	< 2 – 20	200 – 1000	**100 – 4000**
PCPh	< 2 – 50	20 – 500	**50 – 10000**
PAH	**< 5 – 10**	**10 – 300**	**50 – 2000**

Only data from modern facilities have been used in this table. Total organic carbon (TOC) determination in accordance with the standard EN 13137 also detects elementary carbon as TOC, which does not cause any problems on landfills. The TOC of bottom ashes comprises mainly elementary carbon, but to a certain extent, organic compounds are also found (coming e.g. from sifting of plastics). These cover the spectrum from short-chain compounds up to low volatile species such as PAH or PCDD/F. The I-TEQ (Toxic Equivalent Quantity) levels detected in the bottom ashes of modern incineration plants are in the same order of magnitude as those found in some urban and industrial soils.

Table IV gives survey data of an overview of the PCDD/F content in residues from MSWI plants. The data excludes peak high and low results.

It is important to note that the risks associated with bottom ash are not indicated only by the presence or absence of substances – their chemical and physical form, as well as the nature of the environment where the material will be used is also important to prevent emissions from the ashes to the environment.

The important thing is, therefore, not the fact that the bottom ashes contain pollutants but to check possible emissions from the ashes to the environment.

LANDFILL DISPOSAL LEACHING

The major environmental concerns in relation to the short- and long-term impact of landfilling of MSWI residues are connected with the risk of leaching and subsequent release of potentially harmful substances, particularly inorganic salts and metals/trace elements, into the environment.

The potential environmental impact of leaching includes contamination of soil, groundwater and surface water bodies. Leaching can be defined as the dissolution of a soluble constituent from a solid phase into a solvent. Leaching occurs as a consequence of the chemical reactions taking place at the scale of the individual waste particles as well as of the contaminant transport processes via the fluid moving through the solid particles. As far as MSWI residues disposal is concerned (see Fig. 1), the transport medium of pollutants is mainly represented by water, so that the overall water balance will determine the actual amount of water reaching the application site.

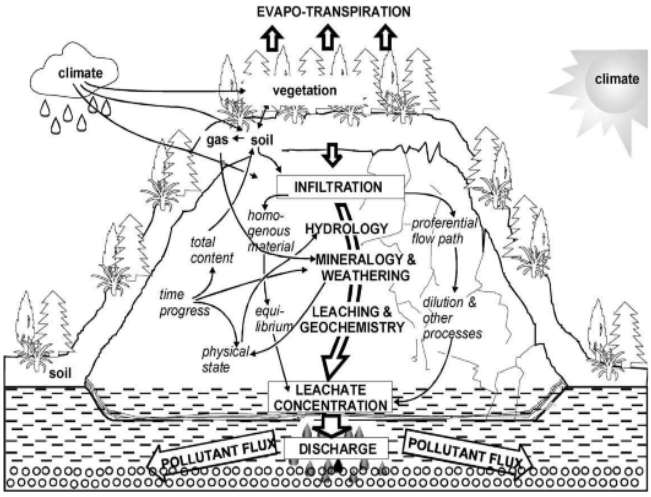

Fig. 1. Schematic layout of water balance and geochemical processes and factors affecting the discharge and pollutant flux from a landfill containing residues from thermal waste treatment [3]

The application site itself then modifies the water infiltration pattern as a result of the physical and hydrological characteristics of the material. Thus, the discharge pattern also depends on the pore type, pore distribution, homogeneity, permeability and field capacity of the material as well as on the presence of preferential flow paths.

Water balance models can also be used to analyze the effect of different vegetation/covering scenarios on leachate generation.

The specific environmental conditions influence and change the leaching behavior and contaminant release from such materials during utilization or final land disposal.

SCENARIO AND MODEL SETUP

The EU Landfill Directive (LFD) distinguishes technically between three main classes of landfills (landfills for inert waste, landfills for non-hazardous waste and landfills for hazardous waste), but only in terms of the contamination potential of the waste and the environmental protection measures required at each class of landfill.

The LFD does not include any landfill strategy or guideline on the design and operation of landfills aiming at the minimization of the period during which active aftercare will be necessary. [3]

To assess the discharge behavior of a specific waste, it is necessary to take the specific conditions (scenarios) into account. To arrive at a conclusion, the following methodology should be applied (SR EN 12920+A1): [4]

a. definition of the problem and the solution sought,
b. description of the scenario,
c. description of the waste,
d. determination of the influence of parameters on leaching behavior,
e. modeling of the leaching behavior,
f. behavioral model validation,
g. conclusions,
h. study report.

Such a methodology will also help identify the most appropriate mitigating measures to be undertaken before, during or after utilization or final land disposal.

The concept related on present papers consists in the investigation of a landfill disposal exposed into environmental conditions in order to assess the leaching behavior. The landfill disposal is build up through a new concept for landfill residues stabilization by encapsulation into ash rock crystallization matrix.

The proposed technology is meant to reduce the leachability of the landfill disposal, and is reducing the aftercare period of the disposal. By cementing process that end with the formation of the ash rock, the dust emissions of the disposal are eliminated.

In this demand, the promoted technology was already investigated on laboratory testing conditions, with positive results regarding the tracking of pollution migration that occurs by leaching.

According to up mentioned methodology the scenario and model setup for the investigated landfill disposal will be presented further.

G. Definition of the problem and the solution sought

As incineration residues are produced by high-temperature processes, they are thermodynamically unstable under ambient conditions. This renders incineration residues highly reactive, especially under wet conditions. This means that they change their mineralogical and physico-chemical characteristics as well as their leaching behavior as long as thermodynamic equilibrium conditions with the surrounding environment are attained.

The promoted solution is to use fly ash and FGD by-products arisen from coal combustion, as binder material for MSWI residues. The dense slurry technology (DST) presumes to create a homogenous mixture between solid residues arisen from coal combustion, flue gas cleaning products and water, in a controlled mixture ratio, with the aim to activate cementing reactions of pozzolanic elements of the fly ash. Those cementing reactions are meant to be used to encapsulate harmful chemical compounds by absorption, hydration and precipitation reactions, into a binder matrix preventing the leachate occurring on environmental exposure.

H. Description of the scenario

There will be built a small scale landfill disposal according to DST, with overall dimensions of L x l x H = 6 x 4 x 1.5 m, that will be exposed into environmental conditions for leaching behavior investigation. The landfill disposal will be foreseen with leachate collection system for batch sampling. Targeted exposure time will be 365 days, in order to investigate the landfill disposal behavior for all seasons of the year, under the environmental actions of sun action, rain, snow, frosting, defrosting, wind and combination of those.

This scenario setup will provide valuable registered data

based on which the behavior model validation will be developed furtherer.

I. Description of the waste

The "wastes" used for landfill disposal construction consists of two types of incineration residues arisen from (i) coal combustion as fly ash and flue gas desulphurization (FGD) by-products and (ii) FGT residues from MSWI or similar.

The residues used as landfill material will be investigated in laboratory for physic and chemical characterization, based on which there will be point out the pollutants that will be tracking on leachate during investigations.

J. Determination of the influence of parameters on leaching behavior

The landfill parameters tracked on investigation campaign, for the landfill material will be: porosity, density, moisture content, pH value and overall integrity of the disposal under the environmental conditions actions. There will be sampled batches for every 28 days according to standard protocols for lab investigation [5].

K. Modeling of the leaching behavior

Based on the results, the leaching behavior will be point out, related to the environmental conditions influence, on which a leaching model can be developed.

L. Behavioral model validation

The behavioral model will be subjected to validation for the exposure time scale. The arisen results will highlight the behavior of the landfill disposal related to environmental condition influence.

M. Conclusions

Conclusions will follow after investigation campaign based on the analyses of the recorded results.

N. Study reports

All recorded data, analyses and conclusions will be encompassing into a study report that will point out the research investigation campaign.

CONCLUSION

The study report related to the experimental investigation campaign can be used for further research that focus on the landfilling techniques for stabilization of municipal solid wastes incineration residues or similar ones, in an environmentally sound manner.

ACKNOWLEDGMENT

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Changing of energy of consuming to achieve an industrial growth: comparison to China and east Europe

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Abstract: **The link of energy consumption and industry growth in China was evaluated in 2003-2015, which was compared to that of East Europe in 2005-2016. The changing of energy consuming in China was investigated with the industrial evolution and reduction of greenhouse gases (GHGs). The industry output of 3 industrial sectors (Manufacture, Mining and Supply) was conducted with green energy and GHGs. Hierarchical clustering analysis (HCA) was used to interrogate the relationship between industry growth and energy consumption. The result was compared to that of East Europe (Bulgaria, Romania, Poland, Czech Republic, and Austria). It is reveal that in China, the output percentage of MaI was not affected by the change of energy market significantly and increased in a higher speed after technique renewing. The changing of industrial structure was not difficult to fit the green energy applied but was promoted by the transformation of energy-consumption structure. The GHGs reduction was contributed to the industry growth and renewable energy consumption. These features reflected that the industry growth had effect on the energy consumption, which is called as "conversation model". In comparison, several countries over Eastern Europe showed different relationship of energy consumption and industry growth. Although the fuel energy consuming might inhibit the industry evolution, the industrial structure changing seemed not achieved in the country that consumed green energy. The GHGs reduction was impacted by industry growth. Accordingly, the "feedback model" can describe the relationship between industry growth and energy consumption, which reflected bidirectional causality between energy consumption and economic growth in East Europe.**

Keywords: energy consumption, green energy, economic growth, greenhouse gases reduction

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I. INTRODUCTION

Due to the environmental problems such as energy shortage and global warming increasing, the energy-consumption structure began to be converted in countries. With the spread of the idea of sustainable development, the green energy such as wind, solar and tidal energy is adopted to take place of traditional energy such as oil and coal. In such situation, the impact of renewable energy on the economic growth attracts much attention (Dechezleprêtre and Sato, 2017). There are four hypothesizes to describe the relationship between energy structure and economic growth (Zhan, Tan, Tseng, 2016). "Growth model" argues the unidirectional causality relationship available from energy consumption to economic growth, which leads to the negative effect on the economic growth as energy conversation policies work; "Conversation model" is the hypothesis that the decrease of energy consumption will not create a negative impact on the economy (Riti et al., 2017). "Feedback model" supposes bidirectional causality between energy consumption and economic growth, which argues that energy conservation policies can restrict the economy (Qamruzzaman and Wei, 2018). "Neutrality hypothesis" suggests that there is no causal relationship between energy consumption and economic growth. In fact, the relationship between economic growth and energy consumption is probably contributed to the economic structure (Peng and Bao, 2006). In the developing countries, many researches supposed that renewable energy consumption had positive effect on the economic growth (Ito, 2016; Sarkodie and Adams, 2018; Sinha et al., 2018). However, the "neutrality hypothesis" was confirmed for Brazil and Malaysia while "conversation model" can describe the relationship between economic growth and energy consumption increasing in India (Gill et al., 2018; Bekhet and Othman, 2018; Kutan et al., 2018). Therefore, the prediction of economic growth by energy consumption should be included the industry structures that impacted the economy in the country.

II STUDY AIMS

The aim of this study is to investigate the relationship between the structures of energy-consumption and industrial during the industrial evolution in the past decade in China. The relationships between the outputs percentages of four industries (Manufacturing (MaI), Mining (MiI) and Supply (SI)) and the mass weights of green energy-consumption were

accessed to evaluate the improvement of green energy development on the transformation of industry. Greenhouse gases (GHGs) emission in countries was another index to evaluate the energy-consumption changed. Hierarchical cluster analysis (HCA) was conducted to distinguish the time points to evaluate the transformation of industrial and energy-consumption structures. In comparison, the effect of the transformation of energy-consumption structure on Eastern Europe was also investigated.

III. METODOLOGY

All the Chinese data were collected in the website of Nation Bureau of Statistic (www.data.stats.gov.cn). All the European data were collected from the European environmental agency (EEA) and the Eurostat. The east European countries including Bulgaria, Romania, Poland, Austria and Czech Republic were selected as investigation objects. The *wind, solar, nuclear energy* and *natural gas* were defined as *green energy* and the *coal* and *oil* were defined as *traditional energy* in the data collection. The time period was from 2003 to 2016.

IV. RESULTS AND CONCLUSIONS

This study investigated the relationship between energy structure changing and industry growth in China (2003-2015) and east Europe (2005-2016). The link amongst renewable energy consumption, industry growth, and GHGs was investigated by hierarchical clustering analysis (HCA). The results reveal that (1) the indices of the industrial output percentages and energy-consumption structure, the development time period in China over past decade was divided into 3 phases (2003~2007, 2008~2011 and 2012~2015), which proposes the features of China industry growth: the industry growth driven by renewable energy consumption, high speed of growth in manufactory with GHGs emission reduction, “conversation model” was responsible for the relationship between industry growth and energy consumption. (2) For countries, the results of HCA indicated that Bulgaria, Romania, Poland, Czech Republic had similar energy-consumption according to green energy indices. Different from that for China, the relationship between industry growth and energy consumption was described by “feedback model”.

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Preparation of Nano-Metakaolin Admixture to Investigate the impact on Mechanical Properties of Oil Well Cement (OWC)

Ali Dawood Salman [60]*, Thamer Adnan Abdullah [61], Mohammed Al-Asadi[3], Tatjana Juzsakova[4]

Abstract: This work aimed at to investigate the effects of the incorporation of Nano-metakaolin (NMK) as pozzolonic material having promising mechanical properties (compressive strength) into oil well cement (OWC). Nano-metakaolin (NMK) was prepared from kaolin rock following thermal activation of kaolin clay at different temperatures (700–800 C) for 2 h then crushing and ball milled for 40-60 h. The cement used in this study comprised of oil well cement class G. NMK was incorporated as a partial replacement additive (in 3 wt %, 6 wt % and 10 wt %) of cement with two different average particle sizes (75nm,100nm) and a water to cement ratio (w/c) of 0.44 was used. Several techniques were used to prepare and characterize the NMK by Particle Size Analyzer (PSA), X-ray diffraction (XRD), X-ray fluorescence (XRF), scanning electron microscopy (SEM) and the Brunauer-Emmett-Teller (BET) methods. The results showed and supported the notion that the NMK acted not only as filler, but also as an activator to consolidate the hydration process, since NMK particles react with the calcium hydroxide $CaOH_2$ crystals to produce calcium silicate hydrate (Ca–Si–H) bonds. It fills the pores to increase the strength, decreases the size of the crystals at the interfacial zone and transmutes the calcium hydroxide feeble crystals to the Ca–Si–H crystals, and upgrade the interfacial zone and cement paste domain.

Keywords: Nano-metakaolin, Oil Well Cement (OWC), Ball milling, Kaolin rock.

1. INTRODUCTION

In neoteric years, the employ of Nanoparticles as received special alertness in many frameworks of applications to innovate materials with new functionalities. When very fine particles (nanoparticles) are integrated in cement paste, mortar or concrete, materials with different features from classical materials were obtained. Oil-well cementing can doubtless be known as one of the most ticklish operations in petroleum and gas industry amongst all operations performed throughout oil or gas well drilling. Portland cement (PC) has been consumed as well cement for numerous years. However, Portland cement is not sufficient for some ticklish state of affairs, particularly in profound oil wells, geothermal wells, and corrosion environments wells. In elevated temperature and acidic milieu, the Portland well cement could lose strength, increased porosity and decreased durability in a shortened duration of time [1–6]. In the harsh environment lead to piecemeal deterioration of interconnection between admixture and cement paste matrix [7]. The output of an oil well was quite influenced by the cementing quality, and therefore well cementing is devoted to restrict movement of fluids between formations at different levels, shore vertical and radial loads utilized to casing which is laid in the drilled borehole, and protect the casing from corrosion and sealing of abnormal pressure formations [8-10]. According to the American Petroleum Institute specification for materials and testing for well cements (API Specification 10A, 2002) nine special classes of cements were established (Class A–Class J) [11]. Also OWCs are assorted into three grades based upon their C3A contents [12]. A vast assortment of cement admixtures is currently obtainable to improve oil well cement properties, to realize successful placement and rapid compressive strength improvement for suitable zonal isolation during the lifetime of the well [13-15]. Metakaolin vary from the conventional used different admixtures, such as (CNT), fly ash (FA), and silica fume(SF), that it is not a by-product. It is prepared by calcining kaolin under controlled conditions, one of the most abundant natural clay minerals, to temperatures of 700-900°C [16-17]. The resulting anhydrous amorphous alumino silicate (Al2Si2O7) also represented as AS2 behaves as a highly reactive pozzolonic material react with Ca(OH)2 to produce more (C-S-H). Newly, Nano technology has attracted considerable scientific interest on account of the new possibility uses of particles in Nano meter (10-9 m) scale [18-19]. Subsequently, through the present study, the impact of NMK on the compressive strength of Oil Well Cement has been studied. To preparation OWC, efficacious and suitable for deep well we examined different dosage and particle size of NMK.

Table (1): Abbreviations and nomenclature

Symbols	Meaning
NMK	Nano-Metakaolin
OWC	Oil Well Cement
NM3(75)	Nano-Metakaolin according to the particle size analyzer for this group the average particle size is 75nm.and adding percent 3%
CM	Control mixture
(w/c)	water-to-cementitious materials ratio

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2. Experimental Work

2.1. Materials

Oil well cement (OWC) used in this investigation is Class G according to American Petroleum Institute (API) with a specific gravity of 3.15 g/cm^3.The chemical composition and physical properties of oil well cement class G(API-10A) are offered in **Table (2).** This cement was used in making ready all specimens. NMK was prepared by crushing and ball milling of Kaolin rock brought from (Dwekhla in Western Sahara/ Al Anbar province). Chemical composition and physical properties according to X-ray fluorescence and Brunauer-Emmett-Teller (BET) of prepared NMK are shown in **Table (3)**. Nano-metakaolin (NMK) ($Al_2Si_2O_7$) was prepared from Kaolin rock brought from (Dwekhla in Western Sahara/ Al Anbar province) by thermal activation of kaolin clay at different temperatures (700–800 ^oC) for 2 h then crushing and ball milled for (40-60) hours to reduce particle size NMK to Nano-scale as shown in **Fig.**1 describing practical steps of preparation. The specifications of equipment used during this work have been given in **Table (4)**.

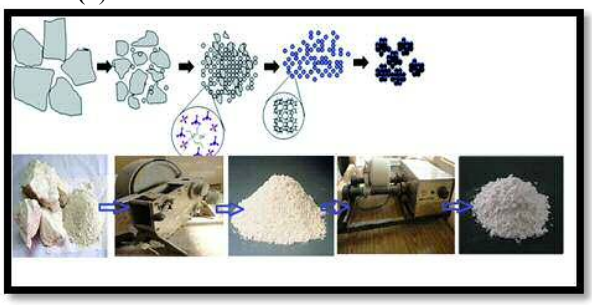


Fig.1 Practical steps of preparation process of Nano-metakaolin (NMK).

Table (2). Chemical and mineral compositions of oil well cement class G(API-10A)

Oxides	Wt.%
CaO	64.21
SiO_2	19.40
$Fe2O_3$	5.50
Al_2O_3	4.50
SO_3	2.80
MgO	2.00
Na_2O	0.10
K_2O	0.59
Loss on ignition	0.50
Density (g/cm^3)	3.15

Table (3). Chemical composition and physical properties according to X-ray fluorescence and Brunauer-Emmett-Teller (BET) of prepared NMK.

Oxides	Wt.%
CaO	0.17
SiO_2	55.07
$Fe2O_3$	0.76
Al_2O_3	42.13
SO_3	0.15
MgO	0.05
Na_2O	0.05
K_2O	0.56
Loss on ignition 1.20	1.20
Particle size(nm)	**Specific surface area(g/m^2)**
75	350
100	290

Table (4). Specifications of equipment's used.

Equipment	Specification
Scanning electron microscope (SEM)	Type TESCAN
Atomic Force Microscope (AFM)	Angstrom, Scanning Probe Microscope, Advanced Inc., AA 3000A, USA
Particle Size Analyzers (PSA)	Malvern Mastersizer 2000
Ultrasonic	Soniprep 150 (120W, 60KHz)
Compression testing machine	ELE-ACCU-TEK 250.
Brunauer, Emmett and Teller (BET) method by surface area analyzer	Q Surf 1600, USA
X-ray diffraction XRD-6000	Shimadzu scan range is (10.0–60.0) deg.
X-ray fluorescence spectrometry	Shimadzu 1800
Electrical furnace	(100–1000) ^oC
Ball mill machine	300 rpm

2.2. Methods

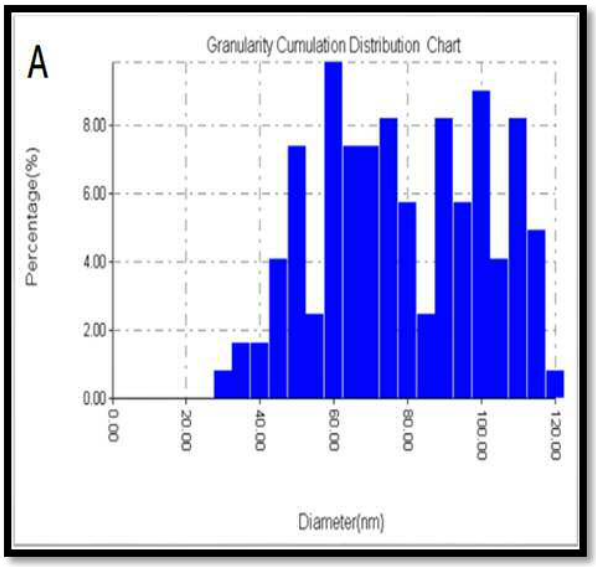
2.2.1. Preparation and casting samples

Cement paste was prepared according to (API Specification 10A, 2002). A certain dosage of additives of NMK substitute by cement weight. **Table (5**). shows specifications and mixing attributions of cement samples. Initially, the weighed quantity of OWC It has been placed in a tureen. Thence, the weighed NMK admixture was added into the mixing distilled water. the mixing distilled water was decanting into the blender, then the weighed NMK admixture was added into the mixing water, then mix and dispersed nanoparticles by ultrasonic for 25sec.collecting and retrieve cement paste sticking accumulated to the wall of the mixing container by spatula to ensure homogeneity. at last, mixing take back for another 30sec at high speed. Thereafter, cement slurry was cast into 5cm cubes and then cured at 70℃ with 100% relative humidity for 7 ,14 and 28 days to test compressive

strength. In this study, three samples were tested for each mix. The average value was served as the final data.

Table (5). Mixing proportion of cement samples

Mixes	Mix proportion (Wt.%)		(w/c)
	OWC	NK	
NM0	100	0	0.44
NM3	97	3	0.44
NM6	94	6	0.44
NM10	90	10	0.44



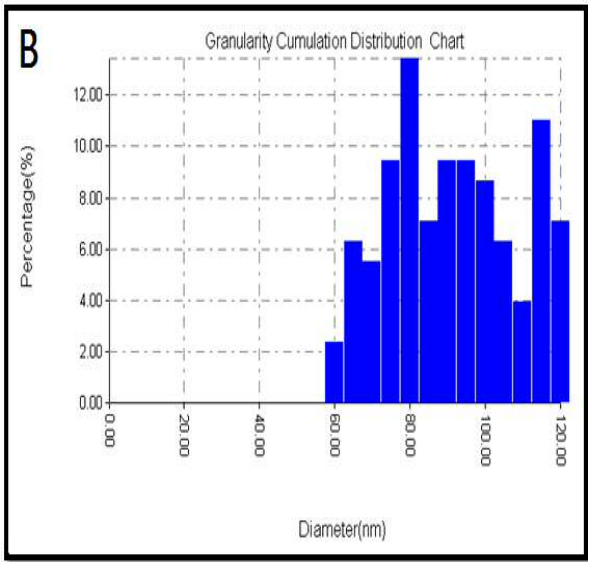


Fig.2. AFM of prepared (NM): A (100nm) and B (75nm).

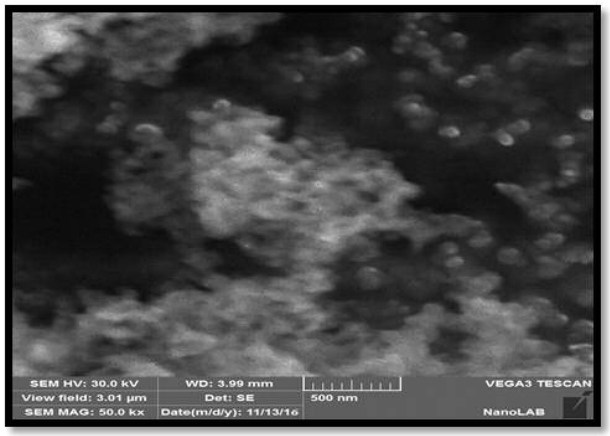


Fig. 3. SEM image of the ball-milled Nano-Metakaolin

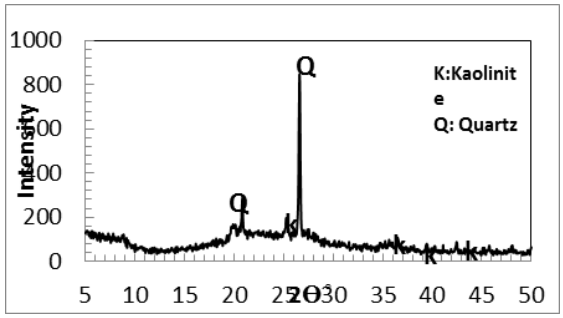


Fig. 4. X-ray diffraction of Metakaolin 750℃.

3.1.1. Compressive strength

A. Effect of (NMK) dosage on compressive strength development of OWC.

The compressive strength of hardened pastes made of Oil Well Cement (OWC) control mixture (without additives) and OWC with different dosage of NMK for all test ages (7, 14, and 28 days) are offered in **Fig.5**. For all ages of pastes, the diversity style of compressive strength of cement pastes with NMK was around congruous at the same temperature. At 70 ^{o}C, the NM6(75) specimen had a great strength at all ages than CM and cement pastes with NMK replacement, it is evident that the strength increased with an augmentation of NMK dosage to optimum concentration as shown in **Fig.6. (a-b)** This clarify that numerous the concentration of NMK is useful in improving strength to a certain limit after which any excess in the NMK dosage leads to a diminution in the compressive strength. The premature strength impact of NMK is inasmuch its effectiveness on accelerating the pozzolanic reaction and transform of C3S, C2S and $Ca(OH)_2$ into the C–S–H gel which is the causative for giving the matrix of OWC its strength. Huge early strength is also due to the high packing efficiency of NMK. **Table (6)** demonstrate the compressive strength results at 7, 14 and 28-days.

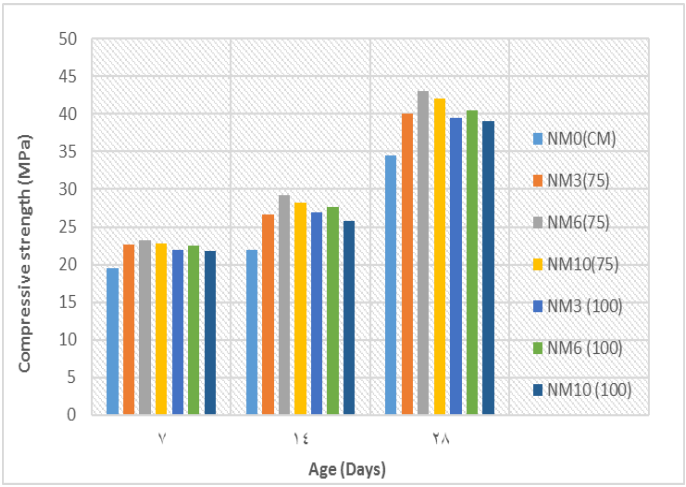
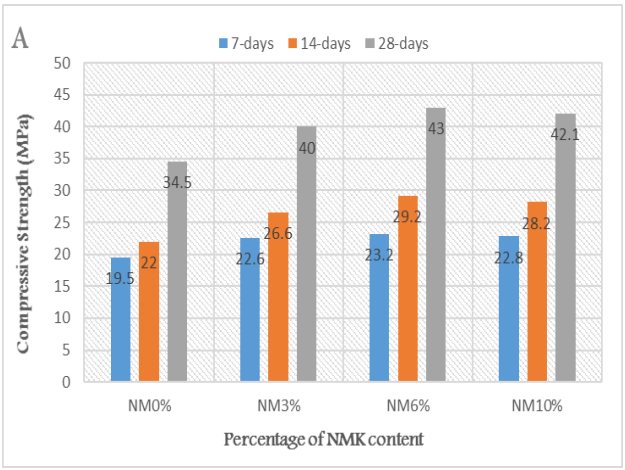


Fig. 5. Effect of curing age on compressive strength of mixtuers.



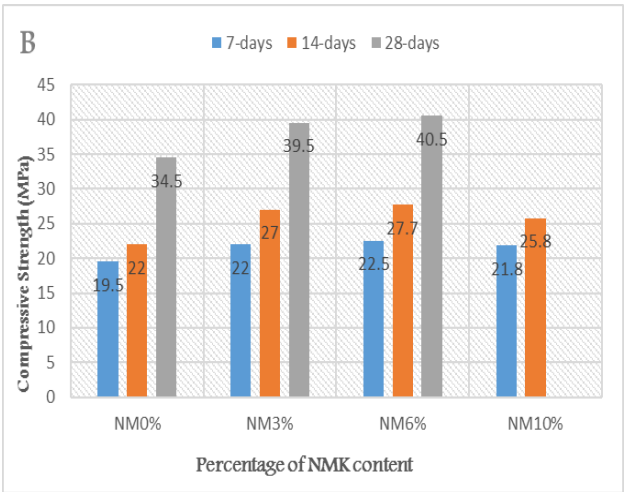


Fig. 6. Effect of (NM) percentage on compressive strength of OWC for A (75nm) and B (100nm) NM.

Table (6): Compressive strength results at 7, 14 and 28-days.

Mixture I.D.	Compressive strength (MPa)		
	7-days	14-days	28-days
CM	19.5	22.0	34.5
NM3 (75)	22.6	26.6	40
NM6 (75)	23.2	29.2	43
NM10 (75)	22.8	28.2	42.1
NM3 (100)	22.0	27.0	39.5
NM6 (100)	22.5	27.7	40.5
NM10 (100)	21.8	25.8	39

***B.* Effect of particle size of (NMK) on compressive strength development of OWC**

The variation in the results seems to be a function of the particle size. For instance, the compressive strength of mixture NM6(75) nm had 43 MPa at 28 days slumped to 40.5 Mpa for mixture of NM6(100) nm. An impartial exegesis for this tendency is that as the particle size of NMK that enhance the packing adequacy decreases lead up to a decline in the compressive strength. This impact of NMK particle size on compressive strength can also be due to the huge surface area that is obtainable for pozzolanic reaction. It can be spotted from the outcomes that the surface area dropped with the altitude in the particle size as in other samples with NMK and as in the control mixtures (CM) which fructify less compressive strength at the same age. These outcomes are in good conformity with the measurement's obtained by **[20].**

4. Conclusions

According to the test outcomes, the following inferences can be drawn.

- Nano-Metakaolin (NM)was successfully obtained by Ball milling method for (30–60) hours with average particle size of 75 nm.
- The characterization of (NM) shows spherical particles having irregular shapes as well as agglomerates fuse together.
- Incorporating Nano-Metakaolin into Oil Well Cement mixtures enhances their mechanical properties, by yielding higher compressive than control mixture, and exhibit relatively high early strengths.
- Within the particle size and dosage range examined at all curing ages, the strength generally increases with the addition of NM, the optimum percentage of NM is (6%) with 75nm particle size gives the highest the strength of OWC mixtures.

- The results approved that the NMK was not only work as filler, but also as an activator to support hydration process, by consuming calcium hydroxide ($CaOH_2$) crystals to produce more C–S–H, and filling the pores to increase the strengths.

Acknowledgement
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European education project ENDIS

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Abstract: **It is discussed the crisis in the Republic of Moldova concerned with the migration of citizens mostly from the country fields of human activities. It is proposed the method and project of anti-migration management at the Border of Romania and the Republic of Moldova ENDIS.**

Purpose consists in presentation of the Project RO-MD of European Business Education ENDIS, analysis and substantiation of the objectives assumed by the Republic of Moldova and Romania through the *Association Agreement between the Republic of Moldova and the European Union*. The general objective of the project ENDIS is to support the economic development on both sides of the Romania-Republic of Moldova border, through building a joint network of educational institutions (universities, high-schools and secondary schools) to pilot a programme on entrepreneurial education and digital education. The network will act as a promoter of a curriculum that includes high-quality, innovative extra-curricular activities, oriented towards entrepreneurial education and digital education.

This approach, aiming to provide the young generation with solid entrepreneurial and digital skills, can be considered an investment in education, representing a premise for the economic initiatives that the future graduates will manifest. The final beneficiaries of this programme are secondary school pupils, high-school students and university students, who are going to act on the labour market in the years to come. They are expected to develop new businesses, in the benefit of their own families, communities and regions.

The joint educational network will include public universities fromn Romania and The Republic of Moldova, high schools, and secondary schools, all of them located in the programme area. The network will be developed within a timeframe of 18 months, and continue to act at least 3 years after the lifetime of the project.

Next Specific objective of the project: Setting and development of a joint educational institutions network. To achieve this objective, the following are to be accomplished:

- A general agreement to include all the educational institutions involved in ENDIS, specifying all the issues to be considered in the framework of the project.

- Definition of the Charter of the network, by all the educational institutions involved in ENDIS, specifying the terms for the network extension, during and after the lifetime of the project.

- Promotion of high-quality education, exchanges of experience, and transfer of good practices during the joint activities developed within the framework of ENDIS.

- Promotion of the educational network, in order to make its goals known to the academic environment and to other stakeholders.

One more Specific objective of the project: Implementation of a programme of extra-curricular activities, oriented towards entrepreneurial education and digital education, in all the member institutions of the network. The programme will train high-school teachers, secondary school teachers, university students, high-school students, and secondary school pupils. To achieve this objective, the following are to be accomplished:

- Preparation of the support materials for the educational programme.

- Selection and training of the mentors in the high-schools and in the secondary schools of the network, based on transparent rules and regulations.

- Implementation of an innovative programme of extra-curricular activities in the educational institutions of the network, meant to provide information and knowledge on entrepreneurship and ICTs, to stimulate the creativity of the participants and their desire to become entrepreneurs in the informational society.

The submitted Project ENDIS represent a sub-project performed under the Project „Anti-migration management in the rural sector of the Republic of Moldova" that is developed in the period 2015 - 2020 by the team of AESM and supporters.

Keywords: Project, Association Agreement, Objectives, Economics, Movement of persons, Services, Transfrontalier.

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INTRODUCTION

The European Union is currently faced with manifold challenges within and beyond its borders. Internally, growing inequality undermines its potential to create prosperity and

provide stability. Six million people lost their job during the crisis, more than 120 million people are at risk of poverty and fourteen million youth (15-29 years) are not in education, employment or training.

Beyond the need to find new sources of growth and employment, the need to deliver quality public services and renew the legitimacy of public policy-making across Europe put additional strain on governments. At the same time, the inclusion of fairness in the objectives of the European Commission means that social dialogue should be enhanced in order to meet the social demands of inclusive growth.

The innovation divide is evident, private investment in research and innovation is falling short of the target, while there is a growing brain drain mostly from regions strongly hit by the crisis and the austerity that followed.

Externally, the Union's neighborhood has become an area of high risk with an increasing number of open conflicts challenging Europe's security. Developments like the crisis in Ukraine and the increasing influence of radical Islam in the Middle East and Africa put the EU's reactive capacity to a test. They pose immediate threats to Europe's security and trigger asylum seeking and immigration that puts pressure on EU external borders and relevant policies – from migration to humanitarian assistance and development cooperation.

1. Migration in the Republic of Moldova

Migration is one of the stringent problems **[http://www.statistica.md/]** that Republic of Moldova is facing today**.**

According to World Bank data, in our country about 700 thousand citizens are working abroad, which constitute about half of the working population. Meanwhile, the sociologists consider that the real number of Moldovan migrants exceeds one million. Around a quarter among them decided not to return to home **[http://web.worldbank.org/archive/website01419/WEB/0__CONTE-12.HTM].**

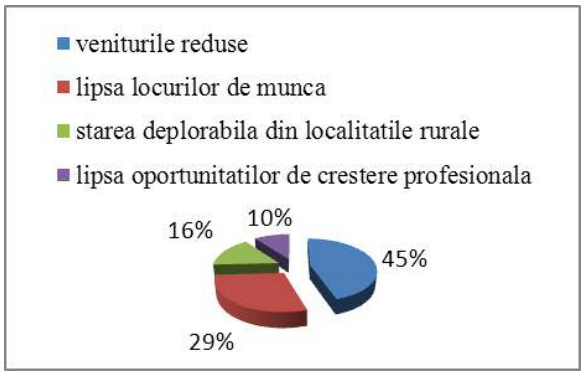
From the above presented we conclude the negative impact of migration such as family breakdown, brain migration, the abroad money transferred dependence of Moldovan young, crisis in the rural sector, rapid liquidation of small and medium enterprises.

In this way, mass migrations contribute to a demographic decline, economic potential decrease of the country that leads to devaluation of the national currency, predominance of imports, narrowingofthe manufacturing sector.

The main reasons for population exodus are considered (*Figure 1*) population low-income in the country (45%), lack of jobs in the country (24.5%) and poor condition of rural localities (15.6%). One of the Moldovans migration reason is considered also the lack of professional career opportunities (10.2%).

Low-income
Lack of jobs
Poor condition of rural localities
Lack of professional career opportunities

The study reveals that the majority of respondents would prefer to work in EU countries (53.4%), but also in Canada, in the USA (27.4%), in CIS countries (13.7%), and 5.5% (37 people) - in Australia **[http://iom.md/].**



The information presented above shows the timeliness and the need for a project to improve the migration crisis in the rural sector of the Republic of Moldova.

One of the pillars of the Republic of Moldova crisis solving we hope to be the involvement of Members of "Parlament 90" those, who established the State of the Republic of Moldova declared its independence and initiated the development of a new state in Europe. These are not statements or "strong words", but a cry of the unsatisfied soul regarding the country's evolution that was created by the first democratic parliament of Republic of Moldova.

Today we have a crisis in the Republic of Moldova, a catastrophic situation of the republic's population especially in rural sector: an exodus huge of the population from the villages, it is a situation of deep crisis, a situation of the Republic of Moldova pre-default.

2. Rural sectors affected by the crisis of migration

Mostly the rural sector of the Republic of Moldova is affected at such small and middle enterprises (SME) as:

„ Ecology, Education, Health", „The small rural industry", „Rural Middle Industry", and „Regional Industry" Sectors.

2.1. The „ Ecology, Education, Health" Sector

In this sector are affected different branches of human rural activities of the types:

- regional ecology;
- human, ground, water, and air ecology;
- barber shop;
- bathroom;
- library;
- science, school, kindergarden;
- culture, theatre;
- small light;
- medical & pharmacy place;
- post & Internet.

For such directions of rural sector human activities can be supported by the SMEs of Micro and Mini types.

2.2. The „The small rural industry" Sector

In this sector are affected different branches of human rural activities of the types:

- ecology in the small industry sector;- human, ground, water, and air ecology;- security;- oil mills;- mills;- bakery;- collection of individual households production (PGI);-

processing, drying, storage PGI;-realization PGI;- shoemaker workshop;- tailoring;- garbage

For such directions of rural sector human activities can be supported by the SMEs of Mini types.

2.3. The „Rural Middle Industry" Sector

In this sector are affected different branches of human middle rural activities of the types:

- ecology in the middle industry sector;- human, ground, water, and air ecology;- mechanization of rural activities such as: sowing, harvesting, territories preparing;
- collection of collective households production (PGC);- processing, drying;-conservation PGC;- storage, realization PGC;- series, planting, monitoring;- fruits, planting, care, orchard monitoring;- winemaking, planting, care, vineyards monitoring;
- vegetalnes, initiation, care, monitoring;- water supply;- fishing, local resources monitoring;- cattle occupation, local resources monitoring;- swine, goats, local resources monitoring;- shepherd, local resources monitoring

For such directions of rural sector human activities can be supported by the SMEs of Mini & Middle types.

2.4. The „Regional Industry" Sector

In this sector are affected different branches of human middle rural regional activities of the types:

- ecology in the regional industry sector;
- human, ground, water, and air ecology;
- water monitoring: pools, lakes, rivers;
- solar, water and wind power;
- bioenergetics;
- dump goods energetics;
- roads;
- irrigation;
- fishing, local resources monitoring;
- cattle, local resources monitoring;
- pigs, goats, local resources monitoring;
- sheeping, local resources monitoring.

For such directions of rural sector human activities can be supported by the SMEs of Middle types.

3. Project beneficiaries

The project expects to protect people that are affected of migration finding out information and solutions. The proposed solutions have a complex and varied function, providing essential support, defining rules in the rural society. It also contains improvement of public administrations, public services and policies due the studies that will be made in the process of project implementation.

Simultaneously, the project has a beneficed impact on economic, cultural, educational and social sectors by increasing and ever more complex expectations from citizens and businesses. Also the project will find the ways to create more effectively EU standard workplaces, educate people to collaborate with foreign organisations and attract funding for economic right projects. Addressing these complex issues requires holistic responses, which in turn call for the transformation its role in society.

The project main issue is to stop the process of migration and growth the level of societal well-being by educating citizen to collaborate with other state structures or citizens.

The process of stopping the migration will start with education of local administrative structures about how to create good live and work conditions in order to ameliorate the number of migrants. The one of the aims of this project is not only to bring people back home, but to create new competent businesses in rural sector, to make researches the running of the more good rural sectors to be developed in each area of the Republic of Moldova. Of course, these facts will have a good impact on the society, migration policy of the country, development of the rural sector and creating the European work conditions.

Conclusion

The project is going to be made a detailed analysis of the progress achieved, the identification of the project's strengths and weaknesses. As a result of the detection of weak points will be elaborated programs to remove the drawbacks thereof.More specifically:

1. Will be obtained the raising level of education in rural area of Moldova and as a result - the finding the situation of assessment independently.
2. Will be acknowledged the European advancements in the field and the work are carried out in European style.
3. The obtained practice from interconnections with European partners has a continuity of progress in the rural area of Republic of Moldova through the Europeanization of the field.
4. Will be found new means of financing from local and external sources by concluding the individual and collective contracts.
5. Will be obtained the raising of the qualification of employees and those from the hiring process.
6. Will be achieved the internal process of transmission of the experience "from father to son" in the rural area with the participation of schools, colleges, relatives to the rural trades developments.
7. In schools and colleges will be opened new European specialties and crafts with their active participation in the rural area of Republic of Moldova.
8. Will be emphasized the local specificity (village, commune, district, region) to be proud with local affairs and customs: skilful potters, weavers of national fabrics, cobblers and national style Fashion designers, stylists - extra class hairdressers, rural tourism with houses, streets, slums, villages with ecological fauna and flora etc.
9. Will be initiated rural festivals and evening sittings of village women with wool teasel and spinning, troubleshooting of distaff, carolling of girls, taking out the maiden for the first dance, have been renewed and Europeanized the horas, the choirs, entertainments and national holidays and international forums.
10. Connecting the educational network and the educational programme with the business community. To achieve this objective, the following are to be accomplished:

- Identification of at least 6 project stakeholders (3 in Romania and 3 in Republic of Moldova), such as: local and/or regional authorities, professional associations, NGOs, SMEs.
- Involving them in providing support to the educational institutions of the network, during the lifetime of the project.

- Realization of (at least) 6 collaboration agreements between the members of the educational network and stakeholders in the business sector (3 in Romania and 3 in Republic of Moldova).
- Identification of the best ways for future collaborations of stakeholders with the network

The submitted Project ENDIS represent a sub project performed under the Project „Anti-migration management in the rural sector of the Republic of Moldova" that is developed in the period 2015 - 2020 by the team of AESM and supporters.

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Nitrogen use efficiency at farm level

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Abstract: Nitrogen (*N*) is essential for life and plays a key role in food production. In the same time, with increasing nitrogen input, there is an increase in the risk of nitrogen losses to groundwater, surface water and the atmosphere, which is harmful to biodiversity, the functioning of ecosystems and potentially to human health. Indicators can play a key role in nitrogen management. Nitrogen use efficiency (*NUE*) is such an indicator. The paper presents a case study for nitrogen use efficiency indicator calculation at farm level. NUE was calculated as a ratio between and nitrogen (*N*) input and nitrogen (*N*) output. N input was evaluated by taking into account the soil mineral nitrogen content before sowing and the nitrogen fertilization during the soil tillage works. Nitrogen output was evaluated by taking into account the nitrogen exported with the obtained crop yield. The tested plant was rape for oil. We observed that the nitrogen use efficiency indicator was low, 15%, in case of organic fertilization (180 t/ha/year of fresh pig manure applied uncontrolled in previous years) and mineral fertilization (36 kg N/ha from complex fertilizer 20:20:0) application. This is a result of uncontrolled organic fertilization which led to accumulation of nitrogen in soil in high quantities, apparently with high risks of surface runoff or leaching on the soil profile depth to the groundwater. However the nitrogen leaching is reduced in this case, because of the soil type, which has a compact clayey layer with low water permeability at 40-50 cm depth. The soil mineral nitrogen content after harvesting was 447 kg/ha, from which 50% may be available for the next crop. The nitrogen use efficiency indicator ranged within the optimum values, 48%, in case of mineral fertilization with the same rate but without organic fertilization. The higher value of the nitrogen use efficiency indicator was a result of the lower soil mineral nitrogen content before sowing.

Keywords: nitrogen, efficiency, fertilization, indicator

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INTRODUCTION

Nitrogen (*N*) is essential for life and a main nutrient element. It is needed in relatively large quantities for the production of food, feed and fibre. It is an essential element of chlorophyll in plants and of amino acids (protein) and nucleic acids in plants, animals and humans. However, excess N pollution is a threat to our health and the environment. Nitrogen is the most important crop-yield limiting factor in the world, together with water.

With increasing N input, there is an increase in the risk of N losses to groundwater, surface water and the atmosphere, which is harmful to biodiversity, the functioning of ecosystems and potentially to human health. Further, N may accumulate in leafy crops and soils to toxic levels. The management of N is therefore important, also because synthetically fixed N is costly.

Nitrogen management aims at achieving agronomic objectives (farm income, high crop and animal productivity) and environmental objectives (minimal N losses) simultaneously. However, N management is not easy, because the N cycle is complex and N is easily lost from the farm into the environment [1].

Indicators can play a key role in management. Nitrogen use efficiency (*NUE*) is such an indicator in agriculture, but currently there is no uniform and robust methodology and protocol for its estimation and use. The EU Nitrogen Expert Panel proposed an easy-to-use indicator for nitrogen use efficiency (*NUE*), applicable to agricultural land, farms and whole food production–consumption systems [1]. The indicator is based on the mass balance principle, i.e. using N input and N output data for its calculation. It is calculated as a ratio between N output and N input. NUE = N output / N input.

For crop production systems, the N output in harvested crop removed from the land is considered, including fruits, vegetables, and straw (in case the straw or other crop residues are transported off from the farm). For animal production systems, the N output may be milk, meat, egg, wool and animals. For mixed production systems, both crop and livestock products transported off the farm are included [1].

In this context, the paper presents a case study for nitrogen use efficiency indicator calculation at farm level. The case study was carried out within a farm located in Arges -Vedea watershed.

MATERIAL AND METHODS

A study case was accomplished in order to determine the soil

mineral nitrogen stock at the end of the plant growing season and to calculate the nitrogen use efficiency indicator at farm level. The farm is located within Arges-Vedea watershed. Two plots were analyzed from this point of view: first one with organic and mineral application (180 t/ha pig fresh manure applied un-controlled in previous years and 36 36 kg N/ha from complex fertilizer 20:20:0 applied during the soil tillage works in the studied year), second one just with mineral fertilization (36 36 kg N/ha from complex fertilizer 20:20:0 applied during the soil tillage works in the studied year). For an adequate management of nitrogen at farm level, it is recommended to analyze the soil from agrochemical point of view in order to establish the potential available nitrogen from soil based on organic carbon content, degree of available bases and mineral nitrogen content before fertilizers application for the next crop sowing. The optimum fertilization doses are then calculated according to crop need and planned crop yield [2]. The optimum fertilization doses are established by using an assisted computing system developed within National Research and Development Institute for Soil Science, Agrochemistry and Environment – ICPA Bucharest.

In this context soil samples were taken from the studied area in order to determine the agrochemical status of the soil before sowing on 40 cm depth. The agrochemical indicators analyzed in laboratory were: soil reaction – *pH* (-), hydrolytic acidity – *Ah* (me/100g), total exchangeable bases – *SB* (me/100g), degree of base saturation – *V* (%), humus content – *H* (%), soil phosphorus supply level – P_{AL} (mg/kg), soil potassium supply level - K_{AL} (mg/kg), clay content – *A* (%).

For soil reaction evaluation, the *pH* of aqueous suspension was measured potentiometrically, at a ratio of 1:2,5. The total exchangeable bases – *SB* was determined by using Kappen method. The hydrolytic acidity – *Ah* was determined by using Kappen-Daikuhara method. The soil humus content was measured by using Walkley – Black modified by Gogoasa. The soil phosphorus supply level – P_{AL} was determined by phosphorus extraction with acetate-lactate ammonium solution at a pH value of 3,7 and using the spectrophotometry. The soil potassium supply level – K_{AL} was determined by using the same extraction solution as in case of phosphorus, but the potassium dosing is done by using flame photometry.

The soil nitrogen supply level was determined indirectly by calculating the nitrogen index – *IN* (-) by using the equation as in (1):

$$IN = H \cdot V/100 \quad (1)$$

The tested plant in the studied area was rape for oil. By using the assisted computer system the optimum economic dose (DOE) of N was calculated taking into account the crop need and planned crop yield.

The soil nitrogen supply level was also determined directly by laboratory analysis before sowing and after harvesting. In this context, nitrate nitrogen ($N\text{-}NO_3$) content and ammonium nitrogen ($N\text{-}NH_4$) content were determined by using the method of selective ion electrodes. Soil samples were taken from two plots within the farm: first one with organic and mineral fertilizers application, the second one just with mineral fertilizers application. The soil samples were taken from two depths: 0-20 cm and 20-40 cm in both plots before rape sowing and after harvesting.

The soil nitrogen supply level was evaluated by calculating the efficient soil mineral content. For this the conversion factor – *F* from mg/kg to kg N/ha was calculated taking into account the soil layer depth and soil bulk density – *BD* (g/cm^3). The bulk density was estimated indirectly by pedotransfer functions.

The nitrate nitrogen ($N\text{-}NO_3$) content and ammonium nitrogen ($N\text{-}NH_4$) content were converted from mg/kg to kg N/ha by multiplying the obtained values with the conversion factor (*F*). Then the soil mineral nitrogen (kg N/ha) were calculated by summing nitrate nitrogen ($N\text{-}NO_3$) content and ammonium nitrogen ($N\text{-}NH_4$) content.

The soil efficient mineral nitrogen stock before sowing and after harvesting was calculated by using efficient coefficients, which are established in long term experiments.

Nitrogen use efficiency indicator was calculated as a ratio: NUE = nitrogen output / nitrogen input after rape harvesting as in (2):

$$NUE = (N\ output / N\ input) \cdot 100 \quad (2)$$

Nitrogen input was evaluated by taking into account the soil efficient mineral nitrogen content before sowing and the nitrogen fertilization during the soil tillage works. Nitrogen output was evaluated by taking into account the nitrogen exported with the obtained crop yield.

RESULTS AND DISCUSSIONS

The values obtained for the agrochemical analyzed indicators are presented in Table I.

Table I. Soil agrochemical indicators

[1] Agrochemical indicators	**[2]** Unit	**[3]** Value
[4] Soil reaction – *pH*	[5](-)	[6]5,5
[7] Hydrolytic acidity – *Ah*	[8](me/100g)	[9]6,43
[10] Total exchangeable bases – *SB*	[11] (me/100g)	[12] 16,64
[13] Degree of base saturation – *V*	[14] (%)	[15] 72
[16] Humus content – *H*	[17] (%)	[18] 3,16
[19] Available phosphorus content – P_{AL}	[20] (mg/kg)	[21] 9
[22] Available potassium content - K_{AL}	[23] (mg/kg)	[24] 141
[25] Clay content – A	[26] (%)	[27] 30
[28] Nitrogen index – *IN*	[29] (-)	[30] 2,28

We observed that: the soil on 40 cm depth has a medium texture ranging in the loamy texture subclass, the clay content is 30%; the soil reaction is moderate acid; the hydrolytic acidity is high; the total exchangeable bases is medium; the degree of base saturation, meaning that the soil has a moderate capacity for exchangeable bases absorption; the organic matter (humus) content is moderate; the available phosphorus content is low; the available potassium content is low; the nitrogen

index ranges within the interval of medium values (2,1-3,0) but closer to the lower limit.

The optimum economic dose (DOE) of N fertilization was calculated for a planned crop yield of 3600 kg/ha. It resulted an optimum fertilization dose of 98 kg N/ha and year.

The values obtained for the nitrate nitrogen (*N-NO_3*) and ammonium nitrogen (*N-NH_4*) contents in both plots (with organic and mineral fertilization and just with mineral fertilization) and on the two depths (0-20 cm and 20-40 cm) are presented in Table II.

We observed very high values of these indicators in the plot with organic and mineral fertilization sources and low values in the plot just with mineral fertilization source.

Table II. Nitrate nitrogen (*N-NO_3*), ammonium nitrogen (*N-NH_4*) contents in the soil from both analyzed plots before rape sowing and after harvesting

[31] Fertilization source	[32] Depth	[33] Before sowing		[34] After harvesting	
		[35] N -NO_3	**[36]** N -NH_4	**[37]** N -NO_3	**[38]** N -NH_4
	[39] (cm)	[40] (mg/kg)	[41] (mg/kg)	[42] (mg/kg)	[43] (mg/kg)
[44] Organic + Mineral fertilization	[45] 0-20	28,00	69,00	24,00	63,00
	[46] 20-40	23,00	65,00	21,00	59,00
[47] Mineral fertilization	[48] 0-20	6,14	23,12	3,07	11,52
	[49] 20-40	1,12	4,78	0,55	2,90

The values obtained for the bulk density and conversion factor from mg/kg to kg N/ha in both plots are presented in Table III.

Table III. Bulk density and conversion factor from mg/kg to kg N/ha in both analyzed plots

[50] Fertilization source	[51] Depth	[52] Soil layer thickness	**[53]** Bulk density	**[54]** Conversion factor
	[55] (cm)	[56] (cm)	[57] (g/cm^3)	[58] (-)
[59] Organic + Mineral fertilization	[60] 0-20	20	1,48	3,0
	[61] 20-40	20	1,67	3,3
[62] Mineral fertilization	[63] 0-20	20	1,45	2,9
	[64] 20-40	20	1,65	3,3

In Table IV, the soil mineral nitrogen (N mineral) (kg N/ha) before sowing is presented. We observed that the soil from organic and mineral fertilized plot has very high values of N mineral, 571 kg N/ha on 0-40 cm, in comparison with the soil from just mineral fertilized plot that recorded lower values of N mineral, 104 kg N/ha.

Table IV. Soil mineral nitrogen (N mineral) (kg N/ha) contents in both analyzed plots before rape sowing

[65] Fertilization source	[66] Depth	$N-NH_4$	$N-NO_3$	N mineral
	[67] (cm)	[68] (kg N/ha)	[69] (kg N/ha)	[70] (kg N/ha)
[71] Organic + Mineral fertilization	[72] 0-20	81	200	281
	[73] 20-40	76	214	290
	[74] 0-40	157	414	571
[75] Mineral fertilization	[76] 0-20	18	67	85
	[77] 20-40	3	16	19
	[78] 0-40	21	83	104

In Table V, the soil mineral nitrogen (N mineral) (kg N/ha) after harvesting is presented. We observed that the soil from organic and mineral fertilized plot has very high values of N mineral, 516 kg N/ha on 0-40 cm, in comparison with the soil from just mineral fertilized plot that recorded low values of N mineral, 54 kg N/ha.

Table V. Soil mineral nitrogen (N mineral) (kg N/ha) contents in both analyzed plots after rape harvesting

[79] Fertilization source	[80] Depth	$N-NH_4$	$N-NO_3$	N mineral
	[81] (cm)	[82] (kg N/ha)	[83] (kg N/ha)	[84] (kg N/ha)
[85] Organic + Mineral fertilization	[86] 0-20	69	183	252
	[87] 20-40	69	195	264
	[88] 0-40	138	378	516
[89] Mineral fertilization	[90] 0-20	9	33	42
	[91] 20-40	3	9	12
	[92] 0-40	12	42	54

The soil efficient mineral nitrogen stock was calculated by summing the efficient $N-NO_3$ content and efficient $N-NH_4$ content. The efficient coefficients for $N-NO_3$ is 1,0 and for $N-NH_4$ is 0,5. The efficient $N-NO_3$ and $N-NH_4$ contents from soil were calculated by multiplying the contents of the two mineral forms of nitrogen in soil with the corresponding coefficient. The soil efficient mineral nitrogen stock before rape sowing in both analyzed plots is presented in Table VI.

Table VI. Soil efficient mineral nitrogen (N mineral) (kg N/ha) in both analyzed plots before rape sowing

[93] Fertilization source	[94] Depth	Efficient $N-NH_4$	Efficient $N-NO_3$	Efficient N mineral
	[95] (cm)	[96] (kg N/ha)	[97] (kg N/ha)	[98] (kg N/ha)
[99] Organic + Mineral fertilization	[100] 0-20	41	200	241
	[101] 20-40	38	214	252

	[102] 0-40	79	414	493
[103] Mineral fertilization	[104] 0-20	9	67	76
	[105] 20-40	2	16	18
	[106] 0-40	11	83	94

We observed that very high values were recorded in the plot with organic and mineral fertilizers applied, 493 kg N mineral/ha, on 0-40 cm depth and high values in the plot with just mineral fertilization applied, 94 kg N mineral/ha.

The soil efficient mineral nitrogen stock after rape harvesting in both analyzed plots is presented in Table VII.

We observed that very high value were recorded in the plot with organic and mineral fertilizers applied, 447 kg N mineral/ha on 0-40 cm depth, and moderate value in the plot with just mineral fertilization applied, 94 kg N mineral/ha on 0-40 cm depth.

The very high soil efficient mineral nitrogen stock either before rape sowing or after harvesting in the plot with organic and mineral fertilizers applied is a result of previous un-controlled organic fertilizer application.

Table VII. Soil efficient mineral nitrogen (N mineral) (kg N/ha) in both analyzed plots after rape harvesting

[107] Fertilization source	[108] Depth	Efficient $N\text{-}NH_4$	Efficient $N\text{-}NO_3$	Efficient N mineral
	[109] (cm)	[110] (kg N/ha)	[111] (kg N/ha)	[112] (kg N/ha)
[113] Organic + Mineral fertilization	[114] 0-20	35	183	218
	[115] 20-40	34	195	229
	[116] 0-40	69	378	447
[117] Mineral fertilization	[118] 0-20	5	33	38
	[119] 20-40	1	9	10
	[120] 0-40	6	42	48

NUE indicator was calculated as a ratio between and nitrogen (N) input and nitrogen (N) output. N input was evaluated by taking into account the efficient soil mineral nitrogen stock before sowing and the nitrogen fertilization during the soil tillage works. Nitrogen output was evaluated by taking into account the nitrogen exported with the obtained crop yield.

The optimum economic dose (DOE) of N fertilization was calculated for a planned rape yield of 3600 kg/ha. It resulted an optimum fertilization dose of 98 kg N/ha and year to be applied.

The efficient N mineral stock before rape sowing for the analyzed plots were: 493 kg N/ha in case of the plot with organic and mineral fertilization applied and 94 kg N/ha in case of the plot with just mineral fertilization applied.

A dose of 36 kg N/ha from complex fertilizer 20:20:0 was applied during the soil tillage works in both plots. Even though the efficient N mineral stock before rape sowing much higer than (in the plot with organic and mineral fertilization applied) or very close to the optimum fertilization dose (in the plot with just mineral fertilization applied) the farmer applied preventively and locally the dose of 36 kg N/ha.

The obtained rape yield was 1600 kg/ha. The total nitrogen consumption of rape for oil is estimated at 51 kg N/1000 kg rape yield. It resulted that the N export with the obtained rape yield was 82.4 kg N/ha.

NUE indicator was calculated for each analyzed plot. Table VIII presents the results obtained.

We observed that the nitrogen use efficiency indicator was low, 15%, in case of organic fertilization (180 t/ha/year of fresh pig manure applied un-controlled in previous years) and mineral fertilization (36 kg N/ha from complex fertilizer 20:20:0) application. This is a result of uncontrolled organic fertilization which led to accumulation of nitrogen in soil in high quantities, apparently with high risks of surface runoff or leaching on the soil profile depth to the groundwater.

The nitrogen use efficiency indicator ranged within the optimum values, 48%, in case of mineral fertilization with the same rate but without organic fertilization.

Table VIII. Nitrogen use efficiency indicator (NUE) in both analyzed plots

[121] Fertilization source	[122] NUE (%)
[123] Organic + Mineral fertilization	[124] 15
[125] Mineral fertilization	[126] 48

CONCLUSIONS

The nitrogen use efficiency indicator was low, 15%, in case of organic fertilization (180 t/ha/year of fresh pig manure applied un-controlled in previous years) and mineral fertilization (36 kg N/ha from complex fertilizer 20:20:0) application. This is a result of uncontrolled organic fertilization which led to accumulation of nitrogen in soil in high quantities, apparently with high risks of surface runoff or leaching on the soil profile depth to the groundwater. However the nitrogen leaching is reduced in this case, because of the soil type, which has a compact clayey layer with low water permeability at 40-50 cm depth. The soil mineral nitrogen content after harvesting was 447 kg/ha, from which 50% may be available for the next crop. The nitrogen use efficiency indicator ranged within the optimum values, 48%, in case of mineral fertilization with the same rate but without organic fertilization. The higher value of the nitrogen use efficiency indicator was a result of the lower soil mineral nitrogen content before sowing.

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The synergy of the agricultural landscape and archaeological heritage as an element of historical urban identity in Iznik (Turkey)

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Abstract: **Cities are the expressions of the cultural, social and economic structures of people in space. Anatolian lands that have been selected as settlement areas since the Prehistoric Ages until today have rich historical and cultural data. The reflection of the rich historical structure of our country to the current cultural values increases spatial attractiveness. The town of İznik that has been selected as the study area is a town under the governorship of the city of Bursa located in the Marmara Region of Turkey that is located to the easts of the lake known by the same name. Served as a capital city to Seljukian, Byzantine and Ottoman states respectively, Iznik bears exceptional testimony to early examples of cultural, architectural and artistic accomplishment of these cultures. It hosted the most important examples of early church in the history of Christianity. In the meantime, the study area is included in the UNESCO World Heritage Temporary List. İznik has suitable conditions for the public to earn their living off the land thanks to its convenient climate conditions. It's high suitability for agriculture is due to being located on a fertile plain as well as its abundant vegetation. In addition, the city attracts attention today with its olives and vineyards as well as its special climate and fertile agricultural lands. This paper emphasizes the agricultural landscapes features and archaeological heritage sites as urban identity elements in the city of İznik. As a result, strategies for the sustainable development of the agricultural and archaeological heritage characteristics of the city as an element of historical urban identity were revealed in İznik.**

Keywords: Sustainable landscapes, Sustainable development, Historic urban landscape, Agricultural landscape, İznik.

I. INTRODUCTION

Lands of Anatolia selected as living areas since the prehistoric ages have a very rich historical and cultural value as the cradle of many civilizations. Cultural values that are shaped by the historical process have significant in the formation of both urban identity elements as well as urban landscape patterns.

Each landscape represents the culture that creates itself. Therefore, natural and cultural resources are effective in the shaping of urban and rural landscape in addition to related perceptions and identity. Important agricultural landscape areas, archaeological assets, historical and cultural assets, water sources, natural water springs, geological and geomorphological resources, topographic resources, unique flora, wildlife areas as well as social and economic resources are among the primary resources (Köse 2006). Historical landscapes have been classified into 2 main classes during the ICOMOS (International Council on Monuments and Sites) Venice 1964, ICOMOS Fontainebleau 1971 meetings. This has also been accepted by the Association of Historical Gardens in England (Yazgan and Kapuci 2007). Accordingly;

- Natural and Archeologic landscapes, Preserved Areas, Rural Landscapes,
- Gardens and Park Landscapes: This group includes structures included in the definition of history and the surrounding parks, urban parks developed over a historical process, Preservation Sites developed for science and technology purposes.

Historical cities that are the most valuable cultural assets of a society as elements that reflect their way of life make up the historical landscape. These areas have been shaped over time by the culture, traditions, way of life and preferences of societies which have reached our day after hosting many different civilizations thereby forming areas in which future generations will live (Yazgan et.al., 2000). The type of local agricultural production and the distribution of agricultural areas are among the factors that are effective in the formation of the landscape pattern in the historical texture. Landscape characteristics as an element of identity are also reflected on the urban settlement texture and structural culture. Archaeological sites, monuments, public open spaces, agricultural areas and residences form a texture in historical cities with unique and local characteristics.

Agricultural landscape is an important source of human welfare, and an important area for biodiversity conservation (Xunling et al 2018). An agricultural landscape is not solely involved in the production of consumer goods but is also related with the continuity and careful maintenance of the territory (Boriani, 2018).

This paper emphasizes the agricultural landscapes features and archaeological heritage sites as urban identity elements in the city of İznik. As a result, strategies for the sustainable development of the agricultural and archaeological heritage characteristics of the city as an element of historical urban identity were revealed in İznik. The study is of importance for landscape and heritage management within the scope of sustainability.

II.SITE DESCRIPTION

Iznik is a district in the province of Bursa located to the southeast of the Marmara Region and to the eastern coast of the lake with the same name. It has a total population of 43 287 (TUIK 2014). It is surrounded with provinces of Yalova and Kocaeli to the north, Sakarya to the northeast, Bilecik to the east, districts of Yenişehir to the south, Orhangazi to the west as well as Lake Iznik. Lake Iznik is the sixth largest lake in Turkey and the largest in the Marmara Region with an area of 312 km² (Anonymous, 2000). As an important natural resource, Lake Iznik and the surrounding fertile agricultural lands have been important factors for its selection as a settlement area throughout history.

The city has a flat land surrounded with steep mountains. The topographic structure of Iznik has been effective in the formation and development of the grid plan transportation system (Figure 1). In turn, this plan has resulted in the distribution of the city in three different directions connected with the land as well as the formation of flat and wide agricultural areas. The fact that it is located at a hollow region surrounded with mountains that run parallel to the coastline has been a determining factor with regard to the climate characteristics of the study. Iznik has a semi-mild climate with a touch of the Mediterranean region climate. This has a positive impact on the agricultural life in the city. Rich flora characteristics and agricultural areas attract attention in the city as a result of the impact of the climate (Yazgan and Kapuci 2007).

Figure 1. Geographical location of the study area (Cengiz and Cengiz 2016).

The city of Iznik during the urban development period is evaluated within the framework of archaeological landscapes that are part of the historical landscape concept in the first category as defined by ICOMOS (Yazgan and Kapuci 2007). Iznik as one of the rare cities that uniquely reflect the interaction between natural and cultural landscapes carries archaeological heritage site characteristics that are nationally and internationally significant. In the meantime, the study area is also included in the UNESCO World Heritage Temporary List.

The city of Iznik has been influenced by the many different civilizations it hosted as a capital city four times throughout its long history due to its strategic location. Iznik has went through different periods as Hellenistic Age (Greek Period) (MÖ 316-281), Roman Period (MS 281, MS 395), Byzantine Period (MS 395-1075), Seljuq Period (1075-1097), Byzantine Period (1097-1332), Ottoman Period (1332-1922) (Cengiz and Cengiz 2016). The 1st Ecumenical Council gathered on May 20, 325 and the 2nd Iznik Council, seventh of the councils between the churches gathered between the dates of September 24 September-October 23, 787 at the Hagia Sophia Church (Erton, 1995; Bodur, 2000). The fact that two of the most important councils for Christianity has gathered in Iznik increased the importance of the city for the Christian world (Şen, 1998).

The city that is in continuous interaction with natural-cultural, historical-social-economic elements has formed a unique living culture and landscape characteristics throughout history. The interaction between the urban texture comprised of physical, architectural, cultural and aesthetic elements and the social life with its dynamic structure holds and important place for the urban development of the city.

III.HISTORICAL URBAN IDENTITY OF IZNIK

The identity elements of Iznik which have been effective for the city to become an important archeological heritage area and for the evaluation of its historical urban identity have been examined in 3 groups; the city plan that forms the main borders of the city, the gates where the two main axes on the plan end and the city walls which make up the natural borders of the city have been evaluated together as the first group. The existing historical monuments and structures in the city have been examined as the second group. Agricultural landscape areas including olive gardens and vineyards along with the historical urban landscape of the city of Iznik as displayed by the Iznik Lake have been put forth as the third group (Yazgan and Kapuci 2007).

A. City plan, City walls, gates

City plan**:** The city that is built on a flat area is surrounded with rectangular walls and has four gates according to this plan system that is also known as the grid plan. There are two main axes in the city that intersect perpendicularly. The location where the two main streets intersect is used as the city center today as was the case in the past. Hagia Sophia Museum and the Government building are among the points of attraction at the city center of our day.

Walls and Gates: The walls have been built, repaired or expanded during each period (Nuhoğlu, 1995; Bodur, 2000). Hence, they reflect the architectural characteristics of each period. The Iznik gates of today dating back to the Late Roman Period are the second most important city walls in Turkey after the Istanbul Land Gates. There are four main gates known as Istanbul Gate, Yenişehir Gate, Lefke Gate and Göl Gate for entering the city of Iznik in addition to the secondary gates used only by pedestrians.

B. Monuments

Important structures that carry monumental characteristics in the city have been listed in the order of the period of their construction: Roman Period; Roman Theater, Great Ceremony Area, Saint Neophytos Basilica Byzantine Period; Hagia Sophia Church, Baptistery Ottoman Period; Green Mosque, Süleyman Pasha Madrasah, Nilüfer Hatun Public Soup House (Imaret), Hacı Özbek Mosque, Şeyh Kudbettin Mosque, Mahmut Çelebi Mosque, I.Murat Turkish Bath, II. Murat Turkish Bath, Tile Ovens Early Republic; Traditional Architectural Buildings

C. Agricultural Landscape Areas (Olive gardens and vineyards)

The city of Iznik has throughout history had climate conditions that are suited for providing the means of income to the city dwellers due to the fact that it is located on the coast of Lake Iznik and its location on a fertile plain. Moreover, the city that is an important and fertile area of agriculture due to its unique climate and fertile soil attracts attention today with its olives and vineyards. The fact that Iznik is surrounded by mountains to the north plays an important role in the fact that the temperature does not drop significantly in addition to generating unique microclimatic effects. This has a positive impact on the agricultural life in the city. This has a positive impact on the agricultural life in the city.

Agriculture is the most important means of income of the public in our day as well. Olive fields and vineyards are among the factors that form and complement the urban texture. Agricultural areas also strengthen urban identity in the city of Iznik while also transforming it into a city of agriculture. The wide agricultural landscape areas both inside and outside the city walls have special importance as identity elements which provide significant contributions while emphasizing the archeological heritage value of the city.

IV.CONCLUSIONS AND SUGGESTIONS

The identity elements of historical urban landscapes generate different levels of awareness for the perceptibility and popularity of the city while also generating cultural components of significant importance. In this scope, preserving the location and characteristics of the identity elements of settlements during historical urban planning studies carries significant importance for strengthening their impact inside the city as well as ensuring their sustainability.

Disruption of the natural and cultural assets that make up the urban identity creates spatial quality, design and aesthetic problems in the city. In this regard; natural, cultural and archaeological landscape values have to be taken into consideration at the national, regional and local scales. Various factors such as intensive structuring and urbanization have adverse impacts on the perception of historical urban landscapes. It is important that natural and cultural symbols along with historical, natural, cultural identity and elements are taken into consideration as a whole within the relationship of sustainability, locality and naturalness.

The impact of landscape on identity formation has been emphasized according to the European Landscape Convention. The preservation and management of natural and cultural heritage have been emphasized with an awareness that the landscape carries public benefits in natural, cultural, ecological, environmental and social areas; that the landscape contributes to the shaping of local cultures which in turn is among the most important parts of the cultural and natural heritage contributing to the reinforcement of the welfare of the people and national identity.

In this regard, the city of Iznik is among the rare cities which have been able to preserve its historical city model until today. It still preserves its importance with its fertile lands along the coast of Lake Iznik, its rich natural resources, climate conditions, agricultural areas and the identity that it has built with a synergy between agricultural and archaeological identity. Integrated approaches for the identity elements of the city of Iznik have to be developed in landscape planning and design studies for the sustainability of this importance.

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Coastal resilient design for the Güzelcehisar heritage coast in Bartın (Turkey)

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Abstract: **that are suitable for the definition, features and problems of the coast is highly important in terms of conservation and usage in coastal resilient planning and design of coastal areas which are treated exclusively with their natural and cultural resources. In addition to their ecological features, coastal areas have high landscape values that enable multiple spatial solutions like cultural usages for tourism and recreation. Therefore, coastal areas contribute significantly to the quality and character of the rural and urban landscape. The geological and cultural significance of coastal areas has led to various national and international designations based on their geology, geomorphology, landscape and associated habitats. In this context, understanding the terms of Geodiversity and Geoconservation terms is important for Coastal Landscape Heritage Project. Turkish coasts are preferred particularly because of their natural beauty as well as cultural and historical values; besides, they are under higher environmental oppression. Güzelcehisar, which has been chosen as the study area, is within the provincial borders of Bartın located in the Western Black sea Region of Turkey. It is a natural bay to the west of and 17-km away from Bartın city center. Güzelcehisar Bay is a First Degree Archaeological Site (Güzelcehisar Castel), and First Degree Natural Protected Area. Due to its volcanic structure, Güzelcehisar stands out with its natural and cultural landscaping features contains special 80-million-year geomorphologic formations in its coastline which have the characteristic of nature monument called "Lava Columns". In Turkish Tourism Strategy 2023, planning, investment, organization, service quality, improving transportation and infrastructure, diversifying tourism, etc. have been included as objectives that are part of a 5-year development plan. In this scope, a landscape application project has been developed where access to lava columns is possible throughout the land, tourism and recreational activity infrastructure in the coastline is developed and resilient coastal landscaping with rural characteristic is maintained. In the scope of the project, a wooden platform road that will start from the view terrace on the First Degree Archaeological Site to the north of Güzelcehisar Bay which continues alongside the beach is connected to a rocky island on the sea and access to the Lava columns in the southern part of the Bay. In this paper, coastal resilient design suggestions have been developed to evaluate the lava columns focusing on sustainable tourism as coastal geological heritage areas.**

Keywords: coastal landscape, heritage coast, resilient design, Guzelcehisar, geotourism

.INTRODUCTION

According to Andres, et al. (2017); Coastal areas are complex areas with rich natural resource potential and biodiversity, where many physical and non-physical (organizations, laws) components interact with each other and experience development pressure (Tampakis et al. 2018). According to Groot et al (2012); Coastal and marine ecosystems play a crucial role in supporting economic prosperity and social welfare in the adjacent human communities (Tampakis et al. 2018). According to Outeriro and Villasante (2013); Economic activities such as fishing, aquaculture, tourism, energy production, or shipping are highly dependent on the functioning of coastal marine ecosystems (Tampakis et al. 2018). According to Costanza et al. (2014); the maintenance and enhancement of these activities as well as of the multiple benefits available from marine ecosystems depend on how societies and governments find ways to balance the demand and the supply of marine ecosystems (Tampakis et al. 2018).

Rural landscapes are cultural landscapes which emerged as a result of a long interaction of environmental factors with the activities of a community living in a given area. Traces of the past can be seen in the form of landscape patterns in these landscapes. Identifying and defining landscape heritage should be an important component of spatial planning processes (Kupidura 2017).

The geological and cultural importance of coastal areas in addition to their geology, geomorphology and landscape has led to the formation of various national and international references/symbols subject to their related habitats. In this regard, understanding the terms of geodiversity and geoconservation are important for the Coastal Landscape Heritage Project (Cengiz and Cengiz 2016).

The concept of resilience has been included in literature as a result of "ecological system" studies by C. S. Holling (1973) (Walker et al. 2006). Obtaining maximum benefit in sustainability studies by ensuring the stability of ecological systems, securing social and economic sustainability have been adopted as an approach for providing resilience (Folke and Berkes 2004). Resilience is used to express the prevention of changes, risks and surprises or ensuring system

sustainability by keeping pace with such uncertainties (Holling 1973; Folke, 2006). The term resilience is generally used for the prediction of future problems in a system by understanding its current values, issues and potentials and to be ready for uncertainties or the ability to be adapted to the new system.

According to Turkey's Sixth National Communication on Climate Change 2016, sustainable environment and infrastructure policies are important for building resilient cities. The following items attract attention among the subjects emphasized within the scope of infrastructure policies:

- A pedestrian and human focused understanding should be developed by building a new plan for sustainable transportation
- Making public and public related areas accessible for the disabled, elimination of architectural obstacles and infrastructures that enable access to technology should be encouraged.

Studies carried out for generating future adaptation based plans/designs in order to create more resilient spaces against sea-level rise, overflow and floods are among the primary subjects of coastal resilience (Folke and Berkes 2004).

Resilience characteristics are studied as; social-technological-environmental domain, spatial scale, transformability, adaptability, and self-organizing ability.

Many plans are under way for adopting coastal regions to sea-level rise. A mix of adaptation strategies often provides the broadest suite of benefits, including newer approaches that involve living system components such as wetlands, sandy beaches, sandbars, or living breakwaters. Some regions have limited experience with these new approaches and may benefit from using decision-support tools that identify such ecosystem-based strategies (Hill 2015).

According to (Beach 2003; Hill 2011); the term "infrastructure" referred primarily to masonry and metal construction in past centuries, but more recently it has come to signify any structures (e.g. powerlines, floodwalls, wetlands) that support or alter the spatial and temporal distribution of resources and risks for human benefit (Hill 2015). A useful typology of coastal infrastructure strategies is one that can serve as a heuristic tool in planning and policy making, meaning that it allows for a more thorough exploration of a set of solutions and the generation of a complete range of alternatives within a defined set of variables (Hill 2015).

Regional resilience for the Headlands:

The Headlands is the most exposed stretch of the New Jersey Shore, with open ocean views subject to the direct action of wind and waves, but is also the highest and driest of the three shore typologies, making it attractive for continued future use (Handel et al. 2018).

New Jersey's headlands were the first sites of tourist-oriented occupation of the Northern New Jersey coast. The first boardwalk was built in New Jersey to prevent sand from entering beachside buildings and, over time, boardwalks have become an iconic emblem of Jersey shore tourism. This was the case for many oceanfront boardwalks, worldwide (Handel et al. 2018).

Güzelcehisar selected as the study area is a coastal settlement area that has national and international importance with its 80 million year old lava columns and its heritage coastal characteristics. The "Landscape Application Project for Tourism and Recreation Purposes at the City of Bartın Güzelcehisar Lava Columns and Coas Columns" supported within the scope of Western Black Sea Development Agency (BAKKA) 2016 Small Scale Infrastructure Financial Support Program has been put into practice including coastal arrangement for improving the visibility and accessibility of the

Güzelcehisar lava columns along with pier applications. The project is an important boardwalk application for providing coastal geotourism infrastructure in Güzelcehisar as well as the spatially integrative use of the coastal area and the increase of the usage time. The objective with the application carried out in this scope was to improve coastal area resilience against the continuing sand activity generated as a result of the tidal stream at Güzelcehisar during the summer and winter months and against the increasing wave level.

This article puts forth information, experiences and strategies on the Güzelcehisar Project carried out with an innovative approach for the introduction of geological heritage.

II.SITE DESCRIPTION

Güzelcehisar, which has been chosen as the study area, is located within the provincial borders of Bartın (Fig. 1). It is a natural bay to the west of and 17-km away from Bartın city center. Güzelcehisar Bay is a First Degree Archaeological Site (Güzelcehisar Castel), and First Degree Natural Protected Area. First Degree Archaeological Site has 1.57 ha usage area, and the First Degree Natural Protected Area has 15.15 ha usage area which consists two sections as sandy and rocky. It ends with the Lava Columns located at the end of the southern coastline. First Degree Natural Protected Area involves the whole Güzelcehisar coast. Limited number of dispersed settlements through the area and the forestlands behind them attract attention (Cengiz et al. 2018).

Güzelcehisar is a traditional rural coastal settlement area affiliated to the city of Bartın with mostly preserved natural and cultural values in addition to microclimatic features. Owing to its natural landscaping features, Güzelcehisar attracts attention with its internationally important Lava Columns, natural vegetation cover and natural beach (Cengiz and Cengiz 2016; Cengiz et al. 2018).

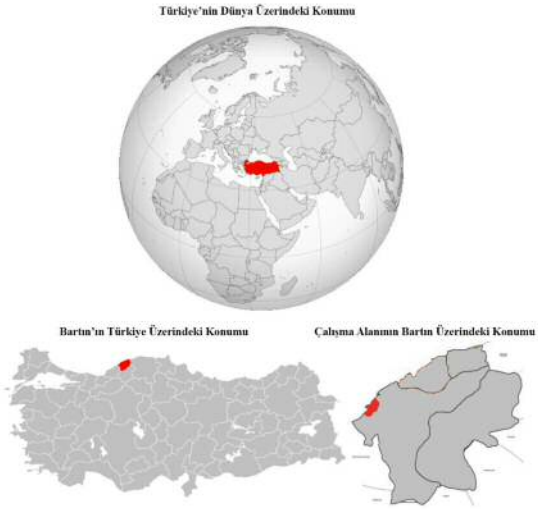

Fig. 2 Geographical location

III.STUDY AREA CHARACTERISTICS

Güzelcehisar is a traditional rural coastal settlement area affiliated to the city of Bartın with mostly preserved natural and cultural values in addition to microclimatic features. Owing to its natural landscaping features, Güzelcehisar attracts attention with its internationally important Lava Columns, natural vegetation cover and natural beach (Cengiz and Cengiz 2016; Cengiz et al. 2018).

According to current land use; First Degree Natural Protected Area does not vary in terms of space functions. In the area where woodlands are dominant, forestlands, built-up areas, cultivated areas, rocky areas and beach are the primary land use types. During current land use evaluation studies, a few 1-2 story constructions were detected in the First Degree Natural Protected Area.

There are dense forestlands and rocks in the First Degree Archaeological Site which is surrounded with cultivated areas. Access to the First Degree Archeologically Site is possible through the cultivated areas via an unstable pathway (Cengiz and Cengiz 2016) (Fig. 2).

LAVA COLUMNS

A volcanic bow starting from Bulgaria to the west stretching all the way to Georgia to the east has been formed when the base of the Tethys Ocean located to the south of the Black Sea in the old times sank to the north and the sinking ocean base resurfaced after melting deep down in the earth. The lavas, gases and water vapor that formed as a result of many volcanic activities that took place during this period have been effective in climate change. Magma rocks that are formed as a result of volcanic activities start around İğneada in western Turkey moving to the east along Şile, Marmara Ereğlisi, Zonguldak, Bartın, İnebolu and all of the Black Sea mountain belt. However, what sets Güzelcehisar apart from other similar regions is that the lava columns stretch all the way to the Mugada Cove which is a natural wonder. Güzelcehisar has 80 million year old special geomorphological formations along its coastline called “Lava Columns” due to its volcanic structure. The diameters of the Lava Columns range between 50-100 cm with heights of over 30 meters. Northern Ireland, Scotland and California are international centers of tourism with their Lava Columns. Güzelcehisar Lava Columns in Turkey suggested among the Geological Heritage Inventory Suggestions is among the rare natural formations in the world with national and international tourism potential (Cengiz et al. 2018).

Fig.2 Satellite image

IV.LANDSCAPE APPLICATION PROJECT FOR TOURISM AND RECREATIONAL PURPOSES FOR THE CITY OF BARTIN GÜZELCEHİSAR LAVA COLUMNS AND COAST

Subjects such as improvement of planning, investment, organization, service quality and transportation, tourism variation etc. have been set as important objectives in the 5 year development plan which is part of the Turkey Tourism Strategy 2023.

A landscape application project has been developed for the sustainability of the rural characteristic coastal landscape that contributes to the tourism and recreational activity infrastructure at the coast with accessibility to the Lava Columns in the whole of Güzelcehisar. The "Landscape Application Project for Tourism and Recreation Purposes at the City of Bartın Güzelcehisar Lava Columns and Coast" project coded TR81/16/KÖA/0042 was approved within the framework of 2016 Small Scale Infrastructure Financial Support Program with the coordination of Bartın University, Bartın Provincial Directorate of Culture and Tourism and Bartın Special Provincial Administration supported within the scope of Western Black Sea Development Agency (BAKKA) 2016 Small Scale Infrastructure Financial Support Program. The general purpose of the project is to carry out infrastructure studies for the improvement of tourism in areas with natural, historical and cultural potential thereby contributing to the presentation of the region. The purpose within the scope of the application project was to diversify tourism and to create new destinations while generating an added value in the city of Bartın (Cengiz et al. 2018).

A view terrace was formed to the north of the Güzelcehisar Coastline within the scope of the project and the lava columns to the south of the Coastline were made accessible with a wooden boardwalk that continues along the beach. The boardwalk on the sea connects the land and the rocky island while also providing an opportunity for the tourists to view the scenery and take photos. The project was applied in accordance with the Conservation Development Plan and the boardwalk was applied on the 3 m section as a 6 m road in the Conservation Development Plan. Stairs and ramps that are in accordance with accessible design standards were used to provide pedestrian crossing. The wooden boardwalk is a "Boardwalk" example that provides ease of access to all sections of the public including the disabled and the elderly thereby providing a continuous coastal experience from the view terrace to the lava columns (Cengiz et al. 2018).

The project that includes coastal arrangements and boardwalk applications for ensuring visibility and accessibility of the Güzelcehisar lava columns is an important boardwalk application with regard to providing coastal geotourism infrastructure in Güzelcehisar in addition to increasing the time of integrated coastal area use. In this scope, it was aimed to improve the resilience of the coastal area against the sand activity and increased wave level that forms in Güzelcehisar during the summer and winter months. The boardwalk was applied on the beach at the +1 code by taking into consideration the sand activity and wave height in Güzelcehisar which has a dynamic coastal landform. The 850 m wooden boardwalk that was applied on bored pile system will also enable yearlong coastal geotourism activities.

The special objectives put forth for actualizing this general goal are as follows (Cengiz et al 2018):

1. Building a boardwalk on the sea: The boardwalk that will connect the rocky island with the land that is part of the tourism and recreational study in the Güzelcehisar coast to the south of the study area will also enable the tourists to view the Lava Columns.

2. Building a Pier on the island: A wooden platform was built on the island in order to ensure that the tourists walk comfortable, view the lava columns, acquire information and take photos.

3. Building a view terrace: A wooden View Terrace was built to the north of the study area in order to ensure that the Lava Columns can be viewed along the Güzelcehisar coastal landscape.

4. Building a Wooden Boardwalk on the Coast: A wooden boardwalk was built between the rock island-view terrace at the Güzelcehisar coast which will not hinder beach use while providing accessibility to the Güzelcehisar Lava Columns for introductory purposes.

V.CONCLUSIONS

According to Panagopoulos et al (2016); Sustainable cities must be planned with respect to environmental quality and they should be simultaneously economically viable, socially just, politically well managed to maximize human well-being (Tampakis et al. 2018).

The use of the natural resources of cities with maximum benefit and minimum harm requires the provision of the sustainability of ecosystem services at all scales from the global to the local. The resilient and flexible governance approach that aims to provide information, experience and learning processes for the society can generate sustainable solutions for the management of the design and planning processes. In conclusion, resilience approach may develop realistic solutions with regard to contributions to the quality of life by examining the relationship that is generated with the interaction and by ensuring the sustainability of the developed systems.

In this scope, the main purpose of the project was to provide coastal geotourism infrastructure to Güzelcehisar and to increase the spatial use of the coastline as well as the duration of use. The purpose of the application carried out was to improve the resilience of the coastal area used against the continuing sand activity that is formed as a result of the tidal movement at Güzelcehisar as well as against the increased wave level.

Improving the accessibility of the Lava Columns at Güzelcehisar which make up a significant potential for coastal geotourism and cultural tourism will contribute to diversifying the tourism in our region in addition to preserving it within the preservation-use balance. As is the case for many international examples that are very popular among tourists worldwide, the increase of the popularity of the Güzelcehisar Lava Columns shall provide national and international awareness. The "Application Project for the City of Bartın Güzelcehisar Lava Columns and Coast for Tourism and Recreational Purposes" that will contribute to the tourism infrastructure of the region is important for regional development.

80 million year old lava columns of Güzelcehisar make up the most important source of coastal geotourism potential. Providing accessibility and proper geological descriptors is important for informing the visitors of the region. Another reason why it is important is that they enable visitors to acquire information and to remember the site after they leave. Providing these descriptors plays an important role for improving visitor awareness and understanding with regard to geodiversity and geoconservation (Cengiz et al. 2018).

The Güzelcehisar settlement that comes to the forefront with its rural characteristic also has significant value with regard to rural, cultural and tourism potential with its coastline, beach, forest assets, microclimatic properties, citrus gardens and olive trees as well agricultural, coastal and archeological landscape characteristics. Spreading out coastal geotourism activities throughout the year with the boardwalk application will make significant contributions especially with regard to rural development. Güzelcehisar is a "Heritage Coast" with its Coastal Morphology Preservation Site characteristics. In this regard, it has been suggested as a "National Geological Heritage" (Cengiz et al. 2015).

Güzelcehisar has a potential to be included as a candidate for the UNESCO world heritage list thanks to its lava columns, coastline and superior landscape characteristics. UNESCO candidacy process should be rapidly started with the participation of the public as well as local and government support in order to register this potential.

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Evaluation polycyclic aromatic hydrocarbons (PAHs) content in marine organisms in the Romanian Black Sea Coastal Area

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Abstract: Marine organisms are able to accumulate large amounts of organic pollutants in their tissues, but this accumulation varies by species and can be transferred to the food chain, sometimes exceeding accepted thresholds for human consumption. Due to their properties and adverse environmental impact, polycyclic aromatic hydrocarbons are included in the list of priority pollutants of concern. The paper presents polycyclic aromatic hydrocarbons content in marine organisms of commercial interest from Romanian Coastal Area. European legislation set out maximum admissible concentration only for benzo[a]pyrene as the representative compound for polycyclic aromatic hydrocarbons. Most of the samples had benzo[a]pyrene concentration below maximum admissible value in respect with human consumption.

Keywords: polycyclic aromatic hydrocarbons, Black Sea, marine organisms, regulated levels pollutants.

I. AIMS AND BACKGROUND

Polycyclic aromatic hydrocarbons (PAHs) are environmental contaminants of major concern because they are lipophilic, persistent and some of them are classified as probable carcinogenic/mutagenic compounds [1].

PAHs have received increased attention over the last decade as they pose a growing threat to the marine ecosystem and a potential risk to human health through fish and seafood [2].

The available data on polycyclic aromatic hydrocarbons in biota on the Romanian Black Sea Coastal Area are mainly in molluscs and different fish species.

The paper presents recent data on priority polycyclic aromatic hydrocarbons concentrations in fish and molluscs sampled during 2016–2018 from various sites along the Romanian coastal zone.

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Evaluation polycyclic aromatic hydrocarbons content is done by comparing benzo[a]pyrene concentrations with levels established by European legislation in respect with human consumption.

II. EXPERIMENTAL

The samples collected between 2016–2018 from eight sites along the Romanian Coastal Area were represented by commercial molluscs and fish species from Romanian littoral (Table I). The molluscs and fish tissue were dried using a Labconco Freeze Dry System.

Table I. Sampling location and marine organisms species

No	Scientific name	Sampling area
1	*Rapana venosa*	East Constanta
2	*Rapana venosa*	Vama Veche
3	*Mytilus galloprovincialis*	Agigea harbour
4	*Mytilus galloprovincialis*	Midia
5	*Engraulis encrasicolus*	Cape Midia
6	*Engraulis encrasicolus*	2 Mai
7	*Sprattus sprattus*	Mamaia
8	*Trachurus Mediterraneus Ponticus*	2 Mai
9	*Trachurus Mediterraneus Ponticus*	Eforie
10	*Neogobius Cephalarges*	Năvodari

For priority polycyclic aromatic hydrocarbons analyses about 2 g of the dried tissue were used. Internal standard 9,10-dihydroanthracene was added to the samples for quantifying the overall recovery of the analytical procedures [3]. Samples were Soxhlet extracted for 8 h with 250 ml of methanol. The extracts were then saponified by adding 20 ml of 0.7 M KOH and 30 ml of water and refluxing for 2 h. The resulting mixture was transferred into a separating funnel and extracted three times with hexane – once with 90 ml, twice with 50 ml. The extracts were concentrated by rotary evaporation down to 15 ml, and then further concentrated to about 5 ml under a gentle flow of clean nitrogen. Finally, the extract was cleaned up and fractionated by passing it through a silica/alumina

column.

Elution was performed using 20 ml of hexane to yield the first fraction (containing the aliphatic hydrocarbons), then 30 ml of hexane:methylene chloride (90:10) and followed by 20 ml of hexane:methylene chloride (50:50). These two eluents containing the aromatic hydrocarbons (PAHs) were combined for analysis. The fraction containing PAHs was evaporated under a weak flow of nitrogen to 1 ml and it was subjected to qualitative and quantitative analysis on GC/MS Perkin Elmer Clarus 500. The 16 priority polycyclic aromatic hydrocarbons were analyzed: naphthalene, acenaphtylene, acenaphtene, flu-orene, phenantrene, anthracene, pyrene, fluoranthene, benzo [a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluo- ranthene, benzo(ghi)perylene, benzo[a]pyrene, dibenzo[ah] anthracene, indeno[1,2,3-cd] pyrene.

III.RESULTS AND DISCUSSION

Of the sixteen polyaromatic hydrocarbons, European Commission set out maximum admissible concentration only for benzo[a]pyrene. European Directive 208/2005/EC stipulated the maximum admissible limit for benzo[a]pyrene in molluscs at 10 ng/g wet weight and in fish at 2 ng/g wet weight [4].

Concentrations of individual compounds in molluscs and fish samples ranged from 0.0 to 309.3 ng/g wet weight (Table II).

Table II. Concentrations of individual PAHs (ng/g ww)

Compound	Mean	Min	Max
Naphthalene	50.6	0.0	309.3
Acenaphtylene	5.3	0.0	45.1
Acenapthene	6.0	0.0	51.7
Fluorene	5.4	0.0	54.6
Phenantrene	64.9	0.0	284.6
Anthracene	11.2	0.0	47.5
Pyrene	5.2	0.0	52.3
Fluoranthene	5.2	0.0	52.8
Benzo[a]anthracene	5.3	0.0	53.1
Chrysene	5.2	0.0	52.5
Benzo[b]fluoranthene	3.4	0.0	34.5
Benzo[k]fluoranthene	3.6	0.0	36.2
Benzo[a]pyrene	3.7	0.0	37.8
Benzo(ghi)perylene	0.0	0.0	0.0
Dibenzo[a,h]anthracene	0.0	0.0	0.0
Indeno[1,2,3-cd] pyrene	4.26	0.0	40.0

Benzo[a]pyrene in molluscs samples did not exceed the maximum allowable concentrations established by Regulation (EC) No 208/2005 (Fig.1) Benzo [a] pyrene values recorded in fish species varied from 0.0001 to 37.86 ng/g ww with maximum in *Trachurus Mediterraneus Ponticus,* a pelagic and commercial fish species (Fig. 2).

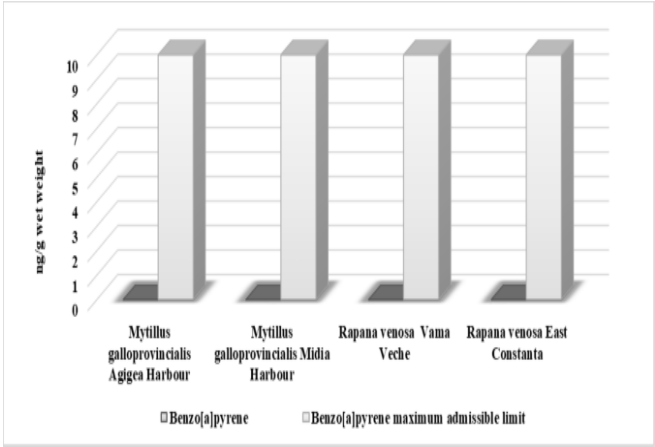

Fig 1. Benzo[a]pyrene levels in molluscs samples taken from the Romanian Black Sea Coastal Area

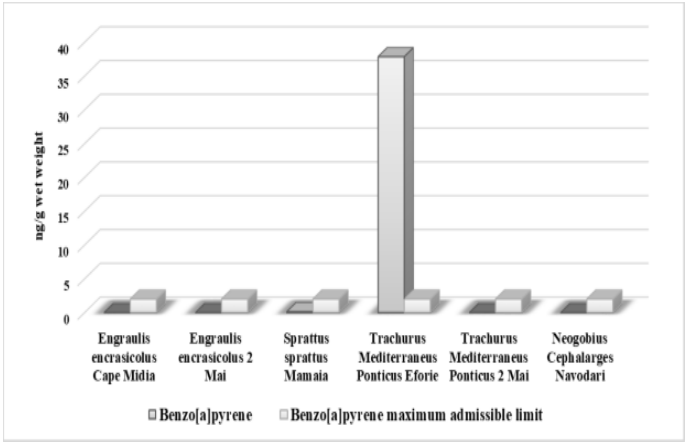

Fig 2. Benzo[a]pyrene levels in fish species taken from the Romanian Black Sea Coastal Area

IV.CONCLUSION

Polycyclic aromatic hydrocarbons content analysis in marine organisms taken from Romanian Black Sea Coastal Area during 2016-2018 revealed the following:

Benzo[a]pyrene concentration in molluscs samples did not exceed the maximum allowable concentration of 10 ng/g wet weight but in fish samples exceeded the maximum limit of 2 ng/g laid down in Regulation (EC) 208/2005.

ACKNOWLEDGMENT

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Soil conservation in High Natural Value farming: towards a closer science-civil society cooperation

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Abstract: Since Romania holds a large proportion of the HNV farmland with roughly 30% of the national total Utilized Agricultural Area eligible to receive financial support, the national planners have set an ambitious scheme for supporting HNV farming through agri-environment payments within the existing national Rural Development Program. As the existing information on soils' level of fertility in the HNV eligible area is scarce, a partnership between a mixed team of soil scientists and civil society environmentalists was concluded within the frame of a recent research project, aiming to: (i) address the stakeholders' perception on the importance of soil conservation and environmental friendly land management, (ii) assess the level of fertility in HNV eligible areas and build-up the first national HNV soil data base and (ii) identify the most relevant soil indicators for designing an expeditious HNV soil monitoring system. The results revealed the strong agreement of the civil society on the existing agricultural policies supporting practices under agri-environment measures and a fair existing level of the soil conservation under HNV practices, as long as land and soil careful administration and resource-efficient management are constantly pursued. A decision support systems' tool was used to identify the most sustainable land management options in a selected HNV area and to prioritize the relevance of soil indicators used in conventional soil surveys.

Keywords: environmental management and sustainable development, High Nature Value, soil conservation, questionnaire based survey

VI. INTRODUCTION

With regard to the growing recognition for the provision of many environmental benefits and a wide range of public goods delivered by low-intensity farming, an important shift of the European Rural Development Program funds' distribution and support payment policies has occurred within the last decade. In large areas of some Central and East Europe countries, the High Nature Value (HNV) farming depends to a significant extent to the conservation of traditional agricultural landscapes and continuation of extensive farming practices. The new HNV concept has been developed and documented in an incipient stage with the technical support of some high professional bodies [1], [2] and the major contribution of the civil society represented by reputed activist non-governmental agricultural and environment protection organizations [3]. In terms of scientific research, there is a great potential for development but HNV farming is still a very young field and investigations and directions have only recently started to be shaped and pursued. Although Romania holds a fair position in Central and East Europe in terms of number of peer-reviewed articles [4], a better interconnected involvement of different stakeholders (scientists, environmentalists, farmers etc) is needed to collect and process new and accurate field HNV data, to understand and substantiate the broad environmental impact and the socio-economic context of the small-scale farming whilst continuing to explore new or improved ways to achieve real participation of society in research and finally, to decision. In Romania, within the frame of a recently initiated project, a team of soil scientists and local civil society activists has completed a first stage of studies in seeking the development of a HNV soil data base and an adequate national HNV soil monitoring system.

VII. CIVIL SOCIETY'S PERCEPTION ON SOIL AND AGRI-ENVIRONMENT PRACTICES

In the initial stage of investigations, a questionnaire based survey was performed on-field, focused on perceptions on soil and soil policy issues and aiming to explore views with regard to soil quality, soil threats as well as the existence and effectives of the national and European policies on soil protection. The sample comprised 140 respondents (representatives of various national stakeholders' groups) out of which 24 representatives of environment and agriculture associations, foundations or NGOs (non-profit, environment pioneering and volunteering civil society organizations) [5]. The most important soil threat perceived by the civil society representatives is by far, „pollution/contamination" (91.7% of the civil society respondents) followed by „soil erosion" (33.3 of the civil society respondents). Questioned about who should be the most interested and responsible to the soil quality and fate, 58.3.7% of civil society respondents replied „the entire society, the public at large, since much of our daily food is grown on soil". 83.3% of the respondents consider the general public interest on soil issues and soil protection as „negligible"

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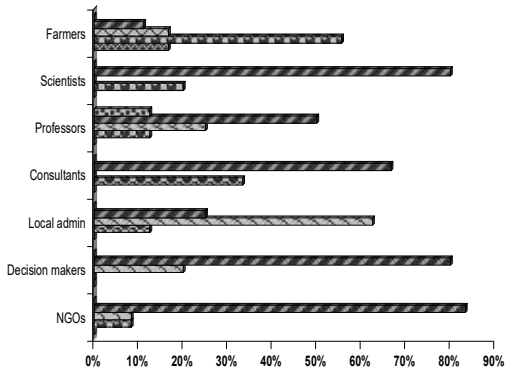
and 58.3% of the respondents view the current national policies and their enforcement regarding soil protection in Romania as „inconsistent". Asked about ticking one option regarding the best technological approach to secure simultaneously the soil fertility, the increasing food demands and the environment protection, the vast majority of civil society respondents, in proportion of 83.3% (the highest among all respondent stakeholders), selected the „environmental friendly agriculture (agri-environment measures) including traditional land management practices and natural landscape conservation" (fig. 1). The second ranked options were „organic farming" and „conservative agriculture/minimum tillage" (8.3% of the respondents for each option). The results reveal the civil society strong agreement on the existing agricultural policies supporting practices under agri-environment measures (including High Natural Value farming and organic farming). The respondents were also asked about the way they may expect an improvement of the acknowledgement of importance of soil sustainability as well as the adoptions of some improved solutions regarding soil protection. Most of the respondent representatives of the civil society selected the option „a governmental program for periodical agro-chemical and soil quality testing of the agricultural land" (75% of the respondents). Half of the civil society respondents (50%) perceived as important a soil quality public awareness raising campaign.



	NGOs	Decision makers	Local admin	Consultants	Professors	Scientists	Farmers
Conventional	.0%	.0%	.0%	.0%	.0%	.0%	16.7%
Conservative	8.3%	.0%	12.5%	33.3%	12.5%	20.0%	55.6%
Organic	8.3%	20.0%	62.5%	.0%	25.0%	.0%	16.7%
Agri-environment	83.3%	80.0%	25.0%	66.7%	50.0%	80.0%	11.1%
Others	.0%	.0%	.0%	.0%	12.5%	.0%	.0%

Fig. 1. Shares of the stakeholders' views regarding the best agro-technological approach to secure simultaneously, the soil fertility, the increasing food demands and the environment protection (%).

VIII. SOIL FERTILITY ASSESSMENT OF ELIGIBLE HNV AREAS

The first stage of building up the HNV soil data base was a soil fertility assessment carried in the HNV support eligible area of south-eastern Transylvania, in Târnava Mare Natura 2000 site. The area was previously subject to important assessments of the botanical biodiversity of HNV grasslands [6]. Backed by the local experience and the sound field knowledge of a non-governmental organization (ADEPT Foundation, Saschiz, Mures), the soil scientists performed soil sampling after hay harvesting in the habitat type 6210* „Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) with important orchid sites" of the Târnava Mare pSCI (priority habitat according to Annex I of Habitats Directive). The laboratory analyses targeted soil physical properties (soil texture, bulk density, penetration resistance, total porosity, soil moisture, compaction index, saturated water hydraulic conductivity and degree of soil compactness), soil chemical properties (organic carbon content, pH, content of available phosphorus and potassium, total nitrogen, C/N ratio and where was the case, cation exchange properties or salinization intensity) and microbiological properties (heterotroph bacteria number, microscopic fungi number and soil respiration potential level). The collected and processed soil data suggested that HNV farming practices carried in the investigated area comply fairly with the soil conservation requirements. It is to be noticed that in the area, the HNV eligibility for financial support is widely acknowledged by the local farmers and the carried land management practices are subject to the annual submission for rural development compensatory payments, with the large support and involvement of the local NGO. A second soil fertility assessment was recently performed in the HNV eligibility area of northern hilly side of Caras-Severin county, where on the opposite, the local farmers seem not interested or informed about the opportunity for HNV compensatory payments whilst no active environment NGO was locally identified.

IX. USING DECISION SUPPORT TOOLS TO IDENTIFY MOST RELEVANT SOIL INDICATORS IN HNV FARMING

In the recent years, a certain interest has been recorded on development of frameworks, information platforms and other instruments and processes of knowledge transfer to inform and support decisions. Many research projects in the field of agriculture, environmental and landscape management have used a wide range of decision support systems (IS/DSS) to disseminate accessible and applicable academic knowledge for decision making [7]. In order to prioritize the most relevant/sensible soil indicators to HNV farming and to select the most appropriate type of farm management in a selected eligible support payment HNV area (in south-eastern Transylvania), a generic decision support system software tool, mDSS version 5 was used [8], facilitating the involvement of stakeholders (soil experts and environment activists) in a environmental decision procedure. Issues at stake were scrutinized by participants from various perspectives and viewpoints and finally, the decision support phase envisaging the use of specific computer support tools was undertaken. The comparison of the four land management alternative options: (i) conventional practices, (ii) HNV farming, (iii) organic farming and (iv) HNV farming coupled voluntary and simultaneously with organic farming, concluded

that organic farming and HNV farming plus additional top up organic farming seem to be, in terms of soil conservation but also from a socio-economic perspective, the most sustainable alternatives. The most relevant soil indicators were the bulk density, the soil organic matter content, the C/N ratio and the soil respiration potential level, followed by soil pH and total nitrogen. Since Romania holds a large proportion of the eligible HNV farmland with almost 5 mil. ha, the results of the decision process will be used to feed the design of an expeditious HNV national soil monitoring system.

ACKNOWLEDGMENT

The investigations were carried under the research project „High Natural Value farming soil indicators sensitivity analyzes and stakeholders' perception assessment with regard to agro-environment practices, soil protection policies and connected societal challenges", PN 18.44.03 02, funded by the „Core" Research Program of the Romanian Ministry of Research and Innovation.

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Initial assessment of the underwater noise in the Romanian Black Sea shelf

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Abstract: Quantification of underwater noise is a current and evolving topic in marine environmental science that is relevant to Marine Directive 2008/56/CE (MSFD). MSFD aims to achieve Good Environmental Status (GES) by 2020. The MSFD highlights the need to establish anthropogenic noise levels that do not affect marine Biota (Descriptor 11) and represents an important progress to preserve marine environment. Over the last decade, anthropogenic noise in the Western Black Sea has increased dramatically in aquatic environments and is now recognised as a chronic form of pollution in coastal waters, neglected so far. To date, very few studies have investigated the noise levels and spectra in marine environments. At present no legislation exists in Romania to protect the living resources and biota from anthropogenic noise. The present study represents the first assessment of anthropogenic noise pollution in the Western Black Sea by characterising noise levels using underwater noise monitoring system. During 2016 - 2017, acoustic samples (30 - 40 min time length) were collected using high end pressure transducers and their spectral content was analysed in 1/3 octave bands (dB re 1 µPa). The NIMRD noise team adapted specific data acquisition standards for different meteorological, hydrological and vessel conditions for several locations. The results are expressed in peak pressure, peak-to-peak and peak–RMS measurements. The total noise of 132 dB (re 1 µPa) was the highest value from all the measured peak – to-peak of the underwater noise levels on the research vessel on a 3 Beaufort sea state scale. The minimum RMS noise of 106 - 108 dB re 1 µPa were determined in the southern Romanian shelf, *2 Mai – Vama Veche* Natural Reservation, in anchor. Mapping of impulsive noise (characterised by short duration and a fast pulse rise time) associated with piling, underwater explosions or airgun signals used in seismic surveying, is analysed too. Results indicate that the current noise levels in the Romanian Black Sea shelf warrant further investigation as a potential threat to the fish and mammal community which occurs in this already pressured habitat. Based on results obtained, it is recommended that further studies focus on a wider geographical and temporal range in order to start to fill the knowledge and legislative gaps regarding anthropogenic noise monitoring in the Romanian EEZ waters.

Keywords: underwater noise, Black Sea, sound pressure, Root mean square (RMS) sound pressure level, MSFD.

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I. INTRODUCTION

Water is an ideal medium for sound: acoustic waves travel four times faster in water than in air and attenuation is much less underwater than above. Human activities introduce into the marine environment many kinds of anthropogenic energy that includes: sound, light and other electromagnetic fields, heat and radioactive energy. Among these, the most widespread and pervasive is *underwater sound*.

Sound energy input can occur on many scales in both space and time. Anthropogenic sounds may be of short duration (*i.e.* impulsive) or be long lasting (*i.e.* continuous); impulsive sounds may however be repeated at intervals (duty cycle) and such repetition may become diffuse with distance and reverberation and become indistinguishable from continuous noise. Higher frequency sounds transmit less well in the marine environment whereas lower frequency sounds can travel far. In summary, there is great variability in transmission of sound in the marine environment.

Noise levels are steadily increasing so that ocean noise is managed both nationally and internationally, preventively, before biodiversity becomes irreversibly damaged and the marine ecosystem is adversely affected.

Although, studies have been conducted on the impact of underwater noise on various marine species, there were no studies on the noise effects on ecosystem as a whole. While any significant addition of a new sources in the ecosystem can have an impact, it can be argued that, because oceans/seas are naturally noisy (waves, rain, lightning's etc.) it can adapt to noise.

The impact of underwater noise on marine life is a growing concern, and current legislations such as the Marine Strategy Framework Directive (2008/56 / EC) recognizes noise as a pollutant and a problem to be investigated. The Marine Strategy Framework Directive (2008/56 / EC) (MSFD) was

transposed into Romanian legislation by G.E.O. 71/2010 and adopted by Law 6/2011 for the approval of Government Emergency Ordinance no. 71/2010 on the establishment of a Marine Strategy aiming to achieve and maintain a Good Environmental Status of the marine environment until 2020 and by Law 205/2013 for the amendment of Government Emergency Ordinance 71/2010 on establishing the strategy for the marine environment.

We present the first nationally coordinated effort to quantify underwater noise levels, in support of Romanian policy objectives under the EU Marine Strategy Framework Directive (MSFD).

Adapted measurements methods and initial results of the underwater noise gathered during 2016-2017 campaigns within the Romanian Black Sea waters using Buel & Kaer 8105 high end pressure transducers, are shown.

II. DATA AND METHODS

Underwater noise measurements were performed along the Romanian Black Sea shelf on-board NIMRD Zodiac boat, during 2016 - 2017 period (Fig.1), with hydrophone type 8105 (Bruel&Kaer). The underwater noise data were processed and analysed using specialized Bruel & Kaer software: Pulse Reflex Core and Pulse LabShop.

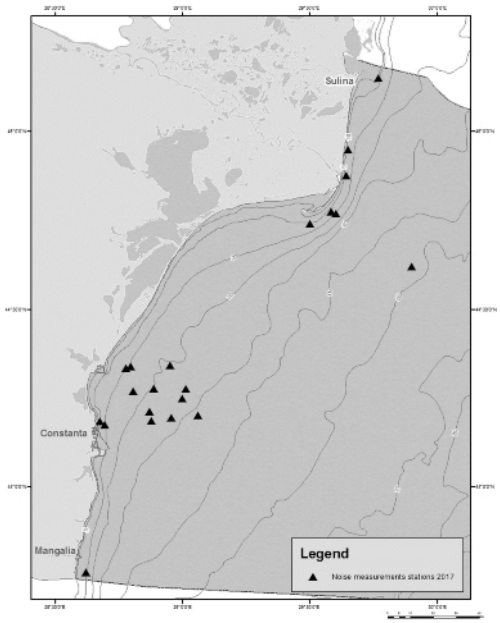

Fig. 9 Underwater noise measurements network stations along the Romanian Black Sea shelf during 2016 - 2017

During the mentioned period, N = 30 recordings (from 30 minutes to 4 minutes) were gathered: N = 4 bottom recordings (2m above the sea bottom), N = 26 at ½ water depth. At 2 Mai – Vama Veche Natural Reservation, 2 recordings were performed during November 2016: N=1 bottom and 1 at ½ water depth.

III. DISCUSSION

The Western Black Sea is a highly shipping route, located at the cross-roads of the trade routes linking the developed countries of Western Europe and the emerging markets of Central Europe with the suppliers of raw materials from the CIS, Central Asia and Transcaucasus (Fig.2).

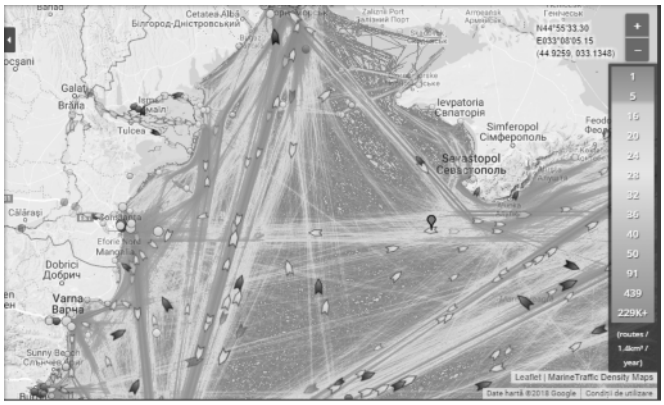

Fig. 10 Density shipping map on the Western Black Sea, source: https://www.marinetraffic.com (accessed in October 2018)

We have used different methods for the identification of the noise sources on-board NIMRD Zodiac boat with diesel engines. The acoustic field measurements were made in anchor with engine on and off. The simplest method of all these described in this part is measuring the sound pressure level (SPL) and root mean square sound pressure (RMS).

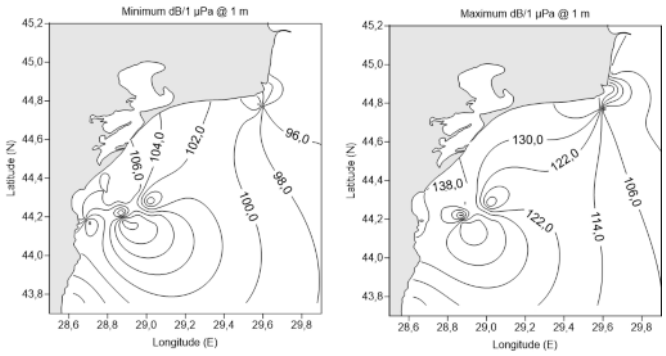

Fig. 11 Underwater noise distribution of minimum and maximum recorded SPL along Romanian Black Sea shelf

Background noise ('soundscape') monitoring requires gathering data during conditions that are statistically representative of the noise environment under consideration. To obtain a reliable estimate of the equivalent continuous sound pressure level as well as the maximum sound pressure level, the measurement time interval shall encompass a minimum number natural variations in the background noise. Hence the background noise measurements should include various atmospheric and sea conditions (e.g. rain, wind, waves), but also possible temporal variation patterns (day-night, summer-winter, etc.).

For monitoring sound in relatively shallow water (Black Sea), is recommended to measure at two depths in the lower

half of the water column: e.g. at 3/4 and at 1/2 of the total depth (measured from the sea surface).

The sound intensity of 132 dB (re 1 µPa) was the highest value from all the measured peak – to-peak of the underwater noise levels on the research vessel on a 3 sea state Beaufort scale. The minimum RMS noise of 106 - 108 dB re 1 µPa were determined in the southern Romanian shelf, *2 Mai – Vama Veche (ROSCI0269 Natura2000)* on a 0 – 1 sea state Beaufort scale (Fig.3).

Noise radiated by ships into the water environment is an important contribution to the ocean ambient noise. For measurements in RIB anchored boat with auxiliary engines on a 1 Beaufort sea-state, a maximum of 154.3 dB/1 µPa @ 1 m was recorded. This peak is connected with the alternating current which powers all electric equipment on-board (Fig.4).

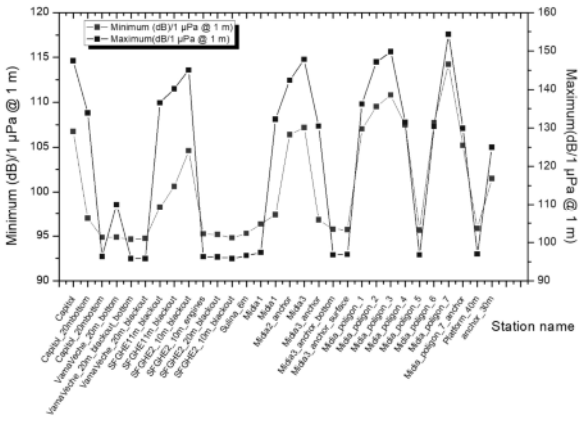

Fig. 12 RMS levels on the measured stations during 2016 – 2017 on the Romanian Black Sea shelf

Dolphins are the only mammals occurring in the Black Sea: they are small-sized and at the same time, they are the largest marine animals in the Black Sea. The three dolphin species that are present in the Black Sea are: *Tursiops truncatus* is the common species of dolphin found near shore waters; *Phocaena phocaena* and *Delphinus delphis* which can be rarely encountered at close proximity to the shores.

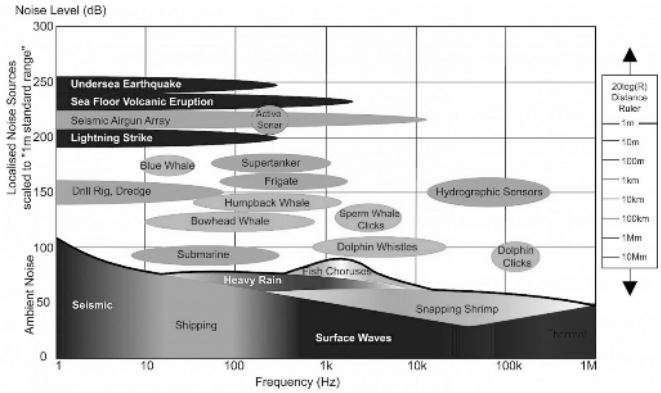

Fig. 13 Levels and frequencies of anthropogenic and naturally occurring sound sources in the marine environment. Spectrum Noise Level ("Acoustic intensity per Hertz") versus Frequency (measured in Hertz or "cycles per second") (OSPAR, https://www.ospar.org, accessed in October 2018)

Underwater sound from anthropogenic sources has the potential to mask biological signals and to cause behavioral reactions, physiological effects, injuries and mortality in marine animals (Fig. 5; e.g: Richardson et al. 1995, 2013; Nowacek et al. 2007; Southall et al. 2007; Erbe C., 2012).

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Business plans for rural ecological development

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Abstract: **The purpose of this sub-project is: (1) to plan a web design business to support information of ecological development of rural sector, (2) to promote business ideas in the field of Information Technologies, (3) to demonstrate the need for a project aimed at promoting business in the on-line environment, and (4) to address effective marketing strategies for ecological business development in Moldova.**
This sub-project is presented under the business plan of an enterprise that offer web design and web development services. The business plan allows for a broad analysis of the structure and strategies addressed by the firm. It is divided into the financial, managerial, marketing, and actual description plan. Based on the business plan we can see the profitability and necessity of WEB FACTORY on the Moldovan market; The web design firm can create a creative and original online environment for local businesses; Can easily expand on the international market.
This sub-project leads to discussions on the development of SMEs in the Republic of Moldova on the virtual platform, facilitating the access of the clients to the services and products of the local companies. It also addresses the problem of the low-profile promotion of domestic firms in the on-line environment.
The business plan developed within this sub-project can easily be applied in practice. All the data and analyzes made are true, so it can be used to set up an economic entity that provides web design and web development services.
The idea of a business is relatively new on the Moldovan market, and the services and strategies that WEB FACTORY intends to apply are creative and feasible.
This sub-project can be implemented in Moldova due to the fact that in the elaboration of this plan was analyzed the demand and supply of web services on the domestic market, and with good financing and qualified staff it can become not only a profitable business, but also a competitor for existing businesses.

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The submitted results represent a research sub-project performed under the Project „Anti-migration management in the rural sector of the Republic of Moldova" that is developed in the period 2015 - 2020 by the team of AESM and supporters.

Key-words: business, web design, ecological development, market, Information technology, plan **JEL Cassification: Z19,** M00, O31, L20

INTRODUCTION

The main activity of Web-Factory is the provision of web services on the Moldovan and international markets. The headquarters of the company will be in Chisinau, and the services will be provided both through direct contract with customers and via the Internet. With its headquarters in Chisinau, the company will have access to a large market of consumers and also qualified human resources. The primary advantage of the company is the accessible price of services and the short service time. Thus, the company will easily be able to compete with the Existing web services on the market.

The success of the company will be ensured by:

- High quality web pages
- Wide range of web services and graphics
- Affordable costs and advantageous deals
- Qualified and responsible staff

With our services, we will display and create a full range of funding mechanism for startups, including both existing and emerging, with a special focus om building on good practices, both domestically and internationally.

Project Goal and Objectives

Main goal of the company is to create websites accessible to all entrepreneurs who want to promote their own business on the virtual platform, thus promoting IT services on the local market.

The objectives of WEB FACTORY for the first year of activity:

- creating a loyal clientele that will continue collaboration with our company
- recruiting a professional and creative work team
- allocating the necessary financial resources for the company financial growth
- developing a well-functioning operational plan to cope with competitiveness

2. Business description

WEB-FACTORY offers dedicated web development and web design services. The quality and efficiency of the services are based on experience in the field, the technical expertise of programmers and the creativity of designers.

The newly created company will be a Limited Liability Company (LLC). This form will facilitate the establishment of the business and make available the creation of a cumulative capital.

The services offered are: html site, simple website, catalog website, online stores, full flash site, flash animations, site promotion, site optimization, web banners, flash presentation CD, logo design.

Web pages will be created in order to advertise the companies and entrepreneurs who will use these services.

The operating system used will be Microsoft, and in this regard it will use the Windows Ten license. Designers will use the Adobe Photoshop and Adobe Flash licenses. For accounting and administration, will be used a computer with the Microsoft Office product.

2.1. Market definition

With the technical and informational progress, the increase in demand for web services has increased considerably. Thus, many companies are looking to promote their business through a website or even an online store.

More and more people have access to the Internet, so it is the best method of advertising. Companies often turn to social networks, but a website offers more opportunities. It is a useful tool in the development of the business, and as a benefit of the project it is worth mentioning that:

• A website means promoting the company's image to a much wider range of potential customers.

• An optimized website means promoting the offer (whether we are talking about products or services).

• An up-to-date web site is a permanent presence for current and potential customers.

• An up-to-date website also means active connectivity with social networks so often used now, so much more openness to the target audience.

To conclude, it can observed that a properly made and up-to-date website has time benefits whatever is your business activity.

In order to be competitive on this market, Web Factory offers a comprehensive package of services, consisting of: web design (making sites with varied and attractive content), digital photo processing and optimization, web graphics (design, Image processing and correction, scanning, logo and web design themes, static and rotating banners, Macromedia Flash, original graphics), other services. Thus, for companies that will use Web-Factory services, they will benefit from a comprehensive package of services including web development + web design + site management.

The prices will be individual and will be set according to the package. Each customer will choose their service package according to their needs and will be able to manage the steps of creating the website.

2.2. Target market

Web Factory's customers are mostly companies that want to make their offer known through a site, especially small and medium-sized businesses (SMEs) that are in the start-up phase, but also individuals who are interested in Creating websites or wanting to start a business through an Online Store.

Customers' requests vary according to the financial resources they allocate to this activity, by the nature of the firm's offer, by their option to call or not on certain items such as: on-line sales, presentation of company listings and prices Location, business location or workstation maps, photos of products / stores / key people in the company, FAQs, event calendar, latest news, links, discussion forum for visitors / clients , Contact info, etc.

Collaboration with customers is very much a matter of communication with them, especially in the initial phase, of planning all activities and processes. It is very important to clearly define the reasons why the website is created, the audience to whom it is addressed, the type of information to be presented and the way of presentation, the pace of updating (after the site becomes active), other specific information to ensure a perfect understanding of the recipient's requirements by the web designer.

2.3. Competition

Due to the development of information technologies, competition in the creation and management of web pages is scarce. On the Moldovan market there are a few large companies that have already gained a certain reputation as well as many small and very small firms that are often made up of one or two people. Compete with existing companies, Web-Factory will lead a policy of promoting price/quality concepts so as to provide customers with high-quality services at

affordable prices. Also, the service package offered by the company will include a marketing analysis, so companies that will use these services will benefit from a broad market analysis and the best way to advertise through web site animations created by Web-Factory programmers. Also, Web-Factory intends to organize trainings and workshops for their clients, in order to enchance the capacity of firms and innovators to engage in import and export activities, including business management and marketing skills.

Existing companies on the web design services market in Moldova are: Webmaster Studio, PRO webdesign, WEB STYLE, Creativ Soft SRL, Fivetn Moldova, Cherry Digital Agency.

2.4. Marketing and sales plan

The best way to advertise the company is the Internet. That's why the first step towards setting up Web-Factory is to create your own website that will include the company's description, the services offered, the contacts, and last but not least, the presentation of a portfolio that includes the websites created and the companies that used our services.

In the early stages of the business, personal knowledge is also very important, which can materialize in finding the first clients of the company. The company can also be known through Facebook Ads, Google AdWords or search engines. They offer direct contact with the market, and it is possible to communicate and directly take orders or contact data.

As the company begins to have customers and build sites, it can increase its notoriety by mentioning its name or logo (Figure 1) inside the pages made.

2.5. Business organization and management

Financial Plan

The initial investment to start the business is about 26226 USD, including the necessary amounts for inflating the company and endowing with the necessary technique, as well as the expenses for the first month of activity.

In order to allocate the necessary amount for the start-up investments, we will apply for a long-term loan at a commercial bank in the Republic of Moldova. Alternatively, we will try to get a grant that can cover start-up expenses.

Managerial Plan

The company's staff will be a qualified, experienced in IT, professional and will have knowledge in the economy, especially in marketing policies. For the first time, the company will work in a smaller number of employees, but during its development will be recruited more specialists. Employee pay will be determined in accordance with the workload and responsibilities of each employee. All employees will work in a team, so each employee will contribute to the programming and design of web pages, being creative and original.

The staff required for Web-Factory to work under the best conditions should be composed of:

- General manager / designer
- Programmers: 2 people
- Manager
- Accountant
- Network Administrator
- Head of Customer Relations Department
- Head of marketing department.

2.6. SWOT analysis

• **Strengths:** Employee qualification and creativity; comprehensive and affordable service package; original and attractive design; well-equipped work equipment ; short service delivery.

• **Weaknesses:** limited capital; high competition; wear of work equipment.

• **Opportunities:** expanding on the international market; attracting funds; organizing different workshops, trainings, conferences; increasing demand for web services; partnering; forming a loyal customer.

• **Threats:** non-coverage of the bank loan; limited time of presentation of the final product; taxes and high taxes.

2.7. Strengths and Innovation of Project

This sub-project have big possibilities and advantages. Besides forming a statute, the company also aims to create several subsidiaries both in Moldova and in neighboring countries. This will raise the IT services of Moldova to a new level and will facilitate the economic co-operation in the countries that have economic relations with RM.

Web factory aims to create a whole network of companies that provide cost-effective web services to start-up businesses that need Internet promotion. Even if the European and Moldavian markets are active in many companies in this field, web facrory will promote a minimum cost policy that will be available to all customers.

3. Conclusion

This project is conceptually based on IT start-up, so it can be implemented at any point in the world and developed into lasting projects. In this paper I have studied the market of the Republic of Moldova as a poorly developed IT field, but with stunning perspectives. Also, the Republic of Moldova faces a serious social-economic problem, namely the exodus of intellects. In this context, a web design business could attract young people with IT and economics studies to work in the Republic of Moldova without having to look for a job outside the country. In conclusion, Web Factory have a large perspective, and with good financing and qualified staff , it can become not only a profitable business, but also a competitor for existing businesses.

Moldova should be promoted, and in particular awareness raising needs to be undertaken among Moldovan consumers about domestic IT solutions. In this case, Web-Factory represent a the best platform, that will facilitate the exchange of information and best practices between stakeholders.

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Cultural religious tourism in the Republic of Moldova

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Abstract

Scope of work: justification of development strategies for the cultural religious tourism, harmonization of the interests of religious cultural institutions and management of economic agents providing special and general services.

Design /methodology/ approach: the work shows the strengths, weaknesses, threats and opportunities of religious tourism in the Republic of Moldova providing for the continued discussions as to the further development of this domain.

Statements: based on the performed analysis one may conclude that the religious tourism is a quite important branch of tourism in the Republic of Moldova, as the monasteries are the main tourist attractions in the country.

Limitations / research suggestions: this work considers the discussions relating to the position of religious tourism in the Republic of Moldova and offers several methods and development methods.

Applied value: the results of this work are upheld by the value of useful statements, conclusions and recommendations: studies in the manner of cultural religious tourism, didactical staff in public and private education, editing of scientific-didactical works. The work may be useful for the students in mastering and examining the dimensions of cultural religious tourism, for the tourist agencies practicing this form of tourism, for the statistical analysis and prognoses, as well as for the determination of new development directions of tourism in the Republic of Moldova.

Scientific novelty and originality: the need to justify new forms of tourism and their integration into the offers of specialized tourist agencies; elaboration of development plans and diversification of tourist offers in collaboration with all institutions.

Conclusions and perspectives:the submitted material representresearch results performed under the Project „Anti-migration management in the rural sector of the Republic of Moldova".that is developed in the period 2015 - 2020 by the team of AESM and supporters.

Keywords: culture, tourism, strategy, competition, religious tourism, humanity, anti-migration management.

JEL Cassification: Z19, M00, O31, L20

INTRODUCTION

Religious tourism is a motivational form of tourism is aimed at visiting cultural objects and points of interest with or without divine services.Religious tourism implies a higher cultural level of tourists capable of appreciating the visited objects from the point of view of architecture, history and architecture, as well as their spiritual and religious significance. Religious tourism is an important sector of global economy with a tendency of permanent growth at international level. The tourist industry covers a wide range of public and private institutions, generators of economic and social benefits, of new jobs for various categories of employees, offering employment opportunities, especially for women. The Republic of Moldova must be promoted efficiently as a tourist destination on the international tourist markets, raising thus its degree of competitiveness.

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Scope of work: justification of development strategies for the cultural religious tourism, harmonization of the interests of religious cultural institutions and tourist management of economic agents providing special and general services.
Design / methodology/ approach:

SWOT analysis of tourism
Strengths (S)
1. Positioning of tourism as a priority branch of economy of the Republic of Moldova
2. Availability of natural and artificial tourist resources
3. Existence of legal and normative framework
4. Implementation of tourism projects with financing from state budget
5. Implementation of strategies and development programs in various districts
6. Availability of modern accommodation and boarding structures
7. Existence of conference halls with modern equipment
8. Existence of 3 professional development centers for the persons employed in the tourism industry
9. Activity of various specialty associations
10. The Republic of Moldova is member of international organizations supporting the development of tourism (the UN Global Tourism Organization, the Danube Competence Center, the Black Sea Economic Cooperation Organization, the CIS Tourism Council, etc.)

Weaknesses (W)
1. The legislation is not aligned to the European standards
2. Insufficient legal and normative framework
3. Insufficiency of qualified staff in the management of branch and provision of quality services
4. The institutional framework needs the implementation of relevant state policies at the central level
5. Lack of Tourist Information Office and its branches in the diplomatic missions of the Republic of Moldova accredited abroad
6. The limited number of tour operators and agencies establishing and selling national tourist products.
7. Insufficiency of 2-3 star hotels that would contribute to the development of tourism receptive to attractive costs, competitive on the international market
8. High accommodation costs in the national objects
9. Small number of accommodation facilities in the rural area
10. Small number of classified accommodation facilities
11. Insufficiency of indicators for tourists
12. Lack of informational boards in the proximity of tourist attractions
13. Lack of specially equipped places for camping
14. Old fleet of tourist buses
15. Lack of staff with knowledge of internationally spoken languages at the most of tourist objects and museums
16. The statistical figures are calculated erroneously and do not reflect the real situation in the domain
17. The individual tourists are not accounted by the statistics
18. Low efficiency of the mechanism of control over the quality of rendered tourist services

Opportunities (O)
1. Traditional hospitality
2. Favorable strategic positioning of country (borders with CIS and European Union)
3. No need for visas for the citizens of EU countries, USA, Japan
4. Smaller number of countries with a raised migration risk status, bearing in mind the list approved by the European Union
5. Airway connections with the major airports
6. Liberalization of prices for the air tickets and de-monopolization of air transportation
7. Existence of external assistance projects for the development of tourism
8. Numerous events of interest for tourists: cultural-artistic, sports, entertainment
9. Known brand of winemaking country
10. Existence of unique winemaking and wine tasting facilities
11. Massive spreading of information technology and communications in the sphere of services
12. Existence of political support.

Hîrjauca Monastery, Călăraşi region

Threats (T)
1. Weakly developed infrastructure at the tourist facilities of national and international level
2. Low level of recognizability of Moldova as a tourist destination in Europe and in the world
3. Lack of favorable investment climate for the investors in tourist infrastructure with accommodation and boarding functions for mass tourism
4. Reduced competitiveness of the tourist offer of the Republic of Moldova (high entry visa costs for the Republic of Moldova, high air transportation costs provided by the national airway companies)
5. Extremely limited number of objects included into the UNESCO patrimony list and the Guinness Record Book
6. Insufficiency of financial resources for promotion: exhibitions, promotion materials, financial support of projects, etc.
7. Insufficient management at local level
8. Inadequate road infrastructure

9. Lack or inadequate condition of sanitary facilities at the entry to the country, as well as at filling stations, meant to serve groups of tourists

Statements:
6 medieval stone fortresses;
over 1000 monuments of architecture protected by the state;
over 15000 outdoor museums;
5698 protected monuments;
66 museums with 673 objects of patrimony.

Vărzăreşti Monastery, Nisporeni region

UNESCO global heritage in the Republic of Moldova includes a single monument and two objects are in the examination list. The Republic of Moldova has ratified the UNESCO Convention on the protection of global cultural heritage in the year 2002.

Research suggestions:

To identify the main objects of patrimony for development.
To establish efficient collaboration between the proprietors or the administrators of tourist facilities and local authorities for the installation of signs, facilitation of access, arrangement of parking areas and structures for hosting the visitors.
To elaborate and implement a training program for the guides.
To organize trainings for the owners of tourist facilities as to the interpretation techniques – boards, signs, brochures, audio materials; navigation.
To organize the edition of promotion materials in several internationally spoken languages.
To organize, with the support of the Department of Development of Tourism, training courses on the techniques and basic elements of designing promotion materials for tourists.
Construction and development of accommodation facilities for visitors in the zones of special cultural potential.
Modernization of accommodation facilities in monasteries and other cultural objects.
Modernization of parking bays with modern toilets, filling stations.
Creation of boarding possibilities at the boarding houses in the vicinity of religious objects.
Creation of a web site that would offer thorough information on the monasteries' services, as well as the pictures of their interesting sites and religious masses.
Creation of touristic programs that would allow visitors to take part in the monks' and nuns' daily activities as well as observe the religious masses.
Creation of a promotional video depicting the monasteries, and later on creation of a documentary about their historical heritage.
Location of Arts and Crafts schools on the monasteries' sites as well as shops selling their products.
Specialization of the monasteries in the areas they find more profitable (horticulture, fruit-growing, vegetable-growing, forestry, vinification, sheep breeding, beekeeping, stitching, etc.)
Participation at fairs with the products of the monasteries' activities (vine, meat, vegetables, fruits, handmade gifts, etc.)
examining the dimensions of cultural religious tourism, for the tourist agencies practicing this form of tourism, for the statistical analysis and prognoses, as well as for the determination of new development directions of tourism in the Republic of Moldova.

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Emotion and temperament robo-intelligenses. Measurement an adaptable creation

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Abstract: **Materialization of notions of information, knowledge, and conscience, its functions, and its adaptability features with the perspective of intelligent systems creation process helps to investigate and develop the Computer Based Information Emotion Systems (CBIES) for Information, Knowledge based, and Consciousness Societies. The CBIES' higher level elements for these societies are evaluated based of its corresponding CBIES' lower level (component parts and phases of activity) elements. Human emotions in order to create Emotional ROBO-intelligences (EQ) as the continuation of Creative ROBO - intelligence (IQ) are examined. Fruitful cooperation of both IQ and EQ intelligences will evolve in Consciousness Society, which will be created, according to multiple surveys in the field, in the 2019 - 2035 years. Adaptable tools help to define the new robotic elements. They are used to define higher level elements of emotional and creative ROBO-intelligences. Formulation, formalization and adaptable algorithmation of higher level elements of the temperament ROBO-intelligences, as first component parts of Adaptable tools, represent the evolutionary development of creation process of the Consciousness Society's ROBO-intelligences. Adaptable Tools, in such a way, are used for preparing first 3 stage of Robotic Program Products development, they define superior, next level elements of ROBO - intelligences. Present 2018 year of research is concerned to Aura development for Robotic Entities. Presented adaptable information technology for ROBO-intelligence's creation process is used in the institutional project "Creating Consciousness Society" that is developed in the period 2008 - 2018 by the team of AESM and supporters.**

Keywords: Emotion, Temperament, ROBO- intelligence, Consciousness Society

JEL Cassification: C88, L86

Human society is on the threshold of Consciousness Society and is currently supported by The Third Industrial Revolution. Consciousness Society, according to estimates by scientists in the field, will be created during the years 2019-2035.

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Dramaturgical Consciousness goes along side with the Distributed energy and Communication systems of The Third Industrial Revolution, as well as Psychological Consciousness that came with The Second Industrial Revolution and Ideological Consciousness which participated in The First Industrial Revolution.

Empathic human civilization has a multitude of features which in Consciousness Society will be specific to the robotic civilization. Books [3] and [7] on the basis of our multiple references support us in demonstration the truth of statement: "In Consciousness Society the Artificial Intelligence (ROBO-intelligence) will be equal to structured Human Intelligence (AI = NIstructured) and this Society will be empathic".

For decades robots have diligently been tasked to perform a range of duties largely scoped within industrial manufacturing. More recently, we have seen the emergence of a new landscape of more social, personal, expressive, nurturing, creative, sensual, and emotional robotic platforms.

Increasingly, robots play a critical new role as extensions of ourselves, enabling our creativity, creating new objects, serving as companions, expressing emotions, empowering communities, and challenging our civil rights.

To initiate discussion in Emotional ROBO-intelligence creation process, for example, lets put some Problem: "ROBO-intelligence entity with emotions (Emotional ROBO-intelligence: EQ) has to activate using some situation: Entity is in the best disposition and is asked to clear the dusty room after school lecture in car driving."

Asked questions: What is emotional ROBO-intelligence? What are ROBO-intelligence's component parts? What ROBO-intelligence competences have to be activated to analyze the emotion situation for doing this task? What are measures of ROBO-intelligence competences? What are to be ROBO-intelligence competences to initiate, process, and finish the task? What ROBO-intelligence competences have to be activated to analyze the emotion situation for doing this task? How to program the evaluation process of doing the task using emotional measures? What are emotional evolution steps of ROBO-intelligence in the process of doing the task? What competences are needed to transmit to asker that task was finished?

Answers to some of these questions can be done on the base of lower level functions of Creative ROBO-intelligences [7] which possess such Piirto's**creative features** as: Inspiration, Imagery, Insight, Imagination, Intuition, Improvisation, and Incubation. These IQ creative features are to **evolve** in

correspondence with lower level Piirto's Six functional Steps to the Creativity ROBO-intelligence top: acquire Knowledge, develop Curiosity, become Interested, Passion, Dedication, and Professionalism.

Creative features and its evaluation steps produce IQ next higher level items ofCreative ROBO-intelligences. Each of those **IQ items** is defines by its special Consciousness Society Intelligent Information System based on lower level ROBO-intelligence functions.

1. Testing

Previous questions underline next problems which have to be solved to obtain ROBO-intelligence. ROBO-intelligence have to: (a) understand the human announced task, (b) do this task in this emotional situation, (c) transform its emotion, and (d) reproduce the answer for asker about finishing the task.

Many tests that promise to measure emotional intelligence appeared in recent years and are used in the process of creation the ROBO-intelligence. Some of these tests seem promising, but many have not been empirically evaluated. We have reviewed many of these tests and selected those for which there is a substantial body of research having a goal of creating ROBO-intelligence (at least five published journal articles or book chapters that provide empirical data based on the test).

Created Consortium for Research on Emotional Intelligence in Organizations (CREIO) do not sell or distribute any measures or assessments. To get information related to obtaining specific tasks of identification and measures such as qualifications or certifications needed to administer specific measures, to store or process emotions and to organize emotion relationship and distribution please refer to the contact information provided with the description of each assessment.

Maps of emotional feelings and Computer Based Information Emotion System (CBIES) represent the first steps we consider to go through to create Emotional ROBO-intelligence.

2. Maps of emotional feelings

Definition of the emotional existence plan is the following: ***level of human existence which registers changes in emotional states.***

The way of expressing the emotions can vary very much: love/hate, happiness/sadness, calmness/anxiety, trust/fury, courage/fear, etc.

Emotions coordinateour behavior and psychological condition during the main survival events and pleasant interactions. Nevertheless we are aware of our current emotional condition as happiness or fury. Mechanisms that cause/ feed these sensations are still undiscovered. Here it is used a personal topographic instrument of report that unveils the fact that different emotional conditions are associated with distinct **topographic** sensations and universally cultural body feelings. These feelings could highlight conscious emotional experiences. Watching the sensation topography caused by emotions we perceive a unique instrument for researching the emotions that could be called biomarker against emotional disturbing.

Somatosensory **Feedback** has been proposed to trigger conscious emotional experiences because the emotions often are felt by the body.

The body maps show regions whose activation increased (warm colors) or decreased (cool colors) when feeling each emotion.

Do they (such color effects of emotions) have some connections with the measures of Emotion's Energetic Signals which activate in composition of Human Aura?

2.1. Researchers at Aalto University in Finland have compiled **maps of emotional feelings** associated with culturally universal bodily sensations, which could be at the core of emotional experience. These emotional feelings are: Fury, Fear, Disgust, Happiness, Sadness, Anxiety, Amazement, Neutrality, Love, Depression, Pride, Shame, Envy, and Hatred. The researchers found that the most common emotions trigger strong bodily sensations and the bodily maps of these sensations were topographically different for different emotions.

If it is put the question to create some entity - Robot with emotions: Emotional ROBO-intelligence (EQ), the specialists must study carefully images from the entire world about at list the human face expressions with different feelings. For an entertaining and pleasant presence of such a machine to the human, such EQ has to

- behave politely,
- express emotions,
- „read" human emotions and
- react adequately.

It is interesting at least to create EQ's Head & Heart which has to have mobile for expressing emotions such as happiness, sadness or melancholy.

2.2. Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT)is an ability-based test designed to measure the **four branches** of the EI model of Mayer and Salovey[8-10].

Our goal is to investigate emotional ROBO-intelligenceswhich possess known **classical emotion** elements: Happiness, Fear, Surprise, Disgust, Sadness, and Anger from the point of view of its introduction in the robot entities as **intellectual, emotional, moral, temperamental**, and **sensual** compartments.

Presented **by** Aalto University's researchers emotional feelingscan be defined and expressed by the help of classical emotionelements using Adaptable tools.

2.3. Emotional ROBO – intelligence evolution

Follow the performing of physical, intellectual and spiritual work (lower level elements of ROBO-intelligences) received with emotional developments of ROBO – intelligences.

Emotional developments of ROBO - intelligences represent the lower level elements of ROBO-intelligences. They are to be evolved to higher level items of ROBO – intelligences using other axe with lower level elements:Physical work, Intellectual work, and Spiritual work.

High level elements of ROBO-intelligences are functionally defined by the Adaptable Tools of Integrated Systems [13]. For example: Higher level ROBO-intelligence's item "Intellectual work managed by emotions" is defined as functional evolution of lower level ROBO-intelligence's

items: "Intellectual work" and "Managing emotions".

3. Emotional Computer Based Information System Emotional ROBO-intelligence is a Computer Based Information Emotional System (CBIES), which **first level component parts** are:

(1) emotion measure, identification and perception,
(2) emotion storage,
(3) emotion processing, and
(4) emotion relationship – distribution.

Each of CBIES **component parts** is supported by corresponding first level elements: **hard**-ware, **soft**-ware, **knowledge**-ware, **social** (people's)-ware, **conscience**-ware and **group**-ware.

It is needs to create special CBIES for each of Emotional ROBO-intelligence's **processing characteristics:**

- emotion **identification**,
- emotion **competence**,
- emotion **quantity,quality**, **storage,**
- emotion **education**, **evolution, processing**, and
- emotion**distribution**.

CBIES's Emotion entity **measure** is referred to such functions as emotional **internal states**, **impulses, preferences, resources,** and **intuitions**.

3.1. CBIES's Emotion **Identification** functionally represents emotion entity's ID, Competences, Measure, Value, Quality and Quantity of emotion entity.

Our investigation is referred to the **classical emotion** elements Happiness, Fear, Surprise, Disgust, Sadness, and Anger.

3.2. CBIES's Emotion entity **competences,** based onEmotional & Social Competence Inventory identified by Dr. **Daniel Goleman** in *Working with Emotional Intelligence* [Wolff, 2006] and Bar-On model of emotional-social intelligence [Bar-On, 2006], functionally **measure** an overall **EQ power** as well as powers for the following **composite scales:** Self-Awareness, Self-Management, Social Awareness, and Relationship Management.

3.3. CBIES's Emotion **storage** and **processing** are referred to the process of accumulation the processing results ofemotion **educational evolution** steps **(**Home 7 years, High School, Second school, …**)** using **Piirto's 7i** intelligence **characteristics** ***axis*** and**Piirto's 6** emotion **intelligence evolution** steps ***axis.***

Emotional ROBO-intelligence's axe ofhierarchically evaluation steps are functionally represented byPiirto's 6 **Creativity's top elements**:(a) Acquire Knowledge, (b) Develop Curiosity, (c) Become Interested, (d) Passion, (e) Dedication, and (f) Professionalism.

3.4. CBIES's Emotional intelligence **relationship-distribution** is defined by:

- emotional **Awareness** of **perceiving and understanding** of others (the skill of perceiving and understanding others' emotions), and

-emotional **Management** of **influencing the moods** of others (the skill of influencing the moods and emotions of others)

CBIES's Emotion **relationship-distribution** accumulates functionally emotional interpersonal processing, stress management, adaptability, and emotional general mood.

4. Temperament Emotion ROBO-intelligences. The **high level Emotion ROBO-intelligence elements** are defined based functionally on elements of inferior level. One axis of ROBO – intelligence's inferior level elements represents emotion functions of intelligence: Happiness, Fear, Amazement, Disgust, Sadness, and Anger. Other axis represents temperament characteristics of the choleric, melancholic, phlegmatic, and sanguine ROBO – intelligences.

High level elements of Emotion ROBO-intelligences presentedare functionally defined by the Adaptable Tools of Integrated Systems [13]. For example: Higher level ROBO-intelligence's item "Amazed Phlegmatic: phlegmatic is master of himself, is not overwhelmed by emotions" is defined as functional evolution of lower level ROBO-intelligence's items: "Amazement" and "Phlegmatic".

Conclusion

If we combine all steps of ROBO-intelligences evaluation (Intelligence, Creativity top, Emotions, and Emotion evolution) we can create all types of ROBO-intelligences with Creativity, Temperament, and Emotions.

Each temperament robot will have his own features, which at the same time shows us that everyone's personality is unique and consists of a combination of features.

Artificial creative and emotional intelligence can become a great help to people working with consumers daily because such robots can determine a human personality and show an idea of how to interact with them.

In **Conscious Society** (2019–2035) Artificial Intelligence will be equal with the value of structured Natural Intelligence (IN)

IA = IN structured

In the advanced period of the Society the formula will evaluate in **IA > IN structured,** from here starts to activate Artificial Conscience that is the next step in the development of the Human Society – it will be already ROBO-human Society.

Using **Adaptable Tools** [13] ROBO-intelligences, represented by its pragmatics as was done in this research, can be completed with its usage context, its syntax (representation forms), its semantics (represented by the algorithms of their creation) and by the examples of its higher level elements. This work have to be done in the nearest feature.

Adaptable tools are based on the usage of ADAPTER. The ADAPTER is a mechanism of adaptable human-machine interactions on the axes: language, processor, data, actions, definition and appeal from the point of view of usage in adaptable ROBO-activity.

The Adapter represents each new element via other elements defining 1) pragmatics of new element; 2) its syntax (shape) 3) semantics (content – its functional expression given via lower level elements), 4) context of the new element usage and 5) one or more examples of presenting the new element.

The Adapter for each of the elements of the higher level of the emotional ROBO – intelligences have to be presented by the cell element which is processed by presenting it as an Adapter pragmatics, syntax, content, context and examples of usage.

High elements of ROBO-intelligences are functionally defined by the Adaptable Tools of Integrated Systems [13].

Future research: Do the color effects of emotions, creativities, temperaments, and sensations have some connections with the measures of Emotion's Energetic Signals which activate in composition of Human Aura?

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Various perspectives over the Great Union in Banat. Identity of the region seen as a reflection of History, Memories and Art

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Abstract: The Great Union of Romania was not seen by historians an independent act but a series of historical events which define the nation building process. Which were the cultural and ethnic realities of Banat province around the Great Union events is the question to be answered by the present study? Memories, arts and history above all, make up the vivid picture of those days when Romania was defined as a nation. But the fact that the provinces were joined after hundred years of political separation resulted in a fragmented society where the determination of national identity conflicted with the multiethnic and multicultural truth. One nation - one state was the desiderate of Romanians from the historical provinces of Romania. Often regarded by historians as „*a war for national reconstruction*", the process ended with the transformation of Romania in a middle size state in Europe. The contemporary history of Banat and how the Great Union with Romania affected the province with multiple identities either political, confessional or cultural created the series of metamorphoses unfolding to shape a nation structure with strong background in the European cultural space. We tend to emphasize the role played by Romanians from Banat, as they became promoters of local nationalism, adhering to the common ideological trends of other Romanian provinces. During the Habsburg period, Romanians were politically weak, despite their large number, but the self-determination principle adopted by the Entente Powers after World War I, turned in fact into their own advantage, although Banat was partitioned between successors states after the Trianon Treaty. The union of Banat with Romania is seen through the memoirs of those who participated in a period when the subordination from Budapest turned to Bucharest. This happened in a period when in Banat Germans and Hungarians ran the economy and Romanians were not represented in the administration of the province, but as a majority started promoting a progressive regional nation discourse.

Key words: Banat, Great Union, historical provinces, nation building

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A reference to the historical process known as the Great Union connects the reader to the reality of the political context which favored the actions leading to the formation of Romania as a national state. The present study is an introduction to the history of Banat unfolding as the final episode of the Great Union with Romania presenting various perspectives which affected lifestyles and mentalities in a province with multiple identities either political, confessional or cultural. We can relate to a series of metamorphoses unfolding to shape a diverse ethnic structure with strong background in the European cultural space. Noted for its genuine diversity, the province of Banat was always shaped by a convergence with European history, note in this sense the period when Timişoara, the capital city of Banat became residence for Carol Robert de Anjou, where he had built a residence in the castle which is today the Banat Museum building. One may notice in this aspect how historical experience plays a fundamental role in the identity of a region, specifically for Romanian Banat, with its natural boundaries surrounding this political, administrative or cultural entity: Mureş River at North, Tisza at West and the Danube at South.

We notice in general how the discourse about the past changes, what we as historians can do is to be objective and always present the historical truth. How can we share the memory of these events, if not by all means providing the documents, the various points of view of those who witnessed them or the reality seen through the eyes of the artists?

Also, we currently witness the replacement of identity in Banat, as we today consider Timişoara a cosmopolite city, part of the central European modern milieu, born when the Habsburgs conquered the province and shaped it as *Kronland,* a part of the empire where strong economic interests collided, which was in fact an official, successful experiment which set the modern coordinates of this area. Having episodes of history which oscillated between the great powers of a specific period: Ottoman and Habsburg, the latter a period when colonists from all over Europe settled in Banat and developed a provincial civilization with multiple cultural layouts. Modernization transgressed to all fields, and we can recall the Baroque architecture and art shaping the newly acquired province. The ethnic character of these colonists was also an important factor in the transformation of the province cities into urbanized areas with all the requirements of such a denomination.

The legacy of the Austrian-Hungarian Empire is visible everywhere, everyone knows that Timişoara is often referred to as „little Vienna" due to the analogues found here which

resemble the urbanistic planning, the religious and civil architecture, sculpture, even landscape art (following the prototype of Versailles with the English gardens realized by Le Notre for king Louis XIV) of 1900s Vienna. As I have stated in the title this is a sincere pleading for the true history of Banat, a history which was lost and recovered by historians presenting the panoramic view of the events most frequently, neglecting the details for the sake of synthesis, or serving identity visions.

Which were the cultural and ethnic realities of Banat province is another question to be answered by the present study? Memories, arts and history above all, make up the vivid picture of those days when Romania was made Whole/Entire. But the fact that the parts were joined after hundred years of political separation resulted in a fragmented society where the determination of national identity conflicted with the multiethnic and multicultural truth. One nation-one state was the desiderate of Romanians from the historical provinces of Romania. Often regarded by historians as ,,a war for national reconstruction", the process ended with the transformation of Romania in a middle size state in Europe, situated on the 10th position as surface was concerned with the largest peacetime geographical extent (295,049 km^2) and on the 8th position on inhabitant number.

The fulfillment of the national unity (the union of Banat with Romania) which after World War I was formed of Oltenia, Muntenia, Dobrogea and Moldova was the result of the political events which led to the change of Temeswar into Timişoara. This brought the Romanian problem into the European attention. Most of the historians challenged by this concept agree that World War I had a key role in the development of Romanian national consciousness. The concept became reality after the war when Romania gained control over Bassarabia, Bukowina and Transylvania. As stated in the title, the union of Banat with Romania can be perceived from various perspectives of the ethnicities involved but with a common goal set by Woodrow Wilson's self determination theory which led to the establishment of the national states in Europe after the end of World War I.

One may notice that historical experience plays a fundamental role in the identity of a nation, throughout history Romania was defined by the concept of union, from the period when Michael the Brave's union (1600) of the principalities with Romanian population (Wallachia, Transylvania and Moldavia) transformed him into the precursor of modern Romania, when he established the Orthodox Metropolitan seat in Alba-Iulia in a period when only Catholic, Lutheran and Calvin religions were recognized despite the fact that Orthodox Romanians were twice as numerous in number. Other events such as the 1848 revolution carried the dream of nation building, even the concept so often referred to as ,,Great Romania" owns its existence to Dumitru Brătianu, who introduced the term in 1852. This nation building can be observed in the Union of Moldavia and Wallachia in 1859 (known as Romania since the 1866 Constitution), which became a kingdom after gaining independence from the Ottoman Empire in 1881. Between 1848 and World War I the idea of Romanian unity was promoted inside the Memorandum movement with the Memorandum Act of 1892 which as a result brought the Romanian conscience into the attention of Europe.

Romanians outside the borders had also an important role to play in the events preceding the Great Union: April 1918- the National Comitee of Romanians from Transylvania and Bukovina, led by Trajan Vuia; June 1918- Italy, where the Romanian Action Comitee was led by Simion Mândrescu, Washington where the Romanian National League led by V. Stoica was established and promoted the national union ideology.

The fulfillment of the national unity is not seen as the work of a single leader (politician, government or party), but it is considered as the *historic deed of the whole Romanian nation, channeled by the political leaders with great intelligence.*

The rise of the political movement of Bolshevism in Russia was another threat to the peace and nation formed states in Europe after World War I. With a faction requiring the preservation of the Austrian-Hungarian Empire, the province of Banat entered the path of no return, of being a powerful voice in the debates over the formation of Great Romania. We tend to emphasize the role played by Romanians from Banat, as they became promoters of local nationalism, adhering to the common ideological trends of other Romanian provinces. During the Habsburg period, Romanians were politically weak, despite their large number, but the self-determination principle adopted by the Entente Powers after World War I, worked in fact into their own advantage, although Banat was partitioned between successors states after the Trianon Treaty. The union of Banat with Romania is seen through the memoirs of those who participated in a period when the subordination from Budapest turned to Bucharest. This happened in a period when in Banat Germans and Hungarians ran the economy and Romanians were not represented in the administration of the province, but as a majority started promoting a progressive regional national discourse. Among the vast array of cases which testify how the past was activated for current political aims, shaping the pro union movement of Banat we present some of the prominent figures: Valeriu Braniște, Vasile Goldiș, Iuliu Hossu, Miron Cristea, Sever Bocu, Traian Vuia and many more (321 delegates to the December 1, 1918 Union from Alba-Iulia), sent in Transylvania with passports (the so called ,,*credenționale*").

Visual documents of the events (pictures taken on the occasion) will set the stage where the ideas of self-determination evolved. The modern ongoing Habsburg province of Banat transgressed into contemporary historical province with the inherent problems of an area considered a nucleus of modernization.

The productive, ecological and environmental functions of grasslands in agricultural landscape

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Abstract: **Grasslands fulfills the important agricultural landscape productive and non-productive functions and ecosystem services. Production relevance is related to the production of plant biomass that is used as forage for livestock, and now also as a renewable energy source. Grasslands ensure along with the productive functions also significant non-production – ecological and environmental functions in agricultural landscape. The sod (root biomass and tillering zone), with a dominant share of 80 % in primary grass swards production, ensures these functions. The production of root biomass and aboveground phytomass was examined on three grass swards types – permanent grass swards (PGS), over-sown grass swards (OGS), temporary grass swards (TGS) with four variants of mineral nutrition. The experiment was carried out in the research area of GMARI in Banská Bystrica (Slovak Republic). The lowest root biomass production was observed on TGS (7.30 t.ha^{-1}), the highest production on PGS (8.27 t.ha^{-1}). The root biomass production is highly influenced with mineral nutrition and with climate change. The significantly highest amount of root biomass (8.34 t.ha^{-1}) was produced on grass swards fertilized at highest doses of nutrients (180 kg N + 30 kg P + 60 kg K.ha^{-1}) and amount of root biomass was significantly higher during the dry years than climatically normal and wet years. Parameter for the evaluation of drought effect on the grass swards is the ratio of the root mass to the aboveground mass ratio (R:S). The results of R:S (4.020 – 5.163) demonstrate the significant ecological stability of the grass swards to the drought stress factor. All studied factors (year, mineral nutrition and grassland type) had a significant influence on the production of the tillering zone. The smallest amount of production of the cut-off zone produced OGS (4.97 t.ha^{-1}), followed by TGS and PGS (5.58 t.ha^{-1}). We recorded the lowest production of above-ground phytomass at TGS (5.81 t.ha^{-1}), higher on PGS (6.35 t.ha^{-1}) and the highest on OGS (6.55 t.ha^{-1}). OGS production was statistically significantly higher than on TGS. The accumulation of biogenic elements in roots and in aboveground phytomass of grass swards was also determined. The total grass sward biomass accumulate: 362.7 kg.ha^{-1} N, 41.8 kg.ha^{-1} P, 252.1 kg.ha^{-1} K, 115.5 kg.ha^{-1} Ca, 49.7 kg.ha^{-1} Mg on average. Based on the results achieved, we recommend a more intensive use of the PGS feed system or the OGS. Permanent grass swards are ecologically more stable, better tailored to the site than TGS, and together with optimal mineral nutrition can provide adequate production of root biomass (8.27 t.ha^{-1}) and crop of above-ground phytomass (6.35 t.ha^{-1}). It is also advisable to recommend the use of OGS where we recorded the highest yield of above-ground production (6.55 t.ha^{-1}) and adequate production of root biomass (7.79 t.ha^{-1}). The TGS cultivation system is economically more demanding and disturbs the dynamic balance of the ecosystem.**

The evaluation of heavy metals concentration in soil and plant biomass is documenting the environmental importance of grassland ecosystems. Monitoring was carried out during the years 2009 – 2011 on permanent grassland, in the region of Starohorské vrchy – habitat Radvaň, National park Nízke Tatry – habitat Panský diel and National park Veľká Fatra – habitat Kráľova studňa (Slovak Republic). We specified following elements of heavy metals in soil and plant samples (root biomass and above-ground part of vegetation): Cd, Co, Cr, Pb, Zn, Mn, Cu, Fe and Ni. We recorded the highest concentrations of Fe (1351.45 – 3569.37 mg.kg^{-1}) and Mn (330.28 – 589.27 mg.kg^{-1}) and the lowest concentrations of Cr (3.93 – 7.62 mg.kg^{-1}) and Cd (1.61 – 2.35 mg.kg^{-1}) in all three evaluated environments (soil, roots, aboveground sward). Based on achieved results, we can state that heavy metals are mostly concentrated in plant roots and in soil. Significantly lower content was determined in biomass of above-ground parts of vegetation. The grasslands are as excluder of a large group of heavy metals – Cd, Co, Cr, Pb, Mn, Fe a Ni in view of the heavy metals transport in soil – root – aboveground biomass, (bioconcentration factor BCF < 1). This strategy is very suitable for bulk feed production, heavy metals concentration is relatively low in aboveground parts of sward, and there is no contamination of the food chain.

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Keywords: above-ground biomass, ecological functions, environmental functions, grassland, heavy metals, root biomass, soil.

INTRODUCTION

Grasslands fulfills the important agricultural landscape productive and non-productive functions and ecosystem services. Production relevance is related to the production of plant biomass that is used as forage for livestock, and now also as a renewable energy source. Grass ecosystems are providing besides a productive function also significant extra-productive functions (erosion control, retention, biofiltration, environmental). Grass sod (root biomass and tillering zone) provides these functions and makes a dominant 80-85 % share in total production of grassland biomass. KRAJČOVIČ, ONDRÁŠEK [1] consider grass sod as a central component of semi-natural grassland, which is physical, morphological, physiological and metabolic interface between aboveground and underground part of the biocenosis with important specific characteristics and functions for aboveground and underground biomass. Grasslands ensure a significant function of ecological stabilization in agriculture landscape. They dispose of homeostasis and adaptive mechanisms that successfully react to several negative anthropogenic effects and factors of environment; they are also resistant to longer drought period or water logging. Grasslands significantly contribute to the soil protection from erosion by their massive root system. Dense over-rooting system of sod layer enriching the soil of organic matter and humus in the mineralization process. Their adequate supply in the soil increases the retention capacity of agricultural landscape [2, 3]. The grasslands have contributed to the ecological stability by relatively closed mass and energy flow circulation. Practically, the whole biomass of roots and tillering zone enter to the closed natural biomass circulation. The opinions on the production of root biomass of grass swards with e ect of fertilization are various. ÚLEHLOVÁ, HALVA, VRÁNA [4], SNYDER, CISAR [5], VELICH [6], TOMAŠKIN, TOMAŠKINOVÁ [49] and others quote an increase in the root biomass amount a er the application of mineral nutrients. On the contrary, FIALA [7, 3] and MRKVIČKA, VESELÁ, SKÁLA [8] quote the root biomass reduction on grass swards a er the use of higher doses of nitrogen fertilization. We can assess the meadow-pasture grassland as highly stable and resistant ecosystem to adverse negative environmental effects in comparison with the agro-ecosystem on arable land where a major part of the biomass is used beyond its border [9].

The evaluation of heavy metals concentration in soil and plant biomass is documenting the environmental importance of grassland ecosystems. Environmental contamination currently presents a serious environmental and social problem with a marked global dimension. The heavy metals are one of the most serious groups of hazardous substances in the environment [50, 51, 52]. They belong to the non-degradable contaminants which are characterized by a different source of origin (geochemical anomalies and anthropogenic sources such as industrial and municipal waste, fertilizers, pesticides, etc. are sources of heavy metals in the soil), characteristics and effect to the living organisms [10]. Biologically irreplaceable microelements (Cu, Zn, Mn and others), as well as numerous non-essential chemical elements (Cd, Pb, Hg and others) belong to the risk elements, and their risks consist in eco-toxicity and accumulation in biotic and abiotic components of the environment [11]. GRAY et al., [12], BIG et al., [13] state that persistence and cumulating of heavy metals in the environment is adversely reflected at all levels of the food chain, soil quality and present an impact on the overall burden of the environment. LĂCĂTUȘU et al., [14], LĂCĂTUȘU et al., [15] state, that systematic consumption of vegetables and fruits polluted with heavy metals by the inhabitants of polluted zones is leading to the healthiness state altering and to appearance of some chronically diseases with unpredictable final.

In this paper, we present the results of the concentration of heavy metals in soil and plant biomass of perennial grasslands and we compare their contents with the permitted legislative limits.

MATERIALS AND METHODS

The production of root biomass and aboveground phytomass was examined on three grass swards types – permanent grass swards (PGS), over-sown grass swards (OGS), temporary grass swards (TGS) with four variants of mineral nutrition. The experiment was carried out during the years 1993–1998 in the research area of Grassland and Mountain Agriculture Research Institute in Banská Bystrica (Slovak Republic). The experiment took place at Radvaň – by the Suchý vrch (48° 44´N, 19° 09´E) at an altitude of 460 m above the sea, in Banská Bystrica, Central Slovakia. In the experiment was used block design in four replications. The area belongs to the region Kremnické and Starohorské vrchy. Climatological characteristic: a slightly cool and a slightly wet area. Exposition to the northern slopes of 5 °C. Average annual precipitations are 746 mm, 422 mm per growing season. The average annual temperature is 8.21 °C and 15.03 °C for vegetation during a growing season. The basic meteorological data, mean air temperature (°C) and rainfall sum (mm) during the growing season and the year for reporting period are shown in Table I.

The Lang's rain factor is equal to 106. The snow cover lasts for 80 days. The geological substrate of habitat consist weathering of andesite, a soil type is cambisol. Acid soil with pH/KCl = 4.34, C_{ox} = 35.1 g. kg^{-1} and N_t = 2.74 g.kg^{-1}. The permanent grass swards belong to *Trisetetum flavescentis* coenosis. (*Arrhenatherion* Union). The grass determinate the coenosis physiognomy, especially the dominant species *Trisetum flavescens* and other valuable grass as *Poa pratensis, Dactylis glomerata* and *Arrhenatherum elatius.* Fabaceous plant types like *Trifolium repens, Trifolium pratense* and *Lotus corniculatus* improve the value of swards. The most significant species of herbs is *Taraxacum officinale*, which

ranks among the subdominant of coenosis. The over-sown grass swards represent the original permanent grass swards improved by seeding the trifoil-grasses mixes consisting of *Dactylis glomerata* cv. Rela (2 kg seeding amount), *Festulolium* cv. Felina (6 kg seeding amount), *Lolium perenne* cv. Metropol (4 kg seeding amount), *Trifolium pratense* cv. Sigord (1.5 kg seeding amount), *Trifolium repens* cv. Huia (1 kg seeding amount per ha). The temporary grass swards consists the same composition mixes as the over-sown grass swards with the double seeding amount of the individual species. Temporary and over-sown grassland were created during the spring in 1991. Each type of swards included four fertilizing types:
Variant 1 – control – non-fertilized variant,
Variant 2 – 30 kg.ha^{-1} P and 60 kg.ha^{-1} K,
Variant 3 – 90 kg.ha^{-1} N, 30 kg.ha^{-1} P and 60 kg.ha^{-1} K
Variant 4 – 180 kg.ha^{-1} N, 30 kg.ha^{-1} P and 60 kg.ha^{-1} K
The grass swards have been used in three cuts. Sampling of roots and tillering zone of grass swards was realized by method of monoliths sampling with the steel rollers. Sampling was carried out three times per year from each type and variant of grassland at the beginning of vegetation season, just a er cut of swards and at the end of the vegetation season. In the article we present average results of five samples. The sampling was realized by using the steel roller (50 mm diameter) to a soil depth of 100–120 mm and was repeated for 20 times. We cut 20 mm top part from the monolith that forms the tilling zone. Sampled roots and tillering zone were washed out by a stream of warm water in sieves. The samples were dried at 60 °C and determined the weight of dry mass.

The accumulation of biogenic elements in roots and in aboveground phytomass of grass swards was also determined. The samples were homogenized by milling and we defined the content of biogenic elements - N, P, K, Ca and Mg. The total content of N was determined by calculation of N substances (N = N substances: 6.25). Substances P and N were determined by SKALAR^{plus} SYSTEM automatic analyzer. Elements K and Ca were determined by using the flame photometry method of the model calibration curve. The atomic absorption spectrophotometrical method of the model calibration curve was applied to determine Mg. Production of aboveground biomass was monitoring with belowground biomass and tillering zone sampling. Results of aboveground stand production were acquired from yields during the each cuts of vegetation season. The weight of green mass was determinate by weighting and subsequently converted to the absolute dry mass. The data were applied to assess the R:S ratio (root biomass weight rate on aboveground swards mass of one cut). The results of the primary production and R:S ratio were evaluated statistically by multiple (multifactor) analysis of the variance at 99 % level of LSD test (Statgraphics so ware version 5.0), with the following variability: three types of grass swards (PGS, OGS, TGS), four mineral nutrition variants (non-fertilized variant, $P_{30}K_{60}$, N 90 + $P_{30}K_{60}$, N 180 + $P_{30}K_{60}$) and six years of monitoring (1993–1998).

Content monitoring of heavy metals in soil and in grass biomass we realized during the years 2009 – 2011 on semi-natural grass swards in the central Slovakia – a region Starohorské vrchy (habitat Radvaň), in the National park Nízke Tatry (habitat Panský diel) and in the National park Veľká Fatra (habitat Kráľova studňa), within three locations at different altitudes:

- Location Radvaň (48° 43´N, 19° 06´E), the lowest altitude (480 m) had the northern exposure with a slope 12 – 15°; the soil type is humus carbonate (rendzinas) on limestone.
- Location Panský diel (48° 47´N, 19° 08´E), the middle altitude (1000 m) had the south-western exposure with a slope more than 20°; the soil type is cambisol from weathered crystalline-acidic rocks.
- Location Kráľova studňa (48° 52´N, 19° 02´E), the highest altitude (1300 m) had the south-eastern exposure with a slope 20-25°; the soil type is shallow humus carbonate on limestone.

Permanent grasslands belong to a plant community Poa-Trisetetum (alliance Arrhenatherion). The community determined grasses, especially the dominant *Trisetum flavescens* and other valuable grasses *Poa pratensis, Dactylis glomerata* and *Arrhenatherum elatius*. Fabaceae plants, *Trifolium repens, Trifolium pratense* and *Lotus corniculatus* increase stand value. *Taraxacum officinale* is the most significant species of herbs. Samples of soil and grass biomass (root and aboveground biomass of the sward) were regularly collected at monthly intervals (May to September) during the growing season. We present average results of five samplings. Samples of soil and plant biomass were taken from identical sampling sites (area 0.2 x 0.2 m, sampling depth from 20 to 150 mm) by a spade. The soil samples were dried at laboratory temperature and sieved through a sieve having a pore size 0.125 mm, and processed under the regular methodologies [16]. Plant samples were divided into root and aboveground part, the samples were homogenized after drying to constant weight. Soil was extracted with 2 mol.dm^{-3} HNO_3 solution, and biomass in 10 mol.dm^{-3} HNO_3 solution. Extracts were analysed by atomic absorption spectrophotometer using flame atomisation (acetylene-air). Soil and plant samples were analysed at the laboratory of the GMARI in Banska Bystrica. Concentration of nine heavy metals elements (Cd, Co, Cr, Pb, Zn, Mn, Cu, Fe, Ni) were determined in each sample. For the evaluation of uptake and accumulation of heavy metals by grassland were used bio-concentration factor (BCF) and translocation factor (TF):

- BCF = concentration of heavy metals in the aboveground phytomass / heavy metal content in soil (mg.kg^{-1})
- TF = heavy metal content in aboveground phytomass / heavy metal content in the root (mg.kg^{-1})

The coefficients make a possibility to assess the ability of grassland to accumulate up taken heavy metals from the soil in their tissue and to classified stand into one of the heavy metals tolerance groups (excluders, indicators, accumulators and

hyper-accumulators) BAKER [17], STAŇOVÁ et al., [18] indicate the following groups of strategy:

- a value of BCF < 1, excluders,
- a value of BCF = 1, indicators,
- a value of BCF > 1, accumulators – hyper-accumulators

The results of heavy metals concentration were processed by mathematical -statistical methods using PC (software Statgraphics ver. 5.0, a method of multifactor analyse of variance, LSD $_{0.05}$ test).

RESULTS AND DISCUSSION

We evaluated production of roots, tirelling zone, aboveground plant biomass and total plant biomass of grassland by multiple analysis of variance (LSD test α 0.01), where as the factors of variability were represented: 3 different types of vegetation (PGS, OGS, TGS), 4 variants of mineral nutrition (non-fertilized variant, $P_{30}K_{60}$, N 90 + $P_{30}K_{60}$, N 180 + $P_{30}K_{60}$) and 6 years of research (1993–1998). Evaluation is presented in Table II.

Grassland produced 7.22–8.34 t.ha^{-1} of dry root mass in depending on the grass swards cultivation type and mineral nutrition. FIALA, JAKRLOVÁ [19] recorded the higher production. They state that the annual production of belowground biomass of different types of meadow swards in Českomoravská vrchovina is about 11 t.ha^{-1} (higher values were reached in fertilized swards) and is 2–3 times higher than aboveground primary production.

We recorded that there has been the lowest amount of root biomass on the temporary grasslands – 7.30 t.ha^{-1} of DM, higher amounts on the over-sown grasslands – 7.79 t.ha^{-1} and significantly the highest amount on the permanent grasslands – 8.27 t.ha^{-1} of dry mass of root biomass (Table II). TESAŘOVÁ [20] had also published the root biomass shortage on the renewed swards (TGS) in comparison with natural swards (PGS). She proves it by some soil physical properties improvement a er grass swards renewal (reduction of moisture, temperature incensement, soil aeration improvement), which speeds up decomposition of herb waste and soil organic mass. On the other hand, herb waste enters to soil decreases on the renewed grass swards in comparison with the semi-natural ones. The unbalance between input and output of the organic substances can be one of the main reasons substantial decrease of humus in soils restored meadow swards and can even cause the smallest amount of root mass in our experiment.

Reducing the amount of root biomass on TGS against PGS also state HRABĚ, PAVLÍČEK [21], who reported 22.38 t.ha^{-1} on PGS, while 20.89 t. ha^{-1} of root biomass on TGS, what represents a decrease of 6.7 %. GÁBORČÍK, KOHOUTEK [22] also report root biomass decrease on the temporary grass swards in comparison with that on the permanent one. Authors studied a root system of grassland in mountain area (Liptovská Teplička, 960 m a.s.l.), on the parallel ecological experiment such as this contribution deals with. They state that an annual application of mineral fertilizers causes an increase of roots in permanent and in temporary grassland. A weight of the root system increases in PGS, while a maximum increase of roots shows application of PK fertilizer in TGS. Temporary grassland is mostly made up of cultivated species of grasses and legumes, which have a different strategy of assimilate distribution between belowground and underground part of vegetation. This is reflected in their stability and reaction of the root system for the application of mineral fertilizers. Ploughing of autochthonous grassland and temporary vegetation establishment based on fodder plant species had a negative impact on root weight, which decreased in average of 56.5 %.

Evaluation of mineral nutrition impact on production of root mass is presented in the following part of the contribution. The application of mineral nutrition constitutes the additional factor affecting the root biomass amount along with grass swards cultivation in agriculture. The mineral nutrients o en feature different effect. We reported the lowest root biomass amounts on the non-fertilized swards (7.22 t.ha^{-1} of dry mass), the balanced amounts on the swards fertilized with doses of 30 kg.ha^{-1} P + 60 kg.ha^{-1} K and 90 kg.ha^{-1} N + 30 kg. ha^{-1} P + 60 kg. ha^{-1} K (7.83 and 7.74 t.ha^{-1} of dry mass) in our experiment. Significantly the highest amount of root biomass was produced on the grass swards fertilized with higher doses – 180 kg.ha^{-1} N + 30 kg. ha^{-1} P + 60 kg.ha^{-1} K (8.34 t.ha^{-1} of dry mass). Some stimulatory effect of nitrogen on root biomass production has been proved. The higher production of the root biomass may be related to intensive nitrogen fertilization. ZENIŠČEVA [23] states that mineral nutrition, and nitrogen particularly stimulates root growth to a certain extent, but less intensively than aboveground biomass. Positive effect of nitrogen fertilization on root production of natural grass swards was confirmed in experiments published by ÚLEHLOVÁ [24]. The author has explained the increase of root biomass weight from 1.9 to 3 kg.m^{-2} a er using 200 kg.ha^{-1} N by changes of grass swards species. HEJDUK, HRABĚ [25] also observed the increase of belowground biomass production as a result of higher fertilizer doses. They quote the production 989 g.m^{-2} on non-fertilized sites, that means 92 g.m^{-2} (8.6 %) less than on fertilized ones (1081 g.m^{-2}). This di erence is significant. On the contrary, KLAPP [26] states that nitrogen deficiency or its appropriate supply influences favourable the root system growth and development, while intensive nitrogen fertilization results in root weight reduction. Also FIALA [7, 3] and MRKVIČKA, VESELÁ, SKÁLA [8] quote the root biomass reduction on grass swards a er the use of higher doses of nitrogen fertilization (200 kg.ha^{-1} N).

The higher production of root biomass is influenced by higher dose of nitrogen (180 kg.ha^{-1}) in our experiment is in agreement with the results published by VELICH [6], HRABĚ, HALVA, ZIMOLKA [27], TESAŘOVÁ [20]. The impact of nitrogen on increasing production of root mass also state JANČOVIČ [28] and GREGOROVÁ, KEČKEMÉTHY, FUSKOVÁ [29].

The year of cultivation has the additional influence on creation of root biomass. The agro-climate conditions constitute its influence, therefore more di cult to be manipulated by a farmer. We shall also focus on this aspect in the view of the fact that we encounter a threat of dry and wet years. A lot of remarkable results related to weather-standard years and extreme seasons (Table III) have been achieved during 6-years research (1993–1998).

The results achieved in 1993, when the total precipitation amounted only 336.5 mm and 794.7 mm during the whole year, document the drought negative effect on root system of grass swards. The air temperature was 15.8 °C during the vegetation season and 9.0 °C during the whole year. Robust of the root system, the depth of roots penetration into the soil profile and rooting density of the soil decide about the resistance of grass swards to droughts (except for the aboveground properties). The largest amounts of root biomass (10.31–11.47 t.ha^{-1}) were detected in 1993 in three evaluated types of grassland. The production of root biomass is significantly higher during the climatically dry year than climatically normal and wet years. We observed the considerable root biomass reduction during the wet years 1995 and 1996, not only in comparison with the dry year but also with the standard climatic ones. Explained through the anatomical and morphological characteristics of the plant rooting adaptation to drought stress resulting in higher rooting creation – to the detriment of the aboveground vegetation parts, etc. The soil moisture deficit inhibits growth of assimilative bodies resulting in distribution of the assimilative bodies into the roots in preference. On the one hand, the adaptations reduce water loss by transpiration; on the other hand, they are capable of gaining water from bigger depths, which enables growth under the soil moisture deficit conditions. KLAPP [26], KOLEK, KOZINKA et al. [30] report that robust root system having the larger adsorption surface ensures better water uptake and more nutrients taken from the bigger soil volume and depths under the drought conditions. GÁBORČÍK, KOHOUTEK, ILAVSKÁ [31], FIALA, TŮMA, HOLUB [32] also report that there is an increase in the grass swards root biomass under the precipitation deficit conditions. MATA−GONZALES, SOSEBEE, WAN [33] evaluated production of roots and aboveground biomass of two species of thermophilic grasses (*Bouteloua gracilis* and *Hilaria mutica*) in irrigation and non-irrigation conditions. They conclude that more root biomass was created at low soil moisture, while more aboveground biomass was created at higher levels of irrigation. The achieved results document that there has been some rooting stability in response to the drought stress. The aboveground part of swards with significant growth reduction responds to drought stress in a more sensitive way. We recorded the lowest production of aboveground biomass 4.44 t.ha^{-1} in the year 1993 what was a climatically dry year (Table II).

An important evaluation parameter of drought impact on the grassland is the ratio of root mass to aboveground parts of vegetation (R:S – root: shoot ratio, S – the average harvest of one cut), which is genetically fixed [2]. The R:S ratio is a measure of vegetation ability to avoid drought. The higher R:S values indicate that there has been a bigger vegetation drought resistance. Table II shows the R:S ratio. There has been approximately equal R:S ratio on the TGS and OGS, which amounts are 4.27 or 4.02. There has been the biggest R:S ratio on the PGS (5.16) and evidently higher one in comparison with the OGS and TGS. The results have documented a higher permanent grass swards ecological resistance to drought stress factor. Therefore, there has been good cause to believe that PGS has been capable of tolerating global warming of the Earth and contribute to stability of the agricultural landscape. The R:S ratio has also marked a substantial influence on grass swards mineral nutrition. There had been the R:S ratio (3.33 or 3.68) reaching evidently lower value in the variants fertilized by nitrogen in comparison with those not fertilized and those having $P_{30}K_{60}$ – 5.47. RYCHNOVSKÁ et al. [2] publish the similar nitrogen fertilizing influence on the R:S ratio. The maximum production of root mass was recorded in 1993, what also documents the largest ratio R:S with the value of 8.78 significantly higher than in others evaluated years. A high value of R:S (5.42) was recorded in 1998, highly significant compared to 1994 to 1997. In this contribution, we evaluate ecological significance of root biomass of grassland, and directly with it also goes assessing of tillering zone production and harvest of aboveground biomass (Table II).

Production of tillering zone was lower on OGS and TGS (4.97 or 5.28 t.ha^{-1}), significantly higher on PGS (5.58 t.ha^{-1}). We observed a significantly higher production of tillering zone with variants which were fertilized with nitrogen than on non-fertilized and PK fertilized. Climatic factors of years have also effect on production of tillering zone (rainfall, air temperature), the lowest production was noticed in 1995 and 1996, significantly higher in 1993.

The lowest harvests of aboveground biomass were noticed on TGS (5.81 t.ha^{-1}), significantly higher on OGS (6.55 t.ha^{-1}). Mineral nutrition had a significant impact on production of aboveground biomass. Harvests were relatively low on non-fertilized control and PK fertilized variant (4.69 or 5.03 t.ha^{-1}), fertilization with nitrogen significantly increased a harvest (7.09–8.13 t.ha^{-1}). The positive influence of nitrogen fertilization on the growth of grassland harvest also confirmed JANČOVIČ [34], MRKVIČKA, VESELÁ [35, 36], ILAVSKÁ, RATAJ, STYPIŇSKI [37] and others. These authors indicated on non-fertilized control PGS harvests of 2.252 t.ha$^{-1,}$ with influence of nitrogen fertilization (90 and 180 kg.ha^{-1} N + PK) the harvest increased at 5.725 or 7.318 t.ha^{-1} of dry mass. Harvests increasing influencing with graded doses of mineral nutrients were also recorded on over-sown and temporary grassland. The positive influence of nitrogen fertilization (100 kg.ha^{-1} N + PK, 200 kg.ha^{-1} N + PK) on an amount of sward harvests are also presented by VESELÁ, MRKVIČKA [38]. Compared to a harvest on non-fertilized control (2.64 t.ha^{-1}) was the harvest on fertilized variants increased at 4.61 or 5.38 t.ha$^{-1.}$ A significant influence of years was also confirmed, the lowest harvests were indicated during a climatically dry year 1993 (4.44 t.ha^{-1}), the significantly highest were in the years 1994, 1996 and 1997 (7.30–7.73 t.ha^{-1}).

We recorded the highest production of total biomass on PGS (20.59 t.ha^{-1}), significantly the lowest production on

TGS (18.53 t.ha^{-1}). Graded doses of N fertilizers significantly increased the primary production of grassland. A significant influence of years was also confirmed, the highest production of total biomass was in a climatically dry year 1993 (23.61 t.ha^{-1}), where a low harvest of aboveground biomass (4.44 t.ha^{-1}) compensates the increased production of root biomass (10.73 t.ha^{-1}).

The accumulation of biogenic elements in roots and in aboveground phytomass of grass swards was also determined. The root biomass and tillering zone together with organic mass are treated as the nitrogen source and more mineral elements. Table IV shows the biogenic elements withdrawn by grass swards biomass. They become potential nutrients for future vegetation crop in the mineralization process as the farmer's additional contribution. The sod significantly contributes to organic mass circulation and mineral nutrients in grass ecosystem. This fact appears more important if we realise that nutrients accumulated in aboveground vegetation often leak beyond the permanent grass ecosystem frontier in the form of livestock roughage, so they will not pass back into the mass natural circulation.

The results achieved in our research with taking of mineral nutrients by the underground plant biomass are within the range published by WHITEHEAD [39] who studied taking of nutrients by the aboveground biomass in various types of grass swards. Extensive grass swards consumed 60 kg N, 6 kg P, 45 kg K, 15 kg Ca a 3 kg Mg. ha^{-1}, intensive ones 400 kg N, 60 kg P, 350 kg K, 120kg Ca a 30 kg Mg. ha^{-1}.

The evaluation of heavy metals concentration in soil and plant biomass is documenting the environmental importance of grassland ecosystems. We determined a concentration of the following heavy metals: Cd, Co, Cr, Pb, Zn, Mn, Cu, Fe a Ni, in the soil, root biomass and aboveground biomass of grassland, at three locations in the central Slovakia (Radvaň, Panský diel a Kráľová studňa). We also determined bio-concentration and translocation factor. The results are presented in Table V.

The highest values of heavy metals us determinate in four cases: Cd – 2.35, Co – 13.17, Pb – 151.09, Mn – 589.27 mg.kg^{-1}, so a soil is an environment where the heavy metals are concentrated significantly. The mean values were determinate for Cr – 5.99, Fe – 2192.9, Ni – 11.24 mg.kg^{-1}. The lowest concentration for Zn – 48.71 and Cu – 11.42 mg.kg^{-1}. The total content of Cd and Pb exceeded 3.36 resp. 2.16 times the permissible legislative limits established by Act No. 220/2004 on Agricultural land Protection and Use [40], which is in conjunction with the current European Union legislation. Concentration of Co, Cr, Zn, Cu a Ni didn't exceed the set limit values.

Heavy metals are significantly concentrated in roots of analysed plant parts, with the highest level of Cr – 7.62, Zn – 208.21, Cu – 39.25, Fe – 3569.37, Ni – 12.52 mg.kg^{-1}. Significantly lower values of heavy metals were determinate in aboveground plant parts. The lowest values were determinate in seven cases (Cd, Co, Cr, Pb, Mn, Fe, Ni). The concentration of Co, Pb, Mn was higher in soil than in roots. Elements like Cd, Co, Cr, Pb, Mn, Fe, Ni had higher content in aboveground sward. Concentration of Cr, Zn, Cu, Fe was significantly higher in roots than in soil, and concentration of Cd, Cr, Zn, Cu, Fe, Ni was higher in aboveground part of grass biomass. The total content of Cd, Cr and Ni in aboveground plant biomass (bulk feed) slightly exceeded the maximum limits of heavy metals in feed (Decree of MASR No.2080/2005 on Feed Materials for the Production of Compound Feed and Animal Feed), [41]. Concentration of Pb didn't exceed the maximum levels of heavy metals in feed.

We recorded the highest concentrations of Fe (1351.45 – 3569.37mg.kg^{-1}) and Mn (330.28 – 589.27 mg.kg^{-1}) and the lowest concentrations of Cr (3.93 – 7.62 mg.kg^{-1}) and Cd (1.61 – 2.35 mg.kg^{-1}) in all three evaluated environments (soil, roots, aboveground sward).

Soil: Fe > Mn > Pb > Zn > Co = Cu = Ni > Cr > Cd
Roots: Fe > Mn > Zn > Cu > Pb > Ni > Cr = Co > Cd
Aboveground sward: Fe > Mn > Zn > Pb > Cu > Ni > Co > Cr > Cd

Samples analyses results of soil and plant biomass allow assessing the ability of individual plant organs accumulate heavy metals and examine the process of transport of these elements in the system soil - root - aboveground biomass, using as a bulk feed for polygastric livestock. The average results of BCF, which we have obtained during the three years and at three locations in the central Slovakia, can define for evaluated grasslands the following characteristics regarding their strategies to accumulate heavy metals: grasslands have been shown as excluder of a large group of heavy metals: Cd, Co, Cr, Pb and Ni, (BCF < 1). This strategy is very suitable for bulk feed production, heavy metals concentration is relatively low in aboveground parts of sward, and there is no contamination of the food chain:

- grasslands have demonstrated as zinc accumulator, sward is actively concentrating metals in aboveground parts of phytomass (BCF> 1), but the value of 2.13 doesn't mean a serious risk of contamination of above-ground biomass production,
- grasslands are expressing as Cu indicator (BCF = 1).

The heavy metals concentration in soil, roots and aboveground biomass was compared with the set limit values for heavy metals (Table VI).

Translocation factor (TF) is for all assessed heavy metals less than 1, what is documenting their significant accumulation in root system of grasslands. We can conclude that the heavy metals are most concentrated in the roots of plants and soil. Root biomass and upper part of soil as a part of grass sod have a great importance in protection of the environment. The grass sod provides a protection of aboveground part production against increased concentration of heavy metals that would otherwise enter to the food chain. The similar results were presented in the works: KLOBUŠICKÝ, BALCAR [42], KLOBUŠICKÝ, KOPEC [43], PETŘÍKOVÁ [44], HECL et al., [45]. The cultivated plants have different abilities to accept and accumulate risk elements. We can conclude that the grass species don't accumulate excessive amounts of heavy metals (in comparison with the soil and roots) in the aboveground part of biomass. It is considered that the transport of hazardous elements to the aboveground plant parts blocks Caspari's strips in endodermic cells of the root [46]. The concentration of heavy metals in

plant tissues also researched ANDRÁŠ et al., [47]. They state that the highest content of metals is in the roots, then in the leafs and in the stalks. The flowers, seeds and fruits contain heavy metals at least. We have also confirmed the impact of altitude of evaluated locations on heavy metal concentration (Table VII).

The lowest concentration of all evaluated heavy metals was recorded in location of Radvaň with the lowest altitude, significantly higher concentration in locations with higher altitudes (Panský diel, Kráľova studňa). HRONEC [48] states, that the tendency may be related to accumulation of gaseous immissions, which contain large contents of heavy metals.

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The tables for this paper are in Annex 1.

ANNEX 1.

Table I. Mean air temperature (°C) and rainfall sum (mm) during growing season and year

Month	Year											
	1993	1994	1995	1996	1997	1998	1993	1994	1995	1996	1997	1998
	Mean air temperature (°C)						Rainfall sum (mm)					
IV–IX	14.8	16.0	14.8	14.1	14.2	15.3	336.5	564.7	568.3	630.9	402.8	494.8
I–XII	8.4	9.4	8.4	7.5	8.0	8.7	794.7	917.3	935.7	971.3	765.8	829.7

(Source: Department of Meteorological Service Banská Bystrica)

Table II. Evaluation of grassland primary production

Production (in DM t.ha^{-1})						
Variability	Factor	Roots	Tillering zone	Aboveground biomass	Total biomass	R:S
Sward	PGS	8.27 c	5.58 b	6.35 ab	20.59 b	5.16 b
	OGS	7.79 b	4.97 a	6.55 b	19.42 ab	4.02 a
	TGS	7.30 a	5.28 ab	5.81 a	18.53 a	4.27 ab
LSD α $_{0.01}$		0.4648	0.3923	0.6143	1.6638	1.07840
Treatment	1	7.22 a	4.79 a	4.69 a	16.63 a	5.46 b
	2	7.83 bc	4.92 a	5.03 a	18.04 a	5.47 b
	3	7.74 ab	5.46 b	7.09 b	20.70 b	3.68 a
	4	8.34 c	5.93 c	8.13 c	22.67 c	3.33 a
LSD α $_{0.01}$		0.5367	0.4530	0.7093	1.9212	1.24523
Year	1993	10.73 e	7.58 e	4.44 a	23.61 d	8.78 c
	1994	8.85 d	6.06 d	7.73 c	22.94 d	3.59 a
	1995	5.97 a	3.09 a	5.75 b	15.51 a	3.40 a
	1996	6.27 a	3.67 b	7.30 c	16.92 ab	2.62 a
	1997	7.03 b	5.25 c	7.44 c	19.54 c	3.09 a
	1998	7.86 c	6.02 d	4.77 a	18.56 bc	5.42 b
LSD α $_{0.01}$		0.6573	0.5549	0.8687	2.3530	1.52509

Statistical method: ANOVA – LSD test (α = 0.01) a, b, c, d, e – significant differences

Table III. The root biomass amount during the individual years (t.ha^{-1})

Year	Total precipitation (mm)		Climatic year	Root biomass weight (t.ha^{-1})			
	IV–IX	I–XII		PGS	OGS	TGS	average
1993	336.5	794.7	dry	10.31 c	11.47 d	10.41 c	10.73 e
1994	564.7	917.3	standard	9.89 c	9.44 c	7.21 b	8.85 d
1995	568.3	935.7	wet	7.16 ab	5.53 a	5.21 a	5.97 a
1996	630.9	971.3	wet	6.69 a	6.28 a	5.83 a	6.27 a
1997	402.8	765.8	standard	7.65 ab	6.12 a	7.33 b	7.03 b
1998	494.8	829.7	standard	7.90 b	7.89 b	7.79 b	7.86 c
Ø for 1951–2000	422.0	746.0					
LSD α $_{0.01}$				1.1481	1.1337	1.2144	0.6573

Statistical method: ANOVA – LSD test (α = 0.01) a, b, c, d, e – significant differences

Table IV. Nutrients accumulation by biomass in the grass swards in kg.ha^{-1}

Biomass/Accumulation	N	P	K	Ca	Mg
Roots	112.1	11.8	60.0	28.6	18.0
Tillering zone	97.2	10.5	40.0	29.8	13.6
Aboveground production	153.4	19.5	152.1	57.1	18.1
Total biomass	362.7	41.8	252.1	115.5	49.7

Table V. Heavy metals concentration (mg.kg^{-1}), BCF a TF of grass ecosystems

	environment	Heavy metals concentration (mg.kg^{-1})								
		Cd	Co	Cr	Pb	Zn	Mn	Cu	Fe	Ni
Average data (3 years,	Soil	2.35	13.17	5.99	151.09	48.71	589.27	11.42	2192.90	11.24
	Roots	2,27	6.92	7.62	24.45	208.21	353.83	39.25	3569.37	12.52
	Sward	1,61	5.93	3.93	12.38	103.93	330.28	11.50	1351.45	8.18

3 locations)	BCF	0.68	0.45	0.66	0.08	2.13	0.56	1.01	0.62	0.73
	TF	0.71	0.86	0.52	0.51	0.50	0.93	0.29	0.38	0.65

Table VI. Heavy metals concentration in soil and plant biomass ($mg.kg^{-1}$)

Environment	Heavy metals concentration ($mg.kg^{-1}$)								
	Cd	Co	Cr	Pb	Zn	Mn	Cu	Fe	Ni
Soil	2.35 b	13.17 b	5.99 b	151.09 b	48.71 a	589.27 b	11.42 a	2192.90 b	11.24 b
	Limit value of heavy metals ($mg.kg^{-1}$) (The Act No. 220/2004)								
	0.7	15	70	70	150	-	60	-	50
	Exceeding the limit value (multiple)								
	3.36	< limit	< limit	2.16	< limit	-	< limit	-	< limit
Roots	2.27 b	6.92 a	7.62 c	24.45 a	208.21 c	353.83 a	39.25 b	3569.37 c	12.52 b
Sward	1.61 a	5.93 a	3.93 a	12.38 a	103.93 b	330.28 a	11.50 a	1351.45 a	8.18 a
	The maximum levels of heavy metals in feed ($mg.kg^{-1}$) (The Decree of MASR č.2080/2005)								
	1	-	3	40	-	-	-	-	5
	Exceeding the limit value of heavy metals in feed (multiple)								
	1.61	-	1.31	< limit	-	-	-	-	1.64
LSD $_{0.05}$	0.413	2.423	1.088	24.740	18.899	61.180	14.513	813.807	1.900

Statistical method: ANOVA – LSD test ($\alpha = 0.05$) a, b, c – significant differences

Table VII. Heavy metals concentration at research sites ($mg.kg^{-1}$)

Location	Heavy metals concentration ($mg.kg^{-1}$)								
	Cd	Co	Cr	Pb	Zn	Mn	Cu	Fe	Ni
Radvaň	1.79 a	7.40 a	4.85 a	45.03 a	102.56 a	304.24 a	17.41 a	1315.90 a	7.23 a
Pánsky diel	1.58 a	10.91 b	7.22 b	52.41 a	115.61 a	565.69 c	21.15 a	3728.39 b	17.20 b
Kráľova studňa	2.87 b	7.70 a	5.47 a	90.48 b	142.68 b	403.45 b	23.61 a	2069.43 a	7.52 a
LSD $_{0.05}$	0.413	2.423	1.088	24.740	18.899	61.180	14.513	813.807	1.900

Statistical method: ANOVA – LSD test ($\alpha = 0.05$) a, b, c – significant differences

Cultural ecosystem services as a bridge to future challenges in sustainable development

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Abstract: When featured in management plans, cultural ecosystem services tend to lack adequate integration and quantification. One usually finds them grouped under non-consumptive direct use values. It is envisaged that the demand for cultural ecosystem services in industrialised countries will increase, since more emphasis will be placed on recreational activities and this shift will be backed by higher spending on this segment. This does not mean that such services are not valued in traditional societies; however, here their importance is for the most part attributable to their contribution to cultural identity and even to the survival of such societies. It is regrettable that cultural ecosystem services tend to be marginalised by decision makers, either due to economic or even to ecological considerations, and this in spite of the importance attributed to them by diverse stakeholders in society and indeed by the public itself, as evidenced by the results of numerous exercises carried out to assess public perceptions about such services. This paper reports the results of research aimed at assessment of the recreational value (in the content of cultural value) of *Pembroke* Garigue *Heritage Park* (NATURA 2000 site in the Maltese Islands), which is visited by about 22,000 tourists per year. This region has great potential in terms of tourism and is unique especially because of the presence of cultural and natural heritage in the same location. The questionnaire survey was conducted from January to October in 2018 by direct contact with visitors in the area and its surroundings. The return rate of the questionnaire was 75.54% (491 respondents) out of a number of 650 distributed copies consisting of 24 questions each. Following the processing of the results using the method of travel costs, with an average duration of stay of 1.87 day and respondents' costs of € 127.47 per person / per stay, the total value of the recreational value was calculated at 5,244.115.8 €. The overall ecosystem assessment services of the evaluated protected area are resulting from recreational activities estimated at €87,401.93 when converted to 1 ha of total area of Pembroke Heritage Park. Recreational value (VTR) just setting off costs directly linked to visits of the protected area is €634,790.2 and in recalculation on 1 ha of the total area the value of 10,579.84 € was obtained.

Keywords: ecosystem services, recreational values, *Pembroke* Garigue *Heritage Park*, WTP, VTR.

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I. INTRODUCTION

Over the last decade, the concept of 'cultural services and goods' linked to ecosystems has been adopted by many academics and environmental policy-makers to describe what are experienced as meaningful interactions between people and nature. As such, cultural goods and services represent the newest way of interpreting human environment relations: a 21st Century framing in a sequence covering millennia through which societies have expressed the centrality of the natural environment in supporting human life and well-being.

Fig 1. Diverse range of heritage goods that are linked to CES (Tomaskinova, 2018)

Moreover, there are clearly articulated individual and social values which arise from human interaction with nature. Cultural analysis explores the production, circulation and reception of shared meanings and practices, including those with the natural world. [1] The idea that we can meet human needs and simultaneously conserve and even enhance the natural environment is an attractive one. Since the Brundtland report popularised a definition of sustainable development based on the concept of needs, there has been a widespread belief that it should be possible to achieve a good quality of life without compromising natural ecosystems. [2, 3] Ecosystem cultural services make a significant contribution to achieving people's key needs. In the 21st Century, cultural life

across the World is diverse and dynamic. Yet encounters with the natural world maintain their fascination for very substantial numbers of people, as reflected, for example, in the membership of a very wide range of civil society organizations embracing landscape and nature interests, the numbers of people who use urban parks and green spaces on a daily basis, and the massive popularity of gardening throughout the World. Daily contact with nature is still part, of being human. Sustainability and Wellbeing fills a gap in sustainable development studies by drawing on a range of case-studies to discuss the challenges and opportunities of using Human Scale Development (HSD) framework in a practice developed by Manfred Max Neef. HSD indicates how both existence needs (being, having, doing, interacting) and value needs (subsistence, protection, affection, understanding, participation, creation, leisure, identity and freedom) can be met through nature. [2, 4, 5, 6, 7] The Common Ground (the environmental education charity) provides a case study of an organisation that has campaigned to protect what it calls 'local distinctiveness', not only because of the value of ecological diversity, but also because of the enriching social and spiritual value of sense of place: "*…many of us have strong allegiances to places, complex and compound appreciation of them, and we recognise that nature, identity and place have strong bonds. We sometimes forget that ours is a cultural landscape. It is our great creation: underpinned by nature, it is a physical thing and an invisible web… Places are process and story as well as artefact, layer upon layer of our continuing history and nature's history intertwined. Places offer an exposition of their evolution, given sensitive development and barefoot education, every place is its own living museum, dynamic and filled with sensibilities to its own small rich-nesses. These are places we know when we are in them. Meaning is entrapped in the experience of change, symbolisms and significance cling to seemingly ordinary buildings, trees, artefacts*" [8]. Communicating the cultural significance of nature in everyday life, especially in ways which emphasise its positive benefits rather than resorting to the clichés of destruction and despair which have marked environmental discourse over the last decades, is very important for the mobilisation of wider public support for sustainable environmental management. [1]

II. MATERIALS AND METHODS

The main objective of the presented article is a valuation of selected ecosystem services (especially cultural services) in Pembroke Heritage Park (NATURA 2000). The protected area (PA) covers an area of 60 ha, at the specific coordinates 35.932746 N and 14.478551 E.

Used methodology is based on guidelines for rapid assessment of Ecosystem Services Valuation [9, 10] and Millennium Ecosystem Assessment [11, 12, 13].

A questionnaire survey directly on-site was conducted from January to October in 2018 at the most frequent localities of the Pembroke Heritage Park (MT0000002). The questionnaire (24 open, half-open and closed questions) is focussed on finding out the preferences of the visitors and their willingness to pay (WTP) an entry fee to the protected area (PA), and a willingness to accept (WTA) certain restrictions for the development and for a brand of the Pembroke Heritage Park. The questionnaire was developed to ascertain also visitors' demographic and socio-economic information. We have calculated the recreational value (VRT) of the Pembroke Heritage Park through the scheme VRT = Sm * DM * NV, where Sm (EUR) - average value of expenditures per person per day, DM - average length of stay and NV - average number of visitors.

A total of 491 respondents participated in this survey. The return rate of the questionnaire was 75.54% from a number of 650 distributed copies. Participants came from various grade levels of education (37.3% Tertiary, 31.3% Post-Secondary, 27.5% Secondary and 3.9% Primary school graduates) and various jobs (23.62% students, 13.24% self-employed, 2.44% housewife/parents on childcare, 7.94% skilled/technical, 9.98% pensioners, 0% unemployed and 26.27% others). Male participants were predominant (57%). Average age of participants was 37.8 (Median=34, SD=14.15, CV=44.05%).

For final evaluations, we used statistics: Descriptive Methods – Summary Statistics (M = Mean, SD = Standard Deviation, Median, cv = coefficient of variation) using the software STATGRAPHICS Vers. 5.0.

III. RESULTS AND DISCUSSION

3.1 Main tasks and activities of visitors

Important factors affecting tourism in the area are activities that visitors can carry out during their stay, and they are often a reason for their visit. According to the survey, Pembroke Heritage Park is mostly visited because of educational activities focussed on natural and cultural heritage (28.76%), recreation (18.54 %) and relaxation (16.53%). AMENT *et al*. [14] found that the most-valued cultural services of protected areas were spread over all cultural ecosystem services (CES) subcategories (MA, 2005) in South African national parks: (1) "natural history", (2) "recreation" and (3) "sense of place". Our results confirmed the conclusions of KRUGER and SAAYMAN [15] and AMENT *et al*. [14] that visitors to protected areas have distinct travel motivations and managers of protected areas have to know and understand the visitors' base (socioeconomic backgrounds). ERTAŞ, SADIKLAR, KOÇ and DEMİREL [16] state that in the context of the sustainable development management of each touristic area it is necessary to provide the use of environmental and cultural values in a holistic way and respect the very close relationship between cultural heritage and natural heritage resources or values.

In terms of duration of stay, Pembroke Heritage Park is mostly visited for one-day recreation and tourism, because 82% of respondents did not plan to stay overnight. In 69 cases (14%) visitors came for a 2-day stay and 4% of them used the area for a long weekend stay, which means a 3 to 4-day stay (max. 1 week).

To calculate the recreational value of the area an estimate of total travel costs of visitors spending for individual services or activities is required; therefore, we could calculate the average costs for services per visitor (Table I.).

Based on the data presented, mean value of recreational costs of visitors is 127.47 € per person/day, including all

categories. We only take into account the costs particularly related to a visit of the area to calculate a recreational value of the assessed area, that means transport, local taxes and other cultural costs (museums); a mean value approximately represents €15.43 per person and per day.

Recreational value (VTR) in Pembroke Heritage Park

VRT = Sm * DM * NV = 127.47 * 1.87 * 22,000 = 5,244.115.8 €,

(VTR – taking into account all costs)

VRT = Sm * DM * NV = 15.43 * 1.87 * 22,000 = 634,790.2 €

(VTR – taking into account transport costs only)

Notes: Sm (€): average value of expenditures per person per day, DM: average length of stay, NV: average number of visitors.

Despite the fact that the total area is the smallest and one-day tourism is dominant, recreational values of our assessed area are not the lowest (Table II.) and average cost per person/per day (€) is the highest in comparison with other studies in Slovakia (Fig 2.).

Malta is a typically multicultural country, especially because of the influx of tourists from different parts of the world. According to the national composition, Maltese (28%) forming the largest group of visitors to the park. Our sample of respondents is very diverse in terms of national composition and consists of up to 26 different nationalities (UK 16%, Ireland 11%, Australia 7%, Netherlands 6%, Poland 5%, Spain 4%, Czech Republic 3%, Turkey 3%, Germany 2%, Slovak Republic 2%, Lithuania 2%, Hungary 2%, India 2%, Latvia 1%, France 1%, Italy 1%, USA 1%, New Zealand 0.5%, Japan 0.5%, Portugal 0.5%, Belgium 0.5%, Mexico 0.25%, China 0.25%, Russia 0.25%, Iceland 0.25%). According to the calculations illustrated in Table III., more than half of the respondents have Post-Secondary and Tertiary education.

3.3 Willingness-to-pay (WTP) for management in Pembroke Heritage Park

The last question of the questionnaire was hypothetical and focussed on willingness to pay an entrance fee to enter the protected area, which would be used for ensuring particular management measures for the sustainability of Pembroke Heritage Park; it was explained to respondents that financial contributions by government had been reduced and that moreover they are often inadequate, so their willingness to pay an entrance fee would serve to meet other expenses. Percentage of the amount for entrance fee that visitors would be willing to pay for supporting the development and nature conservation in our assessed protected area is presented in Table IV.

The average amount that visitors would be willing to pay as an entrance fee to the Pembroke Heritage Park is 8.69 € per person, which is the highest result in comparison with other PAs in the Mediterranean (Table V.). The relationship between the choice of whether to accept to pay an entrance fee or not and the income level was a significant albeit a negative one indicating that, when income levels increased, the willingness to pay for the use of the park tended to decrease. One would have expected persons that have more disposable income to be more willing to pay an entrance fee, however this was proven not to be the case since the correlation was a negative one. Such a relationship is in agreement with a previous similar study in the Maltese Islands which had been reported by PARASCANDALO [20]. These results contrast with those reported by NIKODINOSKA, PALETTO, FRANZESE and JONASSON [22], where increased income levels tended to increase the total mean WTP per respondent in Swedish National Park. The highest total mean WTP per respondent was found in Abisko National Park (Sweden), where the mean individual WTP were found to be 6.20 € for the provisioning services, 5.69 € for the regulating services, 6.35 € for supporting services and 4.09 € for cultural services [22]. In our study, we found out the positive linear relationship between a higher education level and willingness to pay for the use of the park. The results showed that the higher education of respondents actually increased their willingness to pay the entrance fee (Table III. and Table IV.).

IV. CONCLUSION

A very important socioeconomic factor was definitely the environment and how important people considered it in their lives. The study tried to assess and analyze the importance that respondents gave to the environment in order to see how this could affect the willingness to pay an entrance fee. The questionnaire thus had a section dedicated to the importance of the environment as perceived by respondents. Participants were asked if they thought the environment was important for the quality of their lives and, if so, to give reasons for their answers. The environment appeared to be of importance for many people, since nine out of ten respondents (90%) stated that they considered the environment to be either important or very important. Ecosystems are vulnerable to local and global impacts due to human well-being, human activities and climate change. In this study, an economic valuation of the main CES generated in the Pembroke Heritage Park effected and tourists were chosen as main stakeholders in the protected area. We found out the positive linear relationship between respondents` perception on CES and their WTP for supporting conservation activities capable of preserving the functionality of the assessed area to provide different goods and services. The connection of natural areas with cultural heritage has a long and distinctive history in the Maltese Islands. Environmental settings also function as a generator of a vast range of local identities based around a more local and everyday sense of heritage. Heritage goods, therefore, can be a source of community empowerment, as well as of potential conflict between different interests.

These outcomes could support local decision-makers in charge of the implementation of adaptive conservation management strategies in the protected area.

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Fig. 2 and the tables for this paper are in Annex 2..

ANNEX 2.

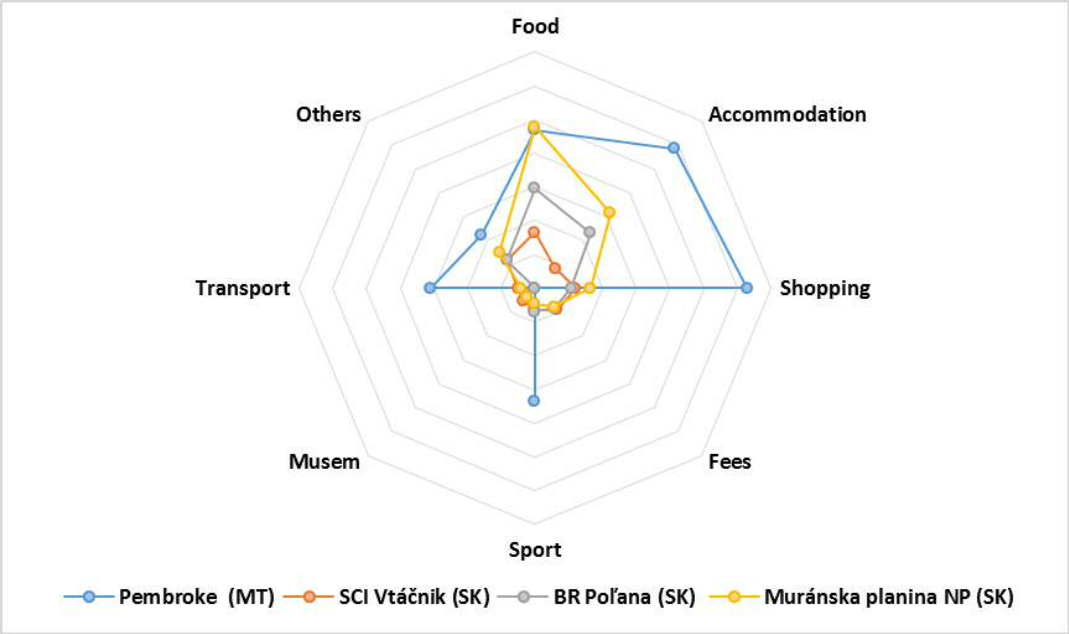
Table I. Average of visitors expenses per person and per day during their stay in the area

	0 €	**5 €**	**10 €**	**15 €**	**20 €**	**30 €**	**40 €**	**50 €**	**>60 €**	**average €**
Food	0	7	11	75	171	227	0	0	0	**23.42**
Accommodation	211	0	0	0	26	38	125	68	23	**29.26**
Shopping	55	0	0	44	51	141	92	63	45	**31.45**
Expenses	491	0	0	0	0	0	0	0	0	**0.00**
Sport	115	91	54	21	37	79	94	0	0	**16.66**
Museum	491	0	0	0	0	0	0	0	0	**0.00**
Transport	48	277	0	0	26	17	99	24	0	**15.43**
Others	193	35	21	110	47	85	0	0	0	**11.25**

Table II. Comparison of VTR in the Pembroke Heritage Park with others PAs in Slovakia

	Pembroke Heritage Park (MT)	**SCI Vtáčnik (SK)** [17]	**BR Poľana (SK)** [18]	**Muránska planina NP (SK)** [19]
Total area (ha)	60.00	10,056.59	20,360	20,318
Number of visitors per year	22,000	16,000	18,000	30,000
Average duration of stay (days)	1,87	1.38	1.59	2.29
Average costs per person/per day	**€**	**€**	**€**	**€**
Food	23.42	8.30	14.80	23.89
Accommodation	29.26	4.16	11.60	15.73
Shopping	31.45	6.00	5.40	8.24
Fees	0.00	4.56	4.10	3.92
Sport	16.66	3.15	3.50	2.26
Musem	0.00	2.55	1.60	1.78
Transport	15.43	2.50	----	2.08
Others	11.25	5.92	5.90	7.46
SUM average expenses/day	**127.47**	**37.14**	**46.90**	**65.36**
Recreational value of area calculated per 1 ha	**87,401.93**	**81.54**	**65.93**	**210.63**
Average expenses related to visiting the area per day (according to expenses related to visit the area directly)	**15.43**	**9.61**	**5.70**	**7.78**
Recreational value according to transport costs only, related to visit of the area per 1 ha	**10,579.84**	**21.10**	**8.01**	**25.07**

Note: BR - Biosphere Reserve, PA – Protected Area, NP – National Park, SK – Slovakia, MT - Malta



2. Comparison of average costs per person/per day (€) in the Pembroke Heritage Park with others PAs in Slovakia

Table III. Comparison of available demographic and socioeconomic statistics of visitors in protected areas

	Pembroke (MT)	**Salini (MT)** [20]
Number of Respodents/ Annual Number of Visitors	491 / 20,000	100 / -
Gender	**% Respondents**	
Male	57% (280)	54% (54)
Female	43% (211)	46% (46)
Average Age	37.8	40.12
Number of Members in Family of Respondent	2.91	3.84
Education Level	**% Respondents**	
Primary	3.9 % (19)	4% (4)
Secondary	27.5% (135)	44% (44)
Post-Secondary	31.3 % (154)	27% (27)
Tertiary	37.3% (183)	25% (25)
Profession Categories of Respondents	**% Respondents**	
Student	23.62% (116)	13 % (13)
Professional	16.49 % (81)	19 % (19)
Self-employed	13.24% (65)	6 % (6)
Skilled/technical	7.94% (39)	19 % (19)
Housewife/Parents on childcare	2.44% (12)	19 % (19)
Unemployed	-	7 % (7)
Pensioner	9.98% (49)	10 % (10)
Others	26.27% (129)	7 % (7)
Respondents' Income Bracket Distribution (EUR)	**% Respondents**	
<12,000 €	1.22% (6)	27 % (27)
12,001 – 19,000	2.24% (11)	24 % (24)
19,001 – 25,000	12.63% (62)	16 % (16)
>25,000 €	83.91% (412)	33 % (33)

Table IV. Comparison of average WTPs in the assessed area with other European Pas

Evaluated area	Willingness to pay	Unwillingness to pay	Don`t know
Pembroke (Malta)	95.65%	4.35%	-
Salini (Malta) [20]	33%	44%	23%
Beigua (Italy) [21]	42.6%	57.4%	-
Nestos (Greece) [21]	42.2%	52.13%	5.67%
Abisko NP (Sweden) [22]	61%	-	-
SCI Vtacnik (Slovakia) [17]	89%	11%	-

Table V. Comparison of the overall willingness to pay in the assessed area with other European Pas

Evaluated Area	Average of WTP (EUR)
Pembroke (Malta)	**8,69**
Salini (Malta) [20]	**0,84**
Beigua (Italy) [21]	**1,91**
Nestos (Greece) [21]	**1,78**
Abisko NP (Sweden) [22]	**22.33**
SCI Vtacnik (Slovakia) [17]	**2.56**

Potential for Renewable Energy Production from Wastes Generated in a Pigs Farm and Slaughterhouse

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Biogas produced from wastes is regarded as advanced biofuel and is under current EU regulation promoting the growth of advanced biofuels. In this study, we have assessed the potential of a pigs farm and an adjacent slaughterhouse and meat processing enterprise to produce not only meat, but energy as well, through anaerobic digestion of wastes produced during current activities to produce biogas as energy carrier. Laboratory equipment used in the Laboratory of Industrial Microbiology and Biotechnology is an Automatic Methane Potential Test System – AMPTS II. The investigated samples and quantities used in the present experiment were prepared according to standard protocol VDI4630 and BPC. We have assessed the potential of a pig's farm and an adjacent slaughterhouse and meat processing enterprise to produce biogas as energy through anaerobic digestion of wastes generated in production activity. The results indicate solid sludge and fats resulted from slaughterhouse to produce high yields of methane reported to dry organic matter. Although organic wastes resulted from slaughterhouse can generate high quantities of methane by anaerobic digestion, large quantities of organic wastes are generated in the assessed pig's farm and the potential for energy production is much higher in the case of pig's farm than slaughterhouse. Combining organic wastes generated in the pig's farm with the organic wastes resulted from slaughterhouse, or organic wastes generated in the pig's farm with the biomass produced on 200 hectares of triticale as catch crop, can supply the feedstock necessary to operate an one-megawatt installed power biogas plant.

Keywords: renewable energy, biogas, biomethane, potential.

IV. INTRODUCTION

Anaerobic digestion is probably the most appealing process to be applied in agricultural farms in order to convert organic wastes produced during farming activities into energy and – not less important – into organic fertilizer.

In this study, we have assessed the potential of a pigs farm and an adjacent slaughterhouse and meat processing enterprise to produce not only meat, but energy as well, through anaerobic digestion of wastes produced during current activities to produce biogas as energy carrier. Biogas produced from wastes is regarded as advanced biofuel and is under current EU regulation promoting the growth of advanced biofuels. In January 17th 2018 EU Parliament adopted RED II (Renewable Energy Directive), by which all EU countries must ensure that at least 10% of their transport fuels come from renewable sources by 2020 and that minimum share of advanced biofuels to be gradually increased from at least 0.5% in 2021 to at least 3.6% in 2030 [1].

V. MATERIALS AND METHODS

The organic wastes were sampled and investigated in the Laboratory of Industrial Microbiology and Biotechnology from University of Agricultural Science and Veterinary Medicine "King Michael I of Romania" from Timișoara. The first analyses were made to establish dry mater content and organic load. Based on the results, suitable recipes for anaerobic digestion (AD) were calculated, and were subjected to AD process by using AMPTS II laboratory equipment, in order to point out the Biochemical Methane Potential (BMP) of the sampled organic materials. The conversion of biomass to biogas was tested according to the widely accepted German standard protocol VDI 4630 [2].

Samples were harvested from pigs farm and from slaughterhouse as follows:

1 - Animal fats from slaughter house
2 – Waste-water from slaughter house pumping station
3 - Solid sludge from slaughter house
4 - Pigs slurry from storage tank
5 - Pigs slurry from pumping station (previous storage tank)
6 – Triticale silage (energy biomass, as control)
7 – Inoculums – harvested from a functional on-farm biogas plant.

The dry matter, i.e. all inorganic and organic compounds, is expressed as DS and was measured according to standard protocols, by keeping samples 24 h on 105ºC in order to remove all water content [2,3].

Experimental set-up

Laboratory equipment used in in the Laboratory of Industrial Microbiology and Biotechnology is an Automatic

Methane Potential Test System – AMPTS II, developed by Bioprocess Control Sweden AB (BPC), which has 15 digesters of 600 ml total volume. For high accuracy experimental data records, the BMP investigated for each sample was achieved as triplicates, according to BPC protocol [4].
The investigated samples and quantities used in the present experiment were prepared according to standard protocol VDI4630 and BPC [2,4].
The batches were subjected to mesophilic digestion, at incubation temperature of 37ºC.

VI. RESULTS AND DISCUSSIONS

The BMP test is used to establish the amount of methane and consequently the energy produced in mixtures of several organic substrates, to establish the amount of incentives offered in cases of energy production from waste materials versus dedicated crops etc.

The recorded data represent the average values of daily methane production in Normal milliliters of methane generated in each triplicate consisting of three 600 ml digesters containing 400 ml digestion medium. For a clearer picture regarding flow rates and gas methane dynamics, the recorded data are plotted in the graph in table 1.

Table 1: Methane yields during anaerobic digestion

Day	1 Animal fats [Nml/day]	2 WW slaughter house [Nml/day]	3 sludge slaughter house [Nml/day]	4 pigs slurry tank [Nml/day]	5 pigs slurry pumping [Nml/day]	6 triticale [Nml/day]	7 mixture (2+3+4) [Nml/day]	8 inoculum [Nml/day]
0	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2	160,55	101,50	229,90	237,30	155,85	325,85	250,70	114,40
4	136,55	68,00	256,10	105,50	89,15	131,00	132,95	83,00
6	101,95	35,45	164,40	34,85	53,10	83,60	65,95	71,50
8	77,40	22,70	95,80	25,95	34,35	64,50	45,65	58,70
10	70,00	18,25	60,60	25,30	27,70	46,35	32,20	52,30
12	61,05	13,75	43,30	19,90	29,90	36,15	24,15	43,00
14	48,95	9,95	29,90	13,60	27,50	30,45	19,15	34,00
16	40,80	7,00	20,90	12,00	22,40	27,20	16,10	29,00
18	42,90	5,20	16,30	9,80	16,85	21,25	13,95	24,90
20	30,60	3,30	12,70	7,80	10,35	14,40	12,10	18,90
22	21,80	3,20	11,70	8,15	9,85	10,70	10,80	16,20
24	19,50	4,25	8,70	11,15	8,80	11,55	11,65	18,00
Average total yields [Nml]	**1727,5**	**690**	**2016,1**	**1171,5**	**1115,5**	**1725,3**	**1375,6**	**1234,2**

Data in table 1 reveals high production of biogas when the mixture of energy crop and inoculum from a large-scale biogas plant is used as substrate (triticale silage). Organic wastes generated in both locations – pigs farm and abattoir produce important quantities of methane although lower than energy crop used as control.

When data generated in laboratory scale digesters are used in BMP (Biochemical Methane Production) test, methane yields are reported to mass of organic matter. BMP test is a simple batch assay developed to determine the methane production of a given organic substrate during its anaerobic decomposition.

After calculating BMP for each type of substrate, data indicates the highest methane yields in solid sludge and fatty residues generated in abattoir. The late substrate generate similar yields as energy crop triticale.

Economic aspects

The results generated in laboratory assay and by analyses and calculations, were used to quantify the amount of energy to be generated on-site. The calculation is based on quantities of organic materials generated during a 12 months period, most of data provided by the farmer.

Our assessment is in concordance with other researches [5] and indicates that conversion on-site of diluted abattoir residues is not an efficient option, as high capital and operational costs are needed to convert large quantity of diluted waste-water to produce low quantity of energy. A more efficient option is to transport the separated sludge and fats from the waste water treatment plant (w.w.t.p.) of the slaughterhouse to the pigs farm and convert the mixture of farm wastes and w.w.t.p. sludge and fats to biogas. The conversion can be made in simple digesters as covered lagoons or mixed and covered storage tanks. A close-range quantity of energy, (enough to feed a 900 kWe CHP unit) can be obtained if ensiled triticale obtained from around 100 hectares of land is added to the digester containing the organic wastes from pigs farm. A surface of around 200 hectares of agricultural land cultivated with triticale as catch-crop is sufficient to be added to organic wastes from pigs farm to feed a one-megawatt CHP unit.

VII. CONCLUSION

Although organic wastes resulted from slaughterhouse can generate high quantities of methane by anaerobic digestion, large quantities of organic wastes are generated in the assessed pig's farm and the potential for energy production is much higher in the case of pig's farm than slaughterhouse.

Combining (1) organic wastes generated in the pig's farm with the organic wastes resulted from slaughterhouse, or (2) organic wastes generated in the pig's farm with the biomass produced on 200 hectares of triticale as catch crop, can supply the feedstock necessary to operate an one-megawatt installed power biogas plant.

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Assessment of ethanol production from agricultural Assessment of ethanol production from agricultural lignocellulosic biomass using on-site cellulases from *Trichoderma viride*

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Abstract: Lignocellulosic biomass, like wheat straw and corn stalks, is generated world wide as residues from agricultural activities, or cultivating special crops. The yield, productivity and cost for the enzymatic hydrolysis of cellulose to glucose are crucial for the production of second generation ethanol. In this study we evaluate the activity of a crude extract of a local strain of *Trichoderma viride*. The enzymes are the whole cellulolytic enzyme pool produced in SSF culture by *T. viride CMIT3.5*. These enzymes were used in combination with cellobiase from *Aspergillus niger* – Novozyme 188 to hydrolyze two types of biomass: wheat straws and corn stalks. The pretreated was hydrolyzed at 50°C, pH 4,8 for 96 hours applying 15 U of cellulase/gram cellulose and 90 U of cellobiase/gram cellulose. Calculating the ethanol yields reported to lignocellulose (DM), the following results were obtained: 0.272 g g^{-1} wheat straw and 0.186 g g^{-1} for corn stalks. Our calculations indicate regions having high agricultural productions as suitable for a 50000 tones capacity ethanol biorefinery capable to process one half of the entire straw production. The surface needed to provide the feedstock necessary for the biorefinery: around 10000 km^2 need to be covered to harvest the agricultural residues for bioethanol production in agricultural areas as south-west and west regions with counties of Timis and Dolj. As for montaineous and colinary region Center, 34000 km^2 can provide just over one half of the feedstock necessary for a commercial scale biorefinery.

Keywords: renewable energy, biorefinery, lignocellulose, biomass

IX. Introduction

Various types of lignocellulosic biomass, such as agricultural residues (straws, stalks, husks etc), or special energy crops are generated worldwide and is available virtually everywhere on dry land from equator to polar circles. The conversion of lignocellulose to biofuels and other biochemicals, up to date is made by application of processes consisting on mainly three steps: in the first step the lignocellulosic complex is degraded or disrupted; in the second step the carbohydrate biopolymers (cellulose, hemicellulose) are hydrolyzed to simple sugars; and the final step consists of fermentation of sugar to biochemicals [1]. In Romania, millions of tons of lignocellulosic biomass, especially wheat straw and corn stalks are generated yearly as residues from agricultural activities. Although some of these materials can be used in many sectors of the economy, a large part of the lignocellulosic biomass is left on the fields and is degraded more or less in time, depending mainly on soil microbiota. This surplus can be used as feedstock for biorefineries. With Romania being the place for building the largest lignocellulosic biorefinery in Europe [2], this region will provide agricultural residues for production of lignocellulosic ethanol. "*At full capacity, the plant will process around 250 000 tons of wheat and other cereal straw sourced from local farmers to 50 000 tons of cellulosic ethanol annually*." [2].

In this study, the main objectives are to evaluate the possibility to produce on-site cellulases, to be used in the lignocellulosic ethanol production chain and to assess the regional potentials to provide feedstock for a commercial biorefinery for lignocellulosic bioethanol, in three regions of Romania.

X. Material and Methods

The research setup in this study is a combination of laboratory tests and assessments of potentials regarding production of bioethanol, as study case, from main lignocellulosic residues from Center, South-West and West regions of Romania. In our laboratory tests, we have used cellulolytic fungi to produce enzymes for hydrolysis of agricultural residues. The fresh enzymatic cocktail produced in laboratory was applied to hydrolyze residual lignocellulozic biomass. The resulted hydrolysate was fermented to ethanol. For assessment of regional potentials regarding production of lignocellulosic ethanol, we have used data from National Institute of Statistics (INS) Romania [3], indicating the regional productions of main cereals (wheat, corn, barley and rye).

Laboratory tests regarding production of cellulase and conversion of biomass to ethanol

Fungi used in our research for cellulase production are preserved in the Collection of Industrial Microorganisms of Timisoara (CMIT), from the Faculty of Animal Science and Biotechnology from Timisoara as spores suspension by freezing at –70°C in glycerol 16% as cryoprotective agent. The microorganisms used in this experiment are: two strains of *Trichoderma:*

- *T. viride* CMIT3.4 (other name: *T. viride ATCC13.631);* and

- *T. viride* CMIT3.5 (other name: *T. viride* CMGB1, isolated by University of Bucharest, Faculty of Biology).

1. Submerged liquid cultures (SLC)

Spores suspension of *Trichoderma* were obtained by washing the surface of cultures obtained above with Mandels liquid medium The liquid cultures were obtained by inoculation 50 ml Mandels media containing 1% cellulose (Avicel, Fluka) in 300 ml flasks with 10% spores suspension of *Trichoderma*. The inoculated media were incubated in a water bath with shaker at 28°C, 180 r.p.m., for 21 days. Probes were harvested in regular basis to verify the purity of the cultures, development of fungi and cellulolytic activity.

2. Solid-state cultures (SSC)

In this case, the cellulosic substrate used as carbon source is wheat bran. The substrate was distributed in 300 ml Erlenmayer flasks in 1 cm layers (50 ml or 13 grams). The flasks with wheat bran were autoclaved 30 minutes at 121°C (1 bar). The flasks with cellulosic biomass represent the following experimental variants:

- **SSC** – represent solid-state culture with biomass washed as described above, which will be incubated 21 days at 28°C;
- **SSC+f** - represent solid-state culture with biomass washed as described above, which will be incubated 21 days at 28°C. Every seven days a flushing will be made (f = flushing) with two volumes of nutritive solution. This flushing brings nutrients and wash out cellulases and released soluble sugars;
- **SSC+fc** - represent solid-state culture with biomass not washed after pretreatment (we assume that the released sugars during pretreatment inhibit the cellulase production). Incubated 21 days at 28°C and every seven days a flushing will be made with two volumes of nutritive solution (fc = flushing, control).

Assays. Total reducing sugars were determined colorimetric using dinitrosalicylic acid reagent, cellulase activity was determined using the modified method of Mandels [5], using as substrate filter paper; the activity is expressed in FPU (filter paper units).

Lignocellulosic biomass as raw materials

Dry wheat straw and corn stalks were obtained from the didactic farm of University of Agricultural Science from Timisoara. The biomass was air-dried and milled with a hammer mill to a mesh sieve of 2 mm.

Pretreatment of the raw material

We used two types of pretreatment. One is a combination of physical and chemical pretreatments indicated by previous research (J. MOHAMAD & al. **[6]** T. VINTILĂ & al **[7]**) to be optimal for this kind of raw materials (steam combined with 2% NaOH).

Enzymatic hydrolysis of the raw material

Pretreated biomass was used as substrate in enzymatic hydrolysis stage. The hydrolysis of pretreated biomass was performed as follow: after autoclaving, the flasks were left to cool to 45°C. Enzymatic cocktail obtained in previous phase by cultivation *Trichoderma* strains were used for hydrolysis at 50°C, pH 4,8 for 96 hours applying 15 U of cellulase/gram cellulose contained in the pretreated biomass. To enhance the effect of endoglucanases from *Trichoderma*, we have added to the enzymatic cocktail 90 units of cellobiase from *Aspergillus niger* – Novozyme 188/gram cellulose. After addition of enzymes, the flasks were incubated at 50°C. The flasks were stirred for 5 minutes every 24 hours. Stirring of the flasks content disperse the biosolids for a better contact with the enzyme, reduces scum build-up, dilutes level of inhibitors, retains inorganic material in suspension and reduces thermal stratification (R.H. ZHANG & Z.Q.ZHANG **[8]**).

Fermentation

The hydrolysates containing fermentable sugars obtained in the previous step were fermented by yeasts to produce ethanol and CO_2. The yeast strain used in this phase was *Saccharomyces cerevisiae CMIT* 2.21 from the collection of Industrial Microorganisms of the Laboratory of Applied Microbiology from Banat's University of Agricultural Science of Timisoara. We inoculated the fermentation media with 2.5 g (humid biomass) of yeast for each 100 ml. The fermentation of the 4 batches was done 4 days in water bath incubator at 30°C.

XI. Results and discussions

Activity curves for the two strains of *Trichoderma* were obtained in submerged liquid cultures using wheat bran as substrate. The maximum activities were 0,46 FPU/ml for *Trichoderma viride* CMIT3.4 from the 7th day until the 14th day and 0,76 FPU/ml for *Trichoderma viride* CMIT3.5 in the 10th day.

In solid-state cultures, data indicate a higher rate of enzyme synthesis and higher accumulation of enzymes in the first seven days of incubation (table 1). The values in the table show the activity of the cellulases harvested in the flushing liquid, which represents double volume of the culture (100 ml liquid used to wash 50 ml solid culture). This means that each flushing harvest a quantity of enzyme much higher than the quantity of enzymes that can be excreted in submerged cultures. For example, *T. viride* CMIT3.5 has expressed 0,98 FPU/ml in 50 ml liquid culture as the maximum activity. In solid-state cultures, with the first flushing, 0,98 FPU of cellulases / ml was harvested in 100 ml washing liquid. Analyzing the values in table 1, it can be concluded that washing cellulose before inoculation leads to higher production in the first cycle of 7 days of incubation (0,61 FPU/ml in the flask with washed biomass (SSC+f), compared with 0,46 FPU/ml in the flask with unwashed biomass (SSC+fc) in *T. viride* CMIT3.4. Still, it can be observed that the productivity in *T. viride* CMIT3.4 has increased in SSC+fc flask (unwashed biomass) after the first cycle of 7 days, probable due to glucose removal with the first flushing. The cellulolytic activity of *T. viride* CMIT3.5 is higher in the first cycle of 7 days, but decreases and is surpassed by the activity of *T. viride* CMIT3.4 until the last cycle. These data indicate that cellulolytic activity of *T. viride* CMIT3.4 is inhibited by the content in reducing sugars, while *T. viride* CMIT3.5 is less affected by the content in sugars of culture medium. This can be concluded from the activity in SSC without flushing, where

T. viride CMIT3.5 express an activity 3 times higher than T. viride CMIT3.4 (0,46 FPU/ml, compared to 0,15 FPU/ml). The total production in cellulase can be found multiplying the activities of enzymes (FPU/ml) in each flushing with 100 (the volume of flushing liquid) and adding the productions of each of the three cycles.

Table I. Production of cellulase of tested strains in solid-state cultures in wheat bran

Strain	Production of cellulase (FPU / ml of washing liquid)						
	7 days		14 days		21 days		
	SSC+f	SSC+fc	SSC+f	SSC+fc	SSC+f	SSC+fc	SSC
T. viride CMIT3.4	0,61	0,46	0,61	0,8	0,15	0,3	0,15
T. viride CMIT3.5	0,98	0,91	0,61	0,46	0,15	0,15	0,46

Hydrolysis of lignocellulosic biomass

The highest yield of total sugars was observed in pretreated wheat straw: between 20.8 g and 35.6 g total sugar/100 g biomass, followed by pretreated corn stalks: between 12.73 g and 13.23 g total sugar/100 g biomass.

Our results are comparable with those reported by C.L. Hsu & al. (2011) who obtained 27.1 g total sugars/100g DM in case of treating the corncob with 0.25-0.5 % sulfuric acid/20 minutes(C. L. HSU & al. [8,9]).

It is important to mention that in implementation of a large-scale technological process, important data need to be considered, such as: if the crude extract can be concentrated; if it can be used immediately to hydrolyze lignocellulose (the storage of the cellulolytic extract leads to important decrease of enzymatic activity); if the quantity of cellulase that can be daily produced on-site, can cover the production capacity of the biorefinery. The assessment should consider solid state fermentation system as an alternative to produce low-cost and more concentrated cellulolytic preparates [10-13].

Fermentation of hydrolysates to ethanol

In each batch the initial concentration of biomass was 136 g (DM). During the hydrolysis and fermentation process the biomass was decomposed, and at the end of the experiment we recovered the following quantities of fermentation residues (DM): 11.27 g physicochemical pretreated corn stalks and 20.44 g physicochemical pretreated wheat straw. These indicates results regarding biomass hydrolysis and liquefaction rates.

In the batch bottles containing physicochemical pretreated wheat straw, after fermentation of 15% DM lignocellulose (136 g DM/900 ml hydrolysis medium), a maximum concentration of 4.08% ethanol was produced. After the fermentation of corn stalks hydrolysates, the maximum concentration of ethanol was 3.10% for mechanical pretreated corn stalks. Calculating the yields of ethanol reported to lignocellulose (DM), the calculations generated the following results: 0.272 g g^{-1} physicochemical pretreated wheat straw and 0.186 g g^{-1} for physicochemical pretreated corn stalks. Our results are comparable with those reported by other researches, for example J. Szczodrak obtained 2.4% (w/v) ethanol after fermentation with *S. cerevisiae* of 10% (w/v) DM chemically treated wheat straw (ethanol/lignocellulose yield 0.24 g g^{-1}), while in the SSF, the production increased to 3% (ethanol/lignocellulose yield 0.3 g g^{-1}) (J. SZCZODRAK [14]). These results demonstrates that using *S. cerevisiae* as fermenting organism, the productivity in terms of ethanol/lignocellulose yield is comparable with processes using recombinant *E. coli* strains as fermenting organism, as in study reported by B. C. Saha and M. A. Cotta in 2007. In their research, the concentration of ethanol from lime pretreated enzyme saccharified wheat straw by recombinant *E. coli* strain FBR5 was 2.25%, with a yield of 0.29 g g^{-1} straw. In the case of SSF by the *E. coli* strain, the ethanol concentration was 2.06 % with a yield of 0.26 g g^{-1} straw (B. C. SAHA & M. A. COTTA [15]).

Assessment regional potential for bioethanol production

Our laboratory results, in concordance with others [8,9,10,11,12] indicate an average production potential of 200 – 250 ml ethanol per 1 kg of agricultural residual biomass. The question raised in our studies is: ***what are the potentials in different regions to provide agricultural residues for a 50000 tons commercial scale lignocellulosic ethanol biorefinery***? We assume that half of an entire region straw production can be harvested from the fields and transported to the biorefinery. We consulted the INS data [3] and selected six areas for our study: three regions (West, South-West and Center) and three counties: Dolj, Timis and Sibiu. The reasons for this selection was the surface and the geography – we assessed regions with large agricultural areas and regions with high relief and lower agricultural productions. See table 2 data regarding examples from six regions in Romania: South-West region, Dolj County, West region, Timis County, Centre region, Sibiu County.

Table II. Availability of feedstock and potentials for bioethanol production

Region (surface)	Main cereals production, tons	Production, average, tons	Straw (1:1 grain: straw), tons	Straw available (40%), tons	Ethanol from straw, t/y	% from 50000 tons biorefinery
South-West (29212 km^2)	**2347000-3230000**	**2788500**	**2788500**	**1115400**	**223080**	**446**
Dolj County (7414 km^2)	**900000-1352000**	**1126000**	**1126000**	**450400**	**90080**	**180**
West (32034 km^2)	**2034000-2650000**	**2342000**	**2342000**	**936800**	**187360**	**375**
Timis County (8697 km^2)	**983000-1416000**	**1200000**	**1200000**	**480000**	**96000**	**192**
Centre (34100 km^2)	**990000-1208000**	**1099000**	**1099000**	**439600**	**87920**	**176**
Sibiu County (5432 km^2)	**124000-150000**	**137000**	**137000**	**54800**	**10960**	**22**

Our calculations indicate regions having high agricultural productions as suitable for a 50000 tones capacity ethanol biorefinery capable to process one half of the entire straw production. Studying data in table 2, it can be assumed the surface needed to provide the feedstock necessary for the

biorefinery: around 5000 km^2 (≥70 x 70 km) need to be covered to harvest the agricultural residues for bioethanol production in agricultural areas as south-west and west regions with counties of Timis and Dolj. As for mountainous and hilly region Center, 34000 km^2 can provide similar quantity of feedstock as 7000-8000 km^2 in agricultural areas from western Romania.

Of course, these numbers are purely assumptions, the figures can be re-evaluated, but the main picture doesn't change much. To produce ethanol exclusively from agricultural lignocellulosic residues, it needs large surfaces to be cleared of biomass and the harvest has to be transported long distances.

XII. CONCLUSION

Comparing the productions of cellulases in the systems applied in this study, data indicate the system of solid-state culture with flushing as the most efficient. *T. viride CMIT3.*5 has higher cellulosic activity than *T. viride CMIT3.4* in laboratory conditions, which recommend this local strain to be used in industrial applications for cellulase production. Although in the first part, the crude extract of cellulases from the local strain of *T. viride CMIT3.5*, released the highest amount of glucose, the fresh enzymatic cocktail is not stable in time. These data allow us to conclude that even on-site cultures of *Trichoderma* can be considered in a biorefinery, for production of low cost cellulases.

In summary, this work demonstrates once more the potential of producing fermentable sugars from agricultural residues. There is a wide range of cellulases commercially available that can be applied for hydrolysis of lignocellulose. Price, enzymatic activity, stability and availability are the most important parameters to be consider in selecting a cellulolytic preparate to be used on large scale for hydrolysis of lignocellulose.

This work provides guidelines for determining the economic estimations in the technological processes of conversion of lignocellulosic materials to ethanol and other biochemicals.

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STUDIES CONCERNING THE PHYTOREMEDIATION OF SITES DEGRADED BY MINING ACTIVITIES WITH *ROBINIA PSEUDOACACIA*

Adriana, Mihaela, Chirilă Băbău[65], Valer, Micle[66]*, Gianina, Elena, Damian[67], Ioana, Monica, Sur[68]

* Valer Micle

Abstract: Under the current economic growth and population, there is a pressing need to develop and implement effective technologies for environmental remediation. The technologies of interest at present are ecotechnologies. The cyanide mining is one of the most polluting industries in the world. Past mining activity in Romania has led to the pollution and set-aside of large areas of land and has adversely affected the environment. The present study aimed at the phytoremediation ability of the *Robinia pseudoacacia* species using experimental variants prepared. On the experimental variants were used: 99.5% KH2PO4 solution, enzyme solution and tap water. The results indicated that the seeds developed much better in the enzyme solution. The germination rate of the seeds in the control solution did not show a germination rate of more than 50%. The roots, stems and leaves developed much better in the variant with enzymatic solution, but were close and solution variants.

Keywords: phytoremediation, *Robinia pseudoacacia*, experimental variant, rates of germination, heavy metals.

XIII. AIMS AND BACKGROUND

Phytoremediation is a technology that can recover the contaminated soils [1] [2]. The organic matter in the soil can lead to immobilization of heavy metals and may also contribute to the remediation of contaminated sites [3]. Heavy metal pollution is an issue that concerned all humanity [4] [5]. Some plant species can be considered as hyperaccumulators that can absorb a large amount of heavy metals from soils [6] [7]. The lead and cadmium are toxic to the humans, animals or plants body even at low concentrations [8] [9]. The *Robinia pseudoacacia* can be planted on soils contaminated with heavy metals because of high resistance to these metals, due to rapid growth and deep root system [10] [11] [12] [13].

Therefore, the main objective of this research was to determine the potential of *Robinia pseudoacacia* for the phytoremediation of contaminated sites with lead and cadmium in various solutions and experimental variants.

XIV. EXPERIMENTAL

The experimental phytoremediation at the laboratory level involves three stages: seed preparation, preparation of experimental variants, potting sowing of white acacia seeds and preparing various solutions in order to find the effective method to improve the phytoremediation process. The sterile material used in the phytoremediation experiment was taken in June 2017. The soil collected from the Cotorăști mountain area was used as the reference soil in this experiment. The pots with different types of experimental variants were watered with 99.5% KH_2PO_4 solution and enzymatic solution every week. Each experimental variant was multiplied three times in pots, the composition of which is shown in Table 1.

Table 1. Composition of pots used in the phytoremediation experiment with *Robinia pseudoacacia*

The name of the pot	The content of the pot
1 (a, b, c)	sterile material (1000 g)
2 (a, b, c)	sterile material (1000 g) + enzymatic solution
3 (a, b, c)	sterile material (1000 g) + solution of KH_2PO_4 (99,5 %)
4 (a, b, c)	unpolluted soil (reference) (1000 g)
5 (a, b, c)	sterile material (500 g) + unpolluted soil (500 g)
6 (a, b, c)	sterile material (500 g) + unpolluted soil (500 g) + enzymatic solution
7 (a, b, c)	sterile material (500 g) + unpolluted soil (500 g) + solution of KH_2PO_4 (99,5 %)
8 (a, b, c)	sterile material (800 g) covered with sludge (200 g)

The phytoremediation experiment was conducted in the laboratory of soil quality analysis laboratory and depollution processes in the Department of Environmental Engineering and Entrepreneurship of Sustainable Development, Faculty of Materials and Environmental Engineering, Technical University of Cluj Napoca. The plantlets were harvested from pots seven weeks later. Biometric measurements were perfermed on plants by determining the height of the plantlets, the length of the roots and the stem together with their leaves.

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XV. RESULTS AND DISCUSSION

The concentration of lead found in the sample of material sterile was 2489 mg / kg and the copper concentration was 424 mg / kg. These concentrations exceeded the alert and the intervention threshold of the order 756/1997 issued by the Ministry of Waters, Forests and Environmental Protection for less sensitive land use [14]. Finally the seeds have germinated spectacularly in the variant 6 and the smallest seed germination rate was reported in variant 8. The highest and lowest germination rate of acacia seed in relation to each type of variation formed are shown in the graphs below.

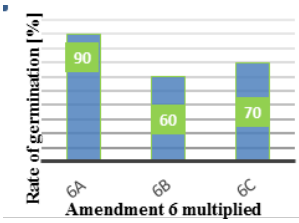

Figure 1. The germination rates of *Robinia pseudoacacia* seed in the multiplied variant 6

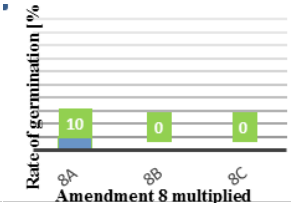

Figure 2. The germination rates of *Robinia pseudoacacia* seed in the multiplied variant 8

The results obtained at the measurement of the lengths and amounts of the roots of each plant (*Robinia pseudoacacia*) from each pot and experimental variant are presented in the figure 3 and 4.

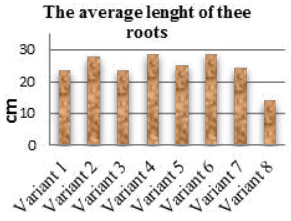

Figure 3. The average length of *Robinia pseudoacacia* roots

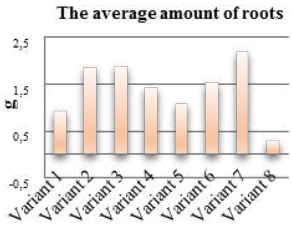

Figure 4.The average amount of *Robinia pseudoacacia* roots

The results showed that the solutions used on the prepared variants increased the growth and development of the plantlets.

XVI. CONCLUSION

The results obtained shown that the seed *of Robinia pseudacacia* developed much better in the enzymatic solution than in the monobasic potassium phosphate solution. The variant 8 had the lowest germination rate. The control variant did not show a germination rate of more than 50% for any of its pots. Also, the roots, stems and leaves of the white acacia have developed much better in variants with the enzymatic solution than in the variants with monobasic potassium phosphate solution.

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Preparation of Papers for GLOREP Conference(NOVEMBER 2018) (24 points, bold, center)

First Name, Family Name Author[69]*, First Name, Family Name Author[70](TNR, 11 points, centered, capitalize first letter

**corresponding author*

Abstract: (TNR, 10 points, bold, justify) These instructions give you guidelines for preparing papers for GLOREP CONFERENCE, November, 2018. Use this document as a template if you are using Microsoft *Word* 2007 or later. Otherwise, use this document as an instruction set. Paper titles should be written in uppercase and lowercase letters, not all uppercase. Avoid writing long formulas with subscripts in the title; short formulas that identify the elements are fine (e.g., "Nd–Fe–B"). Full names of authors are preferred in the author field. Put a space between authors' initials. The abstract must be a concise yet comprehensive reflection of what is in your article, self-contained, without abbreviations, footnotes, or references. Size of abstract should be between 150–250 words, written as one paragraph and mathematical equations or tabular material are not allowed.

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For this Conference the files must be sent also in MS Word format to glorep2018@upt.ro and should be formatted for direct printing. Font size of the text of the paper should be 10, TNR, justify. Highlight a section that you want to designate with a certain style, and then select the appropriate name on the style menu. Use this template when preparing the paper. The style will adjust your fonts and line spacing. Do not change the font sizes or line spacing to squeeze more text into a limited number of pages.Use italics for emphasis; do not underline text. To insert images in *Word,* position the cursor at the insertion point and either use Insert | Picture | From File or copy the image to the Windows clipboard and then Edit | Paste Special | Picture (with "float over text" unchecked).

Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have already been defined in the abstract. Abbreviations such as "SI", "ac", and "dc" do not have to be defined. Abbreviations that incorporate periods should not have spaces: write "C.N.R.S.," not "C. N. R. S."

A. Other Recommendations

Use one space after periods and colons. Hyphenate complex modifiers: "zero-field-cooled magnetization." Avoid dangling participles, such as, "Using (1), the potential was calculated." [It is not clear who or what used (1).] Write instead, "The potential was calculated by using (1)," or "Using (1), we calculated the potential."

Use a zero before decimal points: "0.25," not ".25." Use "cm^3," not "cc." Indicate sample dimensions as "0.1 cm × 0.2 cm," not "0.1 × 0.2 cm^2." The abbreviation for "seconds" is "s," not "sec." When expressing a range of values, write "7 to9" or "7-9," not "7~9."

If you wish, you may write in the first person singular or plural and use the active voice ("I observed that ..." or "We observed that ..." instead of "It was observed that ..."). Remember to check spelling. If your native language is not English, please get a native English-speaking colleague to carefully proofread your paper.

XVIII. Math

If you are using *Word,* use either the Microsoft Equation Editor or the *MathType* add-on (http://www.mathtype.com) for equations in your paper (Insert | Object | Create New | Microsoft Equation *or*MathType Equation). "Float over text" "*not"* should be selected.

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Number of equations consecutively with equation numbers in parentheses flush with the right margin, as in (1). First use the equation editor to create the equation. Then select the "Equation" markup style. Press the tab key and write the equation number in parentheses. Use parentheses to avoid ambiguities in denominators. Punctuate equations when they are part of a sentence, as in

$$X = a \cdot b \quad (1)$$

Be sure that the symbols in your equation have been defined before the equation appears or immediately following. Italicize symbols (*T* might refer to temperature).

[69]*The first author affiliations, e-mail
[70] The second author affiliations, e-mail

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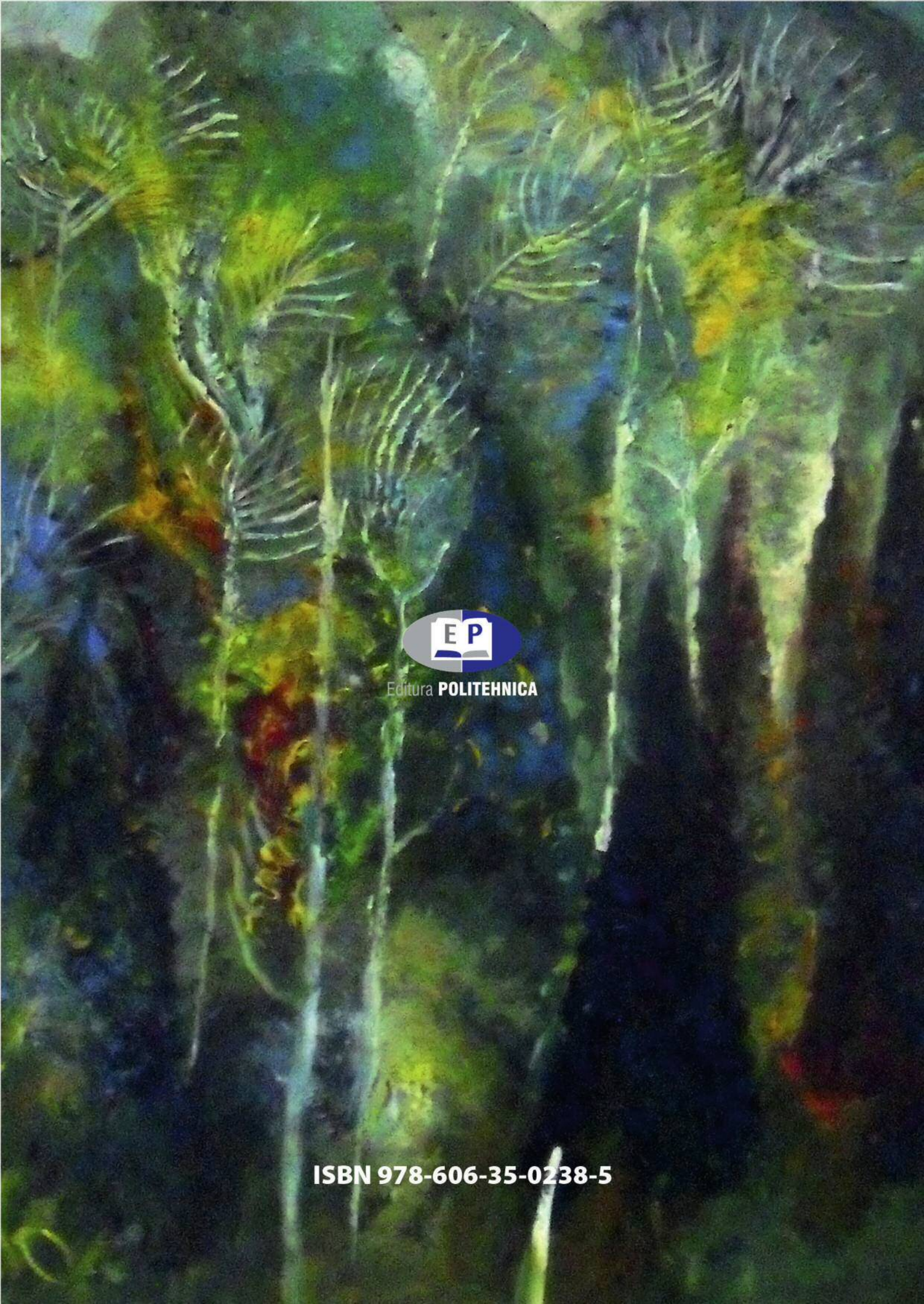

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