WBAA

WESTERN BALKANS ALUMNI ASSOCIATION

"1st scientific conference for

CRITICAL ENVIRONMENTAL ISSUES

OF THE WESTERN BALKAN COUNTRIES"

BOOK OF ABSTRACTS

October 28th to 30th, 2019, Faculty of Agriculture,

Goce Delčev University, Štip, Republic of North Macedonia

ORGANIZERS:

Goce Delčev University, Faculty of Agriculture, Štip, Republic of North Macedonia

WBAA-Western Balkan Alumni Association

The conference is organized within the project titled **"**Creating sustainable transfer of knowledge for building novel ideas for critical environmental issues of the western Balkan countries", **project number 2019-B1_010, financed by Western Balkans Alumni Association.**

WELCOME

On behalf of the project coordinators of

"CREATING SUSTAINABLE TRANSFFER OF KNOWLEDGE FOR BUILDING NOVEL IDEAS FOR CRITICAL ENVIRONMENTAL ISSUES OF THE WESTERN BALKAN COUNTRIES"

Project number **2019-B1_010**

financed by Western Balkans Alumni Association

The project involves networking of students and scientific researchers from Western Balkan countries for creating dataset base of the latest chemo-metric approaches for environmental pollution/protection and ecological effects as well. Even the environmental pollution is a global problem, the latest research indicate that the Western Balkan countries are significantly affect with the environmental pollution. Furthermore, the Western Balkan countries still deals with the problem of poor population awareness for environmental protection. Therefore, this project idea is to unite knowledge from Western Balkan countries and share with youth from this region, increasing the environmental protection awareness within students. Therefore, the students will have the main role in lunching the environmentally friendly aspects for creating novel chemo-metric models in environmental sciences. The beneficiary effect for the Western Balkan students will be creating long-term valuable and sustainable correlations.

The project has regional focus, networking six universities from the Western Balkan countries (students and scientific experts-University professors). Furthermore, this project has a national focus for the students from three state Universities from North Macedonia (students from "Goce Delčev" University in Štip, "Ss Kiril and Methodius" University in Skopje and University in Tetovo). Even the environmental pollution is a global problem, the latest research indicate that the Western Balkan countries are significantly affected with the pollution, pointing strongly on heavy metal industry, uncontrolled xenobiotic introduction in the different parts of the environment, electronic waste disposal etc. Furthermore, the Western Balkan countries still deals with the problem of poor population awareness for environmental protection. Therefore, this project will involve regional and national students and scientific researches in order to provide novel chemo-metric methodology and beneficial environmental protection methods.

The project intends to involve three national and five regional universities (WBAA members). Each regional university will participate with one scientific expert (university professor) and two students (WBAA member). Two national universities ("Ss Kiril and Methodius" University in Skopje and State University in Tetovo) will participate with one scientific expert and three students. "Goce Delčev" University will participate with 10 scientific experts and 15 students. Four representatives from Non-members institutions (Ministry of education and science, Ministry of environment and physical planning and Academy of science and art of North Macedonia) will be invited as well. Participants from North Macedonia, Albania, Kosovo, Serbia, Bosnia and Hercegovina and Montenegro shall collaborate for the benefit of the whole region for several critical environmental issues.

Overall objective: Use of Universities' expertise in creation new valuable, suitable and accurate chemometric models for predicting and measuring the contamination level in different parts of the Environment (air, soil, water, plant food). Creating a regional scale of experience for determining the anomalous parts of the Environment. Proposing new ideas for national and regional strategies for Environmental protection. Promoting new ideas for Inter-university cooperation. Creating sustainable University network for continuous cooperation in the field of Environmental monitoring, pollution and protection (both, for students and researchers).

Assist. Prof. Biljana Balabanova

Kiril Jordanov

About the Western Balkans Alumni Association (WBAA)

The Western Balkans Alumni Association (WBAA) is a regional network of students and alumni from the Western Balkan region (Albania, Bosnia and Herzegovina, Kosovo*, North Macedonia, Montenegro, Serbia) who have spent part of their studies in one of Erasmus+ programmed countries. These exchanges were mostly funded by the European Commission. WBAA is neutral, unbiased and nonpartisan in the existing political discourse.

WBAA is supported and funded by the European Commission.

WBAA Mission:

- Advocating modernization and improvement of higher education quality in the region;
- Empowering young people of the Western Balkans on their academic and career development towards successful employment;
- Strengthening regional exchange, collaboration and integration;
- Supporting region's efforts towards European integration;

Web page:

https://www.western-balkans-alumni.eu/

FB page: https://www.facebook.com/WesternBalkansAlumniAssociation/

Instagram: @wbaassociation

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"1st scientific conference for CRITICAL ENVIRONMENTAL ISSUES OF THE WESTERN BALKAN COUNTRIES"

SCIENTIFIC COMMITTEE MEMBERS

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Biljana Balabanova, Assist. Professor at Faculty of Agriculture, Goce Delčev University, Štip, Republic of North Macedonia

SCIENTIFIC PROGRAM

October 28th, 2019 (Monday)

Time: 12:00-16:00, Registration for regional participants (Faculty of Agriculture, Campus 2)

16:00-16:15	Moderator's Introduction speech Presentation of Goce Delčev University to the regional participants	
16:15-16:30	WBAA representative	
16:30-17:30	Introducing Scientific Research Centers of Goce Delčev University	
17:30-17:40	***Coffee break***	
17:40-18:30	**Regional experts meeting** Problems and challenges facing each country; Introduction and proposing new and beneficial chemo-metric tools for environmental pollution; Proposing "environmentally friendly tools" for reduction the toxic effect of the pollutants and hazards.	**Students/young participants meeting** Introduction of regional and national participants; Promoting environmental issues from each country; Generating new proposal ideas; Creating sustainable cooperation's.
19:00	***Welcoming dinner (Hotel Izgrev hall)***	

October 29th, 2019 (Tuesday)

Time: 08:00-09:00, Registration for national participants

09:00	Opening Ceremony (Hall Campus 2)	
09:00-09:05	Moderator's Introduction speech	
09:05-09:10	Rector's speech, prof. Blazo Boev	
09:10-09:15	Project coordinators introduction: Biljana Balabanova / Kiril Jordanov	
09:15-09:20	Representative from Ministry of Education and Science, Republic of North Macedonia	
09:20-09:25	Representative from Macedonian Academy of Science and Arts, Republic of North Macedonia	
09:25-09:30	WBAA representative	
ENVIRONMENTAL POLLUTION: critical issues concerning at national and regional scale -PLENARY LECTURES-		
09:30-09:50	**Trajče Stafilov** Faculty of Natural Sciences and Mathematics, Institute of Chemistry, Ss. Kiril and Methodius, Skopje, Republic of North Macedonia	**ENVIRONMENTAL POLLUTION STUDIES IN DIFFERENT ENVIRONMENTAL MEDIA IN THE REPUBLIC OF NORTH MACEDONIA**

09:50-10:05	**Biljana Balabanova** Faculty of Agriculture, Goce Delčev University, Štip, Republic of North Macedonia	**CHEMOMETRIC MODELS FOR PREDICTING ENVIRONMENTAL "HOTSPOTS"**
10:05-10:20	**Panvera Lazo** University of Tirana, Department of Chemistry, Tirana, Albania	**PASSIVE AND ACTIVE MOSS BIOMONITORING FOR MULTIELEMENTS ATMOSPHERIC DEPOSITION IN ALBANIA**
10:20-10:35	**Musaj Pacarizi** University of Pristina, Department of Chemistry, Pristina, Kosovo	**ELECTROCHEMISTRY METHODS AND THEIR ENVIRONMENTAL APPLICATION**
10:35-10:50	**Jordana Ninkov** Institute of Field and Vegatable Crops, Laboratory for Soil and Agroecology, Novi Sad, Serbia	**POTENTIALLY TOXIC ELEMENTS (PTEs) IN SOIL**
10:50-11:00	**High-end Dialogue**	
11:00-11:15	***Coffee break***	
Creating sustainable transfer of knowledge and technology ***-PLENARY LECTURES-***		
11:15-11:30	**Vasko Zlatkovski** Technology Transfer Office, Goce Delčev University, Štip, Republic of North Macedonia	**OPENING NEW POSSIBILITIES FOR UNIVERSITY'S GOCE DELČEV STUDENTS AND RESEARCHERS**
11:30-11:45	**Alen Mujčinović** University of Sarajevo, Faculty of Agricultural and Food Sciences, Sarajevo, Bosna and Hercegovina	**QUEST FOR INNOVATIVE KNOWLEDGE TRANSFER**
11:45-12:00	**Radomir Ljupkovich** Department of Chemistry, Faculty of Science and Mathematics, University of Niš, Serbia	**CONSTRUCTION WASTE AS POTENTIAL CATALYST FOR BIODIESEL PRODUCTION**
12:00-12:15	**Violeta Ivanova-Petropulos** Faculty of Agriculture, Goce Delčev University, Štip, Republic of North Macedonia	**LIFE CYCLE ENVIRONMENTAL IMPACTS OF VITICULTURE AND WINE INDUSTRY**

12:15-12:30	**Arianit Reka** State University of Tetovo, Republic of North Macedonia	**HYDROTHERMAL TECHNOLOGY *vs* "CLASSICAL" TECHNOLOGY-ENVIRONMENTAL BENEFITS IN THE PRODUCTION OF POROUS CERAMICS**
12:30-12:40	**High-end Dialogue**	
12:40-13:30	***Lunch break, University lunch bar (First Floor-Campus 2)***	
ENVIRONMENTAL PROTECTION: critical issues concerning at national and regional scale ***-PLENARY LECTURES-***		
13:30-13:45	**Ljupčo Mihajlov** Faculty of Agriculture, Goce Delčev University, Štip, Republic of North Macedonia	**SELECTED EXCERPTS FROM PUBLISHED RESEARCH DATA AND PUBLICATIONS RELATED TO ENVIRONMENTAL PROTECTION**
13:45-14:00	**Fidanka Trajkova** Faculty of Agriculture, Goce Delčev University, Štip, Republic of North Macedonia	**AGROCHEMICAL SOIL PROPERTIES AS A KEY FACTOR FOR HIGH YIELDS AND ENVIRONMENTAL PROTECTION**
14:00-14:15	**Biljana Kovachevik** Faculty of Agriculture, Goce Delčev University, Štip, Republic of North Macedonia	**THE IMPACT OF AGRICULTURE ACTIVITIES ON GROUNDWATER QUALITY**
14:15-14:30	**Violeta Stefanova** Faculty of Natural and Technical Sciences, Goce Delčev University, Štip, Republic of North Macedonia	**GOLD IN MACEDONIA-REALITY, OPPORTUNITIES, PERSPECTIVES**
14:30-14:45	**Emilija Arsov** Department for Plant and Environment Protection, Faculty of Agriculture, Goce Delčev University, Štip, Republic of North Macedonia	**IMPLEMENTATION OF ACCREDITATION METHOD IN UNILAB LABORATORY, FOR HEALTHY LIFE AND ENVIRONMENTAL PROTECTION**
14:45-14:50	**High-end Dialogue**	
14:50-15:00	***Coffee break***	
15:00-16:30	**Students presentations** **Oral presentation + e-posters** (Hall Campus 2)	

16:30-18:30	**Students workshop** **"Eliminate & Minimize & Hazards & Pollution"** Laboratory for Environmental Chemistry (Part 1) 
19:00	***Dinner -Hotel Izgrev***
October 30th, 2019 (Wednesday) Faculty of Agriculture, Campus for Natural, Technical and Biotechnical Sciences, Goce Delčev University, Republic of North Macedonia	
09:00-10:00	**Students workshop** **"Eliminate & Minimize & Hazards & Pollution"** Laboratory for Environmental Chemistry (Part 2) 
10:00-10:10	Summary event conclusions and perspectives (Hall-Campus 2)
10:10-10:30	Closing remarks and generating new project proposal ideas
10:30 -10:40	***Coffee break***
10:40-11:00	Certificate awards for participation
11:00-11:20	Awarding the best student presentations
11:20-12:00	Student event evaluation (SWOT)
12:00-12:30	WBAA meeting- Closing remarks
12:40-13:30	***Lunch break – Hotel Izgrev***
14:00	***Departure***

CONTENTS

PLENARY LECTURES

PL 1

ENVIRONMENTAL POLLUTION STUDIES IN DIFFERENT ENVIRONMENTAL MEDIA IN THE REPUBLIC OF NORTH MACEDONIA

Trajče Stafilov

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Anthropogenic environmental changes, associated mainly with chemical pollution, lead to a degradation of the natural human environment. Among all chemical pollutants, potentially toxic elements (arsenic, cadmium, lead, mercury, etc.) are of a special ecological, biological and health significance. Therefore, detailed surveys of pollution with heavy metals of soil, waters, sediments, air and food on the entire territory of Northern Macedonia have been carried out. For that purposes various instrumental techniques such as atomic absorption spectrometry (AAS), inductively coupled plasma - atomic emission spectrometry (ICP-AES), inductively coupled plasma - mass spectrometry (ICP-MS) and neutron activation analysis (NAA) were applied. Air pollution was investigated by the application of moss biomonitoring and dust samples. Special attention was paid to the pollution with heavy metals in the regions with mining and metallurgical activities. It was found that the highest pollution is present in the areas with abounded or active mines, metallurgical plants or thermoelectric power plants. High contents of some heavy metals were also found in the areas were their contents usually vary gradually across the geochemical landscape and depend on the geochemistry of the underlying lithology.

Keywords: pollutants, potentially toxic elements, ICP-AES, ICP-MS.

PL2

CHEMOMETRIC MODELS FOR PREDICTING ENVIRONMENTAL "HOTSPOTS"

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Environmental pollution in some parts of the Earth has create critical condition even for surviving of living organisms. Latest scientific data has improved long-term persistence of hazard toxins in various parts of the environment. Furthermore, air, soil and water pollution has created a lot of problems in the developed and developing countries. To avoid or reduce these problems, constant environmental monitoring should be ensured. Most of the the conventional techniques for pollution analysis requires equipment which is costly, not readily available and time-consuming. Latest researches in Republic of North Macedonia indicate long-term continuous problems with persistent pollutants. Therefore, our country is facing with the challenge of implementing sustainable spatial resolution of monitoring models. Data processing and data normalization as well as data visualization present's most critical issues for creating chemometric model for tracking environmental hotspots. The environmental analysis often generates numerous data, for which various, precisely developed chemometric models should be applied. For that issue multidisciplinary approach should be involved for characterizing environmental quality.

Keywords: environmental pollution, hazards, air, water, soil.

PL 3
PASSIVE AND ACTIVE MOSS BIOMONITORING FOR MULTIELEMENTS ATMOSPHERIC DEPOSITION IN ALBANIA

Pranvera Lazo[1], Flora Qarri[2], Lirim Bekteshi[3], Shaniko Allajbeu[1], Sonila Kane[1], Marina Frontasyeva[4], Trajce Stafilov[5]

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[2]Department of Chemistry, University of Vlora, Vlora, Albania
[3]Department of Biochemistry, University of Elbasan, Elbasan, Albania
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[5]Institute of Chemistry, Faculty of Science, Sts. Cyril and Methodius University, Skopje, Republic of North Macedonia

For the first time the moss biomonitoring technique were applied to study multielement atmospheric deposition in Albania since 2010. Moss samples (*Hypnum cupressiforme*) were collected during the autumn of 2010 and 2015 respectively from 62 and 55 sites evenly distributed over the country. Sampling was performed in accordance with the LRTAP Convention–ICP Vegetation protocol and sampling strategy of the European Programme on Biomonitoring of Heavy Metal Atmospheric Deposition. The dominant moss species in this study area was *Hypnum cupressiforme (Hedw)*, a carpet-forming bryophyte. This study is based on the concentration data of 51 elements in moss samples collected during 2010/2011 and 2015 moss survey conducted at the same time with European moss biomonitoring surveys. The elements under investigation were determined by using ICP-AES and ENA analytical techniques performed in the Institute of Chemistry, Faculty of Science, Sts. Cyril and Methodius University, Skopje, North Macedonia, and Frank Laboratory of Neutron Physics, Joint Institute for Nuclear Research, Dubna, Russia.

High background level of the elements on moss samples are probably affected by the historical and recent industrial and mining emissions particularly of Al, Fe, Cr, Ni, V, As, Cd, Pb and Hg by indicating a high anthropogenic effect on the air quality in Albania. The predicted trend of distributions was calculated by using time series (linear model) and the areas with high concentration of certain metals were suggested to monitor and to be under control. Wide range of metals concentrations were found for Al, As, Hg, Cd, Pb, Ni, Co, Cr, Fe, V, Eu, Tm, Lu, and Mn. The highest content of Fe, Cr, Ni, Co and Zn was found in the east, and of sea spry elements in the west. The median concentrations and statistical parameters of elements were discussed by comparing the respective concentration data between two monitoring periods and with the results of other European countries. The study shows the differences of air quality in the country for two different moss biomonitoring periods, 2010 and 2015 periods. It may help to distinguish their origin from local and/or long-distance migration of the contaminants. The findings indicate that the air quality of Albania is comparable with the neighboring countries. With regard to the high concentration level of Cr, Ni, V, Al, Fe and Hg, the problems have been identified and the affecting factors are presented. The moss survey data and the applied statistical analysis in combination with GIS technique produced a detailed and up-to-date coverage of trace metals in moss samples that directly indicate the metal atmospheric deposition of Albania. The contamination factor scale was used to interpret and to distinguish the contamination level of each element, while considering the method of dispersion of contaminants in the atmosphere. Cluster and Factor analysis were applied to distinguish elements mainly of anthropogenic origin from those predominantly originating from natural sources. Geographical distribution maps of the elements over the sampled territory were constructed using GIS technology. This study was conducted in order to provide a reliable assessment of air quality throughout Albania, to produce information needed for better identification of pollution sources and improving the potential for assessing environmental and health risks in Albania, associated with toxic metals.

Keywords: moss biomonitoring, atmospheric deposition, trace elements, ICP-AES analysis, multivariate analysis, GIS technology.

PL 4

ELECTROCHEMISTRY METHODS AND THEIR ENVIRONMENTAL APPLICATION

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Electrochemistry is essentially based on the relationships between chemical changes and transfer electrons. The electron transfer can occur during two basic processes which are called "galvanic elements" and "electrolysis". Electrolysis in addition to its industrial applications can largely be used for research purposes. One of its applications is the voltammetry methods, which encompass several electrochemical techniques; linear voltammetry, cyclic voltammetry, differential pulse voltammetry, differential pulse anodic stripping voltammetry, etc. Voltammetry methods as any electrochemical method, take place in an electrochemical cell which is composed of the vessel, the electrodes and the solution which contains the substance under investigation. There are three main electrodes: working electrode, reference electrode and auxiliary electrode. One of the most useful working electrodes is the mercury electrode, which given the large stability potential (+0.2 V to -2 V) enables the qualitative and quantitative determination of a lot of pollutant substances, such as some of heavy metals and organic compounds. Also, voltammetry can be used for the determination of the stability constants of metal complexes.

Keywords: electrochemistry, electrodes, voltammetry, heavy metals, determination.

PL 5

POTENTIALLY TOXIC ELEMENTS (PTEs) IN SOIL

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Soil is a natural resource that is non-renewable in real-time because it takes a long time to form and is quickly destroyed. Soil is subject to increasing pressure exacted by global progress and it cannot be considered separately from other environmental factors, but only within the framework of an all-inclusive system of environmental protection. Soil pollution by potentially toxic elements (PTEs) is one of the global threats to our soils since they are not biodegradable and their concentration increases with the passage of time due to various human activities. PTEs can enter to food chain in relationship soil – plant with toxic effect on human health. There are many synonyms for a group of elements - inorganic soil pollutants: microelements, heavy metals (HMs), trace elements (TEs), potentially toxic elements (PTEs), dangerous and harmful substance. All of these terms have certain disadvantages because they cannot accurately describe such a diverse group of elements from a chemical and environment viewpoint. The concentration of PTEs in soil can be from natural and anthropogenic sources. The natural origin of PTEs in soil is primarily derived from the parent substrate in the process of pedogenesis, by decomposition of rocks and minerals on which the soil is formed. These background concentrations in soil are usually low, as are their bioavailability, so they do not affect the biota and the natural processes in the soil. Generally, the anthropogenic origin of PETs most often reaches the soil through atmospheric deposition from various sources that can be diffuse, scattered and local. There are 18 chemical elements that are essential for plant growth and animal organisms. They are known to be toxic, although essential if found in soil in high concentration (e.g. S, Zn, Cu, Co, Mo). PTEs such as Cd, Pb, As, Hg do not have a natural metabolic function in living organisms, but might have a strong negative metabolic effect to biota even at low concentrations and enter to food chain. From an agricultural viewpoint, PETs can damage or change production capacity i.e. fertility of agricultural soils, as well as being a limiting factor for the production of safe food. Due to the dual functions of PTEs (as nutrients or toxicants), it is very important to determine their background concentration and to establish threshold limits for environmental and agricultural legislation.

PL 6

OPENING NEW POSSIBILITIES FOR UNIVERSITY'S GOCE DELČEV STUDENTS AND RESEARCHERS

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Numerous studies and statistical data point that there is serious demand by the companies to increase the preparedness level of the students to be included in production process once they graduate. The major dissatisfaction is that the companies are spending additional money and time to train their new employees to make them useful in their production lines. In addition, students are demanding more possibilities for practicing what they learn in their theoretical cabinets and to try to resolve certain issue in their own, specific way. Responding to this demand, the university had decided to open new department in its structure. This department will serve as a hub for the companies looking for some contract-based research, for the students (and postgraduates as well) which have gained enough knowledge to understand technological difficulties in their area of interest and for the professors as well. The latter have the possibility to include most perspective students (MSc and PhD too) in their research project. The output of that research, in any form (prototype, technological improvement etc.) shall be given appropriate evaluation and in case there is a potential for marketing shall be protected as intellectual property, patented and licensed. In order to sustain researchers in their projects, the university intends to establish revolving research fund. Funds shall be granted to those proposals that shall receive most points by the evaluation board composed of representatives from UGD, companies and other stakeholders. The benefit. The researchers shall have most optimal conditions to work on their ideas, while the students shall have an opportunity to gain first-hand experience working alongside the researchers.

PL 7

QUEST FOR INNOVATIVE KNOWLEDGE TRANSFER

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The wellbeing of the Plant is one of the critical issues that mankind is dealing with. There is almost no part of society that is currently not endangered because of different types of environmental degradation. In spite of that, new and holistic approach to achieving economic growth is necessary. Universities play important role where knowledge co-creation and dissemination/transfer, identification of solutions to implement in practice, identification of end-users needs, collaborations between different actors, should build blocks for innovations, speeds up acceptance and dissemination of new approaches, and set up flexible innovation ecosystems. Therefore, the aim of this paper is *(i)* to build up framework for innovative knowledge transfer, *(ii)* to highlight university role in „new world ", and *(iii)* to provide some insights regarding the need to develop socially engaged universities able to create „agents of change". The study is based on primary and secondary data collected through group discussions within University representatives. Results of this study identify current standpoints of the academy and food industry in Bosnia and Herzegovina and the way to improve existing links. Some of major conclusions identify low market orientation, low internal capacity (human and financial), low level of innovativeness in BH food industry as well as low R&D investment in Higher education institutions. Current knowledge transfer is „too linear", without interactions and even if interactions exists, they are not fully used in new knowledge creation. Framework for innovative knowledge transfer should focus on both knowledge co-creation and interaction, while special attention should be on a „knowledge receivers" because they are usually observers and very passive. Finding a way to „trigger" them and integrate them into the process of knowledge co-creation is the main goal. Once this goal is achieved, new knowledge becomes part of them, and their ability to use acquired knowledge and implement in practice is highly increased. Implementation of acquired knowledge in practice is main effort of knowledge transfer, therefore change in behavior of „knowledge receivers" is aim and outcome of effective knowledge transfer.

Keywords: knowledge transfer, university role, sustainable development.

PL 8

CONSTRUCTION WASTE AS POTENTIAL CATALYST FOR BIODIESEL PRODUCTION

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It is known that the quantities of fossil fuels are limited, and taking in mind that the demands for them are constantly growing, it is necessary to replace them with alternative renewable energy sources. The increasing requirements for fossil and/or new alternative fuels in all sectors of human life (i.e. transportation, industrial processes, power generation) cause environmental concerns such as more extensive greenhouse gasses emissions. Recently, biodiesel has been considered as suitable potential solution for a diesel fuel substitution. The main benefits of using biodiesel are that it is non-toxic, biodegradable; it produces reduced volumes of harmful gases emissions and can be used without modifying existing (motor) engines. Lately great attention has been given to biodiesel production from renewable energy resources (ex. vegetable oils and/or animal fats) because of energetic, ecological, geo-political and economic benefits. Biodiesel as non-petroleum derived fuel is a mixture of fatty acid methyl or rarely ethyl esters obtained by catalytic transesterification of vegetable oils/fats with the two short chain alcohols. The present technology of biodiesel production comprises the utilization of homogeneous catalysts (NaOH and/or KOH). Disadvantages of homogeneous catalysis are the recovery of the catalyst used in the transesterification reaction, and considerable volume of wastewater discharged from the process utilized to refine the dissolved alkali hydroxide from the produced biodiesel. The utilization of heterogeneous catalysts would be a solution for most of environmental and economic drawbacks of homogeneously catalyzed process. A heterogeneous catalyst can be easily and quickly separated and reused and the produced biodiesel and glycerin could be rapidly purified and collected after separation. Calcium oxide has been extensively researched as a catalyst for biodiesel production. Proved to be very effective, easy to separate, reusable end environmentally friendly. Calcium oxide is non-corrosive, eco-friendly and abundantly. Various materials, such as eggshells, bones, limestone, shells from shellfish, snails, can be used as precursors of calcium oxide. Calcium oxide can be derived from carbonate precursors by calcining at high temperatures between 700 and 1000°C.

The construction waste contains a wide-ranging proportion of municipal solid waste. Mostly, construction waste is disposed by landfilling, so potential use of construction waste as precursor for catalyst for the biodiesel production can provide effective approach to waste management. There are many types of construction waste such as concrete, woods, gypsum or bricks. Cement-based waste is source of calcium sulphate with presence of metal oxide which can enhance catalytic activity. Chemical content of gypsum is calcium sulphate dihydrate and can be transformed to calcium oxide. Gypsum waste can be found at construction site, and after thermal treatment can be used as a solid catalyst in biodiesel production.

PL 9

LIFE CYCLE ENVIRONMENTAL IMPACTS OF VITICULTURE AND WINE INDUSTRY

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Every agricultural activity has its particular impact on the environment, contributing to climate change and global warming. The use of fertilizers, pesticides, soil, land, water, and energy in various agriculture sectors is responsible for approximately 20% of all greenhouse gas emissions. The process of growing grapes and transforming it into wine, contributes to environment issues as well. In general, viticulture and wine industry have a mix of positive and negative impacts in the world, such as the social, health and economic impacts of winemaking industry are recognizable and debatable. The global wine industry use large amounts of chemical fertilizers and organic substances, use pesticides to prevent the vineyard of possible crop diseases and to improve grape quality and yield, generates a large quantities of cane pruning waste each year. Pesticide application in the vineyard contribute the majority of toxicity-related emissions, while the use of nitrogen and phosphorous fertilizers contribute to eutrophication and acidification impact categories. Viticulture, winemaking, manufacturing glass bottles, various transportation links, refrigeration and recycling of glass bottles are processes that influence the wine's life cycle and all of them necessitate the transformation of materials and energy, resulting in emissions which contribute to various environmental impacts. Therefore, in order to improve the wine's life cycle impact and to achieve a sustainable development of the viticulture and wine sector, from one side, as well as to avoid unnecessary environmental emissions which may contribute to irreparable ecological damage, from other side, the materials and energy resources for wine production and consumption must be used efficiently.

Keywords: viticulture, wine industry, waste, environment.

PL 10

HYDROTHERMAL TECHNOLOGY vs "CLASSICAL" TECHNOLOGY-ENVIRONMENTAL BENEFITS IN THE PRODUCTION OF POROUS CERAMICS

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Hydrothermal production of porous ceramic materials offers many advantages over conventional ceramic production. The drying and firing processes are replaced with a hydrothermal process, a process which occurs at much lower temperatures and takes shorter time thus resulting in great energy savings and less emissions. The aim of this study was to utilize the diatomaceous earth as a raw material for low temperature hydrothermal production of porous ceramics. Hydrothermal synthesis of porous ceramics has been carried out under saturated steam pressure at 130 °C for a period of 1, 2 and 3 hours. The objective of this work was to investigate the impact of slaked lime, autoclave curing time, autoclaving temperature and compaction pressure on the compressive strength and porosity of the products. During the hydrothermal synthesis, newly obtained calcium silicate hydrate dominates which give positive effect to the compressive strength and product porosity confirmed by X-ray powder diffraction. Moreover, a calcite was also evidenced by FTIR spectroscopy whose presence additionally increases the compressive strength of the hydrothermally obtained products. The products obtained during the low-temperature hydrothermal reaction are classified as light porous materials with bulk density ranging from 0.71–0.91 g/cm^3 and compressive strength within 14.7–19.4 MPa.

Keywords: calcium silicate hydrate, compressive strength, diatomaceous earth, hydrothermal synthesis, porous ceramics.

PL 11

SELECTED EXCERPTS FROM PUBLISHED RESEARCH DATA AND PUBLICATIONS RELATED TO ENVIRONMENTAL PROTECTION

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The purpose for which this paper was written and composed, with content as shown, is for displaying published publications by authors from the Faculty of Agriculture from Goce Delčev University, as well as their collaborators from the other faculties at Goce Delčev University, as well as colleagues from Universities and institutions from other countries, with whom in the past twelve years fruitful cooperation has been realized for different purposes. They're showing excerpts from published results in 11 domestic and international scientific papers, and reported data and results of 9 scientific meetings in our country and abroad, as well as realized project titles, all directly or indirectly related to environmental protection. Also shown are the headlines, with links to access the contents of a study, and some monographs and published guidelines in this area. The data are presented in the form of relevant excerpts from the publications that show the aspect of the specific research and the obtained results, as well as an overview of some of the conclusions drawn from those studies. Much of the published and displayed publications arise as a result of successfully implemented mostly international project activities. From the content of this review paper, one can see the priority given to certain environmental issues, and to initiate ideas for younger colleagues and students to continue their research in this area in the future.

Keywords: published publications, environmental protection, project activities, research.

PL 12

AGROCHEMICAL SOIL PROPERTIES AS A KEY FACTOR FOR HIGH YIELDS AND ENVIRONMENTAL PROTECTION

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In this study data from agrochemical analysis of 200 agricultural soil samples collected from different locations in Republic of North Macedonia are presented. The soil samples were analyzed in order to determine the status of agricultural soils for active pH in correlation to the availability of humus and readily available forms of phosphor (P_2O_5) and potassium (K_2O), for the purpose of understanding and promoting good agricultural practice and environment protection.

Mapping and spatial distribution of studied parameters showed that 15% of soil samples had an active soil pH lower than 6.50, 59% a pH higher than 7.5 and 26% had an active pH reaction 6.5-7.5, as optimum range for agricultural production. The results for available P_2O_5 content showed that 53.2% of soil samples were low in content of readily available phosphorus, while 53% of soil samples were evaluated as rich in readily available K_2O. The most of soil samples were very poor in humus content and only 13% showed good supply with humus. Phosphorus (P), however, showed a certain degree of dependence from the pH of soil solution, as the analyzed soils samples with pH lower than 6.5 showed very low content of readily available phosphorus.

This study implies that continuous, timely and planned control, analysis and interpretation of soil quality are needed in order agricultural producers to use soil resources more efficiently with optimized fertilizer dosages which will bring higher yields, reduced production costs and improved quality of agricultural crops.

Keywords: soil samples, pH, phosphor (P_2O_5), potassium (K_2O), humus, crops.

PL 13

THE IMPACT OF AGRICULTURE ACTIVITIES ON GROUNDWATER QUALITY

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Groundwater is a valuable natural resource of fresh water and as such should be protected from deterioration and chemical pollution. The main groundwater chemical pollutants from agriculture sources are nitrates, plant protection products and biocidal products. In this manuscript the accent is given to the role of the plant protection products in the groundwater pollution. According to the European parliament and the Council's Directive 2006/118/EC on the protection of groundwater against pollution and deterioration the threshold values set for pesticides in groundwater are 0.1 µg/l and 0.5 µg/l for total pesticides. Significant role in pesticide leaching in to the groundwater have their physical and chemical characteristics as well as the geological characteristics and ecological conditions in the region which contribute in differences regarding groundwater pollution in different regions. The usage of pesticides per hectare of agriculture land varies widely between European countries. Between 1985 and 1991, the usage was found to be the lowest in the Nordic countries, intermediate in Eastern Europe and highest in Southern and Western Europe. In Northern and Central European countries, the predominant type of pesticides used are herbicides, whereas in the Southern and Western countries are insecticides and fungicides. Herbicides such as triazines (atrazine, simazine, terbuthylazine, terbutryn, prometryn, propazine, cyanazine), phenylureas (chlortoluron, diuron, isoproturon and linuron) and anilides (acetochlor, alachlor, metolachlor), and insecticides such as organochlorine (lindane, DDTs) and organophosphorus (azinphos – ethyl, chlorpyrifos, chlorfenvinphos, dimethoate, fenitrothion, parathion - methyl and malathion) are the most common pesticides found in groundwater.

Keywords: pesticides, leaching, geological characteristics, ecological conditions.

PL 14

GOLD IN MACEDONIA-REALITY, OPPORTUNITIES, PERSPECTIVES

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Gold is the most valuable and sought noble metal in the world. Maybe this is the answer of the question: why there is so much interest in this noble metal. According to new recently data, gold reserves in Macedonia put it on decent second place in the Balkans with 6.9 tons. Studies of gold in Macedonia have a long history. In the last two decades, there has been an increase in research on gold, especially when the price rises sharply, fuelling global exploration on an unprecedented scale. Many localities have become significant for study. There are about 30 occurrences where the presence of endogenic gold has been determined. Most of these occurrences, which are more or less studied, are not economically interesting. Only one mine produces gold as a by-product. Also, there are a few localities where detail investigations have found significant amounts of this metal, making them potential gold mines.

Keywords: gold, occurrences, mine, research, protentional.

PL 15

IMPLEMENTATION OF ACCREDITATION METHOD IN UNILAB LABORATORY, FOR HEALTHY LIFE AND ENVIRONMENTAL PROTECTION

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UNILAB laboratory as a part of the Faculty of Agriculture, under Goce Delcev University – Štip, Republic of North Macedonia, implements different laboratory tests, aiming at the improvement of the quality and quantity of the agricultural production and increasing the competitiveness of the domestic production at international level. The laboratory implements different agrochemical analyses of soil together with giving advice on the plant fertilization and nutrition; determination of micro and macroelements, heavy metals, trace elements and pesticide residues in different media such as soil, water and plant material, determination of the active substances of pesticides, the presence of certain nutrients in fertilizers, analysis of the quality of seeds and seedlings, determination of genetically modified organisms, determination and identification of the presence of plant diseases and pests of plants and stored agricultural products, determination of the biological efficacy of pesticides, qualitative and quantitative determination of the presence of mycotoxins of plant products. Total number of accreditation methods is around 45. *UNILAB laboratoty* functioned as a separate organizational unit that operates under the legislative regulation, legislative acts and standards, as follow: • *The Law of higher education*, • *The Law of accreditation*, • *The Standard MKC EN ISO/IEC 17025:2018*. The laboratory is responsible for all tests implemented in accordance with the international standards, methods, rules, beneficiary needs and legislative regulation.

The future of healthy life, production of good and quality food and environmental protection can be done just with good laboratory practice – accreditation method of work implement in UNILAB laboratory (http://unilab.mk/en/index.html)

Keywords: accreditation methods, *UNILAB laboratory*, healthy life, environmental protection.

ORAL PRESENTATIONS

e-POSTERS

OP 1

GENETIC MODIFICATIONS AND *IN VITRO* PRESERVATION AS BENEFICIAL METHODOLOGY IN ENVIRONMENTAL PROTECTION

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Nowadays when scientists are fighting against problems like climate change, pollution and need of bigger yield here arises new issue which came from the will to adapt the plants to our needs. Now we are having GMO crops which can generate unintended and possible hazardous traits to the environment and on the other hand we are facing with rapid loss of the gene pool diversity. Due to the human activities lot of plant populations become isolated, situation in which they become subject of genetic drift and inbreeding resulting with loss of genetic variety, increase of homozygote and inbreeding depression. All these is referred to probable extinction of populations or species. Contrary the new genetic techniques give us opportunity to adjust plants to our needs, creating new organisms with unknown effects. This is a global issue in which scientists are changing the evolutionary direction in a way we don`t know where it leads. The possible method to preserve our crops from extinction and accidental breeding with GMO crops is management of gene pool sources and *in vitro* preservation. In this challenge scientists have a role to adapt the plants they created and preserve the gens and plants that nature has established.

Keywords: genetic erosion, preservation, genetic modification, in vitro, extinction, environmental issue, diversity.

OP 2

DETERMINATION ON THE PHYLLOSPHERIC AND MICROCLIMATIC CONDITIONS AT VINES UPON DEVELOPMENT ON GRAY MOLD (*Botrytis cinerea*)

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One of the most important plant disease in viticulture is gray mold caused by *Botrytis cinerea* Pers.: Fr., the anamorph of an ascomycete fungus (*Botryotinia fuckeliana* Whetzel). Gray mold development on grape berries depends on the genetic structure of the pathogen population but is also driven by some key factors, including climatic conditions, cluster architecture and berry susceptibility. Numerous treatments with fungicides are required for management of the gray mold which intensifies the risk of resistance development since *B.cinerea* has a high risk of resistance development. The forecasting model for *B. cinerea* Pers. which will be shown here is only pioneering attempt to prevent development of gray mold. The white grapevine varieties Smederevka and Zilavka was continuously observed at last three years in the two experimental fields located at Smilica and Sopot, Kavadarci, Republic of Macedonia. The working hypothesis was to follow the development of the disease after increasing glucose over 11% until the time of the grape harvest.

Keywords: plant disease, gray mold, anamorph, forecasting model, working hypothesis.

OP 3
SOLAR DRYER FOR VEGETABLES AND FRUITS

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Many companies in Republic of North Macedonia have many organic fruit producers. They sell first class fresh to traders. Second-class organic fruit with visual anomaly remains unsold. No one likes them are the manufacturer throws them away. Statistics show that only 5% of crops are dried, and we import dried fruits. There are 7 industrial dryers operating on oil, wood or pellets. The drying process is expensive and pollutes the environment. Dried fruits get a smell of oil or ash. We offer a solution: These fruits should be dried with solar dryers. Buyers are growers of organic fruits, mushrooms, collectors of forest fruits. They require small moving solar dryers. Air absorber is 3 times larger than the competition The dryer controls 4 parameters (drying time, temperature, humidity and air flow). About 70% of the finances invested in this is returned through IPARD. The value of the dryer 3174 euros. It's 100kg. dried organic apples.

Keywords: solar energy, drying, environmental protection.

OP 4

THE AIR QUALITY REPUTATION OF THE WESTERN BALKANS

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Air pollution is considered a public health emergency on a global level and its effects are compared to tobacco consumption, affecting everyone from unborn babies to adults. The main sources of air pollution include emissions from thermal power and manufacturing plants, motor vehicles and domestic heating. Electricity generation from thermal power plants produces substantial amounts of Sulphur dioxide (SO_2), Nitrogen oxides (NO_x) and dust or particulate matter (PM). Lignite power plants in the region are major sources of SO_2, while high concentrations of dust (particulate matter) are mostly attributed to plants in Kosovo, North Macedonia and Serbia. The impact of energy generation and consumption on the environment is an important factor influencing energy choices in the region, given that many of the countries aim to join the EU.

Keywords: pollution, emissions, PM, lignite plants, environment.

OP 5

UNIVERSITY'S SCIENTIFIC RESEARCH CENTER - PERSONAL WORK EXPERIENCE

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After finishing high school, every young individual has its own desire, dream and imagined future profession. While we are young, we were usually dreaming for be a doctor, a lawyer, a police officer. You know, life is a crossroad and we are often forced for fast decisions. Sometimes reality is so far from our desires. Sometimes, it's so close. My desire is on the way to accomplishment because I have listened my heart. That's why I'm so satisfied today. The decision to study at the Faculty of Agriculture was very fast, spontaneous and because of that I am happy, fulfilled and productive today. So, that's why I encourage all of those young people who have decided to go the "hard way". The road to the top is filled with thorns but the view from above is very beautiful. Dear students, the world will belong to us. Through hard work and patience, we can make the world a better place to live. Work hard, create often, fight for your desires. Fight for your dreams.

Keywords: profession, desire, work, dream, faculty.

eP 1

EUROPE'S MOST POLLUTED CAPITAL AND ITS EFFECTS ON THE POPULATION

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Air pollution is a mix of particles and gases that can reach harmful concentrations both outdoors and indoors. Its effects can range from higher disease risks to rising temperatures. Soot, smoke, mold, pollen, methane, and carbon dioxide are a just few examples of common pollutants. The poor air quality in the Republic of North Macedonia is predominantly due to the tiny combustion particles called PM10 and PM2.5. These can easily penetrate deep into the lungs, causing not only breathing problems, but also other dangerous health issues. According to the World Health Organization 2,574 people die prematurely every year as a direct result of air pollution from its ill effects. Nearly half of the population lives in Skopje and therefore the problem will increase year after year if there are no major reforms and changes in the transportation, waste management, energy supply, industry, food and agricultural areas. So far, no major changes have been announced in any of these areas.

Keywords: pollution, harmful, smoke, effects, health.

eP 2

SCANNING ELECTRON MICROSCOPY OF THE IRRADIATED BLACK PEPPER

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The objective of this study was to investigate the effects of ionizing irradiation of the morphological properties of black pepper and compare them with an unirradiated black pepper (Piper nigrum L., family Piperacea). For this study, samples of black pepper were obtained from the food processing factory Vitaminka from Prilep. Samples were irradiated by ^{60}Co γ-rays (at absorbed doses 7 kGy) at the Vinca Institute for Nuclear Science, in Belgrade. The characterization method used for this research was the Scanning Electron Microscopy (SEM). SEM results shows that there are structural differences of irradiated and unirradiated black pepper. A difference is observed on the cleft of the surface of black pepper. The rupture on the unirradiated spice is wider (0.61, 0.49, 0.54 μm) and rougher and on the irradiated one the rupture is narrower (0.28, 0.15, 0.21 μm) and smoother. Also in the unirradiated sample of black pepper spice, it can be shown the presence of aspergilllus species. In the unirradiated sample of black pepper we can observe the presence of cuprite Cu_2O, which is absent in the irradiated sample.

Keywords: SEM, black pepper, gamma irradiation, cuprite

eP 3

DETERMINATION OF HEAVY METALS IN HONEY SAMPLES IN FUSHË KOSOVA MUNICIPALITY

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In this study we investigated the determination of heavy metals (Pb, Cd, Fe, Mn and Cu) from 6 places in Fushë Kosova municipality. This area of studied it's not far (8-15 km) from the capital city Prishtina and the coal mines of Obiliq. Object of our study was honey samples as a bioindicator. The honey samples were collected from beekeepers and treated according to standard procedures. The honey samples are analysed by flame atomic absorption spectrometry (FAAS). We found that the value of concentration were: 0.09-0.43 mg/kg for lead; 0.02-0.27 mg/kg for cadmium; 0.33-14.38 mg/kg for iron and 1.78-12.32 mg/kg for copper. From these results we concluded that the level of heavy metals is about 2-10 times higher than maximum permitted level according to EU standard. The high levels of heavy metals as a pollution in honey samples could be as a result of the traffic and the thermoelectric power in Obiliq.

Keywords: heavy metal, honey, bioindicator, pollution, coal mine, FAAS.

eP 4

INVESTIGATION OF THE CONTENT OF MACRO AND MICROELEMENTS IN SOIL AND HONEY FROM THE REGION OF MITROVICA

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The region of Mitrovica which consists of three municipalities: Mitrovica, Skënderaj and Vushtrri, has been studied. In addition to traffic and other sources of pollution, in this region mining activities and ore processing are the major source of metal pollution of the environment. It is the analysis and the evaluation of the contamination level of the area of concern that makes the subject of this work. Sample of soil from 16 points (3 – 5 subsamples, from two layers, 0-5 cm and 20-30 cm) were collected, and 16 samples of honey were also collected. Prior to analysis all samples were treated according to standard procedures. Then samples were analyzed by ICP-AES and ICP-MS. The contents of heavy metals such Cd, Pb and Zn in soil samples were found to be over the target values according to Dutch standards. This also reflects the slightly increased values of the contents of these elements in some of the honey samples.

Keywords: soil, honey, macro-elements, microelements, ICP-AES, ICP-MS, Mitrovica, Kosovo.

eP 5

DISTRIBUTION OF HEAVY METALS IN THE GARDEN SOIL AND VEGETABLES GROWN IN THE VICINITY OF LEAD AND ZINC MINE AND FLOTATION PLANT

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The region of Probištip, Republic of North Macedonia, was exposed on the 70 years pollution with heavy metals from the mining activities and flotation tailings landfill located near the town. The aim of this study is the exploration of the distribution of Cd and Pb, as well as some other elements, in soil and vegetables from the gardens in this area. In total 38 samples from different crops and vegetable products from 19 gardens were investigated. The vegetable samples were digested by microwave digestion system and the analyses were performed by the application of inductively coupled plasma - atomic emission spectrometry (ICP-AES) and inductively coupled plasma – mass spectrometry (ICP-MS). It was found that the content of some elements in the soil samples from the gardens exceeded target values (As, Cd, Cu, Pb and Zn) but lower than the intervention values according to the Dutch standards. Thus, the contents of As is higher from target values in 8 soil samples, the content of Cd is higher in 16 soils from 19 samples, the content on Pb is higher in 8 samples while the contents on Zn is higher in 11 soils from 19 soils samples. The pollution of soils from this area was found to be as a results of mining activities and distribution of tailings material from the near flotation tailings dump. From the other side, the content of Cd and Pb in some vegetables from the gardens close to the Zletovska River and flotation tailings landfill exceeded the maximum permissible content. The content of Cd ranges from 0.01 mg/kg to 0.24 mg/kg in fresh vegetables exceeding the permitted level (0.05 mg/kg) in 15 samples. The content of Pb ranges from 0.01 mg/kg to 6.65 mg/kg exceeding the permitted level of 0.1 mg/kg in 18 out of 39 vegetable samples.

Keywords: heavy metals, pollution, Zletovska River, vegetables, ICP-AES, ICP-MS.

eP 6

HISTOPATHOLOGY EFFECTS ON MALE SEXUAL GLANDS OF RAT (MUS MUSCULUS L.1758) CAUSED FROM POLLUTION IN THE REGION OF MITROVICA

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The trace elements lead, mercury and cadmium have caused major human health problems in several parts of the world. Levels of these elements have increased during the last years in the world, also in Kosovo in the part of Mitrovica because of the water discharge from the mining plant of Trepça. The aim of this study was to observe the effect of heavy metals (mercury, cadmium and lead) on male sexual glands of rats (Mus musculus L.1758). Firstly we have taken rats in region of Trepça, and rats in a Podujeva so we could compare the impact of heavy metals. After the dissection we have observed significant changes in the overall histological structure of the sexual glands, indicating abnormalities in almost all histological cellular elements in the rats of Mitrovica, compared to rats of Podujeva where regular structural contours of the testicles with all characteristic constituent elements are presented.

Keywords: Cadmium, mercury, lead, rats, heavy metals.

eP 7

MINERAL COMPOSITION IN GRAIN OF WHEAT VARIETIES

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The determination of mineral composition and nutritional value of wheat is extremely important as it takes an important place among the crop species being extensively grown as staple food sources. The importance of wheat is mainly due to the fact that its seed can be ground into flour, semolina, etc., which form the basic ingredients of bread and other bakery products, and thus it presents the main source of nutrients to the most of the world population. According to this, the main objective of this research is to determine the content of some macro and micro elements in grain of wheat varieties. Three soft wheat varieties are used as an experimental material (*radika*, *amazon 150* and *pobeda*) in this examination. The seed was produced for commercial purpose from first generation certification seed (C1) in 2018. The laboratory researches are conducted in "UNILAB" laboratory at Faculty of Agriculture in Shtip, Republic of North Macedonia. Microwave digestion method (model Mars, CEM) was applied to destroy the organic matrix to determine the content of Fe, B, Cu, Mn, Zn, Ca, Mg, Na, K, P and S. The content of macro and micro elements in digest samples was performed using inductively coupled plasma mass spectrometry (MS-ICP). *Radika* variety has the highest content of manganese, calcium, magnesium and potassium, compare to the other tested varieties. The content of iron (31,05 mg/kg) and boron (4,56 mg/kg) was the highest in grain of *amazon 150* variety. In *pobeda* variety was determinate the highest content of copper (9,15 mg/kg), zinc (31,62 mg/kg) and sodium (108,23 mg/kg). The content of sulfur was in negative correlation with content of magnesium ($r = -0.997$), at level of significance $p<0.5$. Also, significant negative linear correlation was obtained between content of cooper and potassium ($r = -0.997$). However, all tested wheat varieties differed in their rankings for content of macro and micro elements, due largely to the genetic potential of the variety, but at the same time all wheat varieties content the optimum concentration of these elements.

Keywords: macro and micro elements, wheat grain, variety.

eP 8

POSSIBILITIES FOR UTILIZATION OF HEAVY METAL POLLUTED SOIL

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The reduction of arable land and the increase of contaminated soil due to industrialization and mining occupies the attention of scientists in finding solutions for soil utilization. The use of plants to accumulate heavy metals (HM) from the soil has been recognized as the most economically- and ecologically-friendly alternative. Different plants have different potential to uptake HM. The ability to take up and tolerate metals varies between and within species as well as between metals. Most of the data in the literature focused on hyperaccumulating properties of plant and not paying enough attention to excluders - plants with low accumulating abilities tolerant to high concentrations of HM in soil. Although promising, phytoremediation using natural hyperaccumulators has not achieved its predicted potential as a commercial technology due to the physical limitations of the natural hyperaccumulators like their slow grow, low-biomass production, specific ecology, and climate requirements, specific requirements for soil characteristics, water regime, etc. Another more promising strategies are to plant low accumulated crops on HM polluted soil to produce safe food or to plant fast-growing, high-biomass-producing non-hyperaccumulating plant species like rooting woody species willow (*Salix* spp.) and poplar (*Populus* spp.) which can accumulate HM from the dipper soil layers due to their deep root system. The review focused on positive and negative sites of some strategies for utilization of HM polluted soil that differ in the type of the employed plant.

Keywords: hyperaccumulators, excluders, phytoremediation, plant species.

eP 9

PREVENTIVE MEASURES FOR WATER PROTECTION OF POLLUTION FROM THE CATCHMENT OF THE RIVER GRADECHKA – VINICA

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For the preventive protection of water from pollution from the catchment of the Gradechka River municipality of Vinica two protection zones are separated: narrower protection zone (strict sanitary surveillance zone) and wider protection zone (hygienic-epidemiological monitoring and surveillance zone). A narrower protection zone covers the area just around the intake that is enclosed by a metal fence. This area prohibits all activities except those related to the capture, preparation and transport of water into the treatment system. The wider protection zone covers several hectares of mountainous terrain overgrown with grass and forest. The wider protection zone prohibits the construction of industrial, tourist, catering, sports-recreational, agricultural and other facilities, as well as performing activities whose wastewater and other wastes may endanger the quality, health and safety of the catchment waters area of Gradecka river.

Keywords: water, protective zone, preventive measures, pollution, river Gradechka.

eP 10

MOSS-BIOMONITORING CHALLENGES IN TRACKING AIRBORNE DUST DEPOSITIONS

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Trace elements may be absorbed on the moss from the atmosphere either as soluble chemical species in wet deposition or contained in particles from dry deposition. Part of the trace element content of particulates may eventually be released by weathering and reabsorbed by the moss. Whereas uptake efficiencies for particulate-bound trace elements are generally poorly known, Ions may be subject to active uptake into cells or attached on the moss surface by physical and chemical forces. Main problem with issue moss-biomonitoring are reveal as: a) transport of soluble compounds from the soil into moss tissue, particularly during periods withexcessive soil/water contact. Although mosses do not have a root system, influence from this source cannot be disregarded, in praticular in areas with low atmospheric deposition and b) windblown mineral dust from local soil. As far as the surface bound fraction is concerned, little is known about the binding mechanisms, but the fact that different metals show rather large differences in their retention capacitie, indicates that both simple cation exchange on negative surface charges and complex formation with ligands on the moss surface are involved. Laboratory analysis using scanning electron microscopy (emission SEM, TESCAN VEGA3) has been involved for determination of the dry deposition occurred within two species (*Homalothecium lutescens* and *Homalothecium sericeum*) from the genus *Homalothecium*.

Keywords: moss, bio-monitoring, heavy metals, air deposition.

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