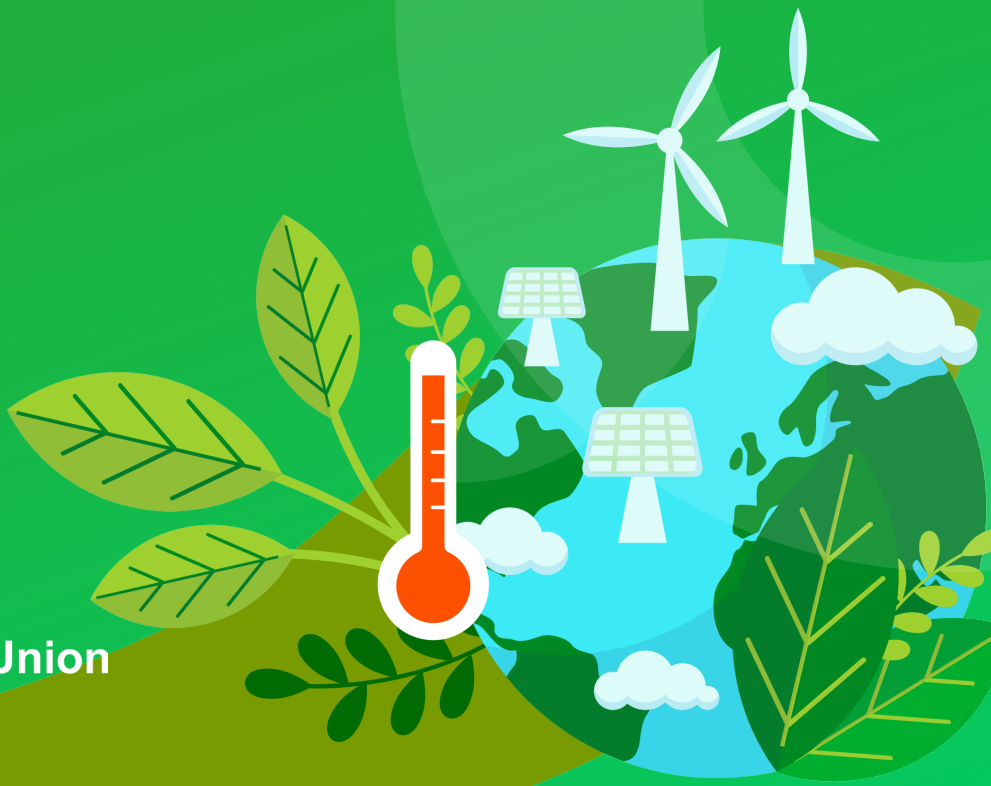
WBAA
WESTERN BALKANS ALUMNI ASSOCIATION

2nd SCIENTIFIC CONFERENCE

FOR CRITICAL ENVIRONMENTAL ISSUES OF THE WESTERN BALKAN COUNTRIES

BOOK OF ABSTRACTS

October 28th to 30th, 2021, Faculty of Agriculture, Goce Delčev University, Štip, Republic of North Macedonia



Funded by the European Union

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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 and financed within the project titled **"**Extracting Green-COVID effects for generating clean technologies and successful youth transition awareness for the climate change and sustainable development of the Western Balkan countries", **project number 2021030, financed by Western Balkans Alumni Association.**

WELCOME

On behalf of the project coordinators of

"Extracting Green-COVID effects for generating clean technologies and successful youth transition awareness for the climate change and sustainable development of the Western Balkan countries"

Project number 2021030

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 chemi-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 chemi-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 and 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. Ss. Cyril and Methodius University in Skopje and University in Tetovo and St. Kliment Ohridski University - Bitola). 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 chemi-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). Three national universities (Ss. Cyril and Methodius University in Skopje, State University in Tetovo and St. Kliment Ohridski University - Bitola) will participate with one scientific expert and three students. Goce Delčev University will participate with scientific experts, young researchers and students. 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 chemimetric 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).

Assoc. 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

e-mail: info@western-balkans-alumni.eu

SCIENTIFIC COMMITTEE MEMBERS

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Musaj Pacarizi - University of Pristina, Department of Chemistry, Pristina, Kosovo.
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Biljana Balabanova, Associate Professor at Faculty of Agriculture, Goce Delčev University, Štip, Republic of North Macedonia

"2nd scientific conference for CRITICAL ENVIRONMENTAL ISSUES OF THE WESTERN BALKAN COUNTRIES"

SCIENTIFIC PROGRAM		
October 28th, 2021 (Thursday) **Time: 12:00-16:00, Registration for regional participants** (Faculty of Agriculture, Campus 2)		
16:00-16:15	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 proposal of new and beneficial chemi-metric tools for environmental pollution; Proposal of "environmentally friendly tools" for reduction of toxic effect of pollutants and hazards.	**Students/young participants meeting** Introduction of regional and national participants; Presentation of environmental issues from each country; Generation of new proposal ideas; Creation sustainable cooperations.
19:00	***Welcoming dinner (Hotel Izgrev hall)***	
October 29th, 2021 (Friday) **Time: 08:00-09:00, Registration for national participants** (Faculty of Agriculture, Campus 2)		
09:00-9:15	**OPENING CEREMONY (HALL CAMPUS 2)**	
	Moderator's Introduction speech	
	Dean of the Faculty of Agriculture, Prof. Ljupco Mihajlov / Vice dean Assoc. prof. Emilija Arsov	
	Project coordinator introduction: Assoc. prof. Biljana Balabanova	
	WBAA representative/ Kiril Jordanov	
ENVIRONMENTAL POLLUTION: critical issues concerning at national and regional scale ***- PLENARY LECTURES -*** ***Chairwoman Assoc. prof. Biljana Balabanova***		
09:15-09:30	**Trajče Stafilov** Faculty of Natural Sciences and Mathematics, Institute of Chemistry, Ss. Cyril and Methodius , Skopje, Republic of North Macedonia	**GEOCHEMISTRY OF MAJOR AND TRACE ELEMENTS IN SOILS OF THE REPUBLIC OF NORTH MACEDONIA**
09:30-09:45	**Musaj Pacarizi** University of Pristina, Department of Chemistry, Pristina, Kosovo	**DETERMINATION AND STATISTICAL ANALYSIS OF THE ATMOSPHERIC DEPOSIT OF ELEMENTS IN KOSOVO THROUGH MOSSES AS BIOMONITORS**
09:45-10:00	**Panvera Lazo** University of Tirana, Department of Chemistry, Tirana, Albania	**STUDY OF AIR QUALITY BY MOSS BIOMONITORING AND TRACE ELEMENTS CONTENT**
	High-end Dialogue	
10:00-10:30	***Coffee break***	

Creating sustainable transfer of knowledge and technology ***- PLENARY LECTURES -*** ***Chairwoman Assist. prof. Biljana Balabanova***		
10:30-10:45	**Stanko Milić** Institute of Field and Vegatable Crops, Laboratory for Soil and Agroecology, Novi Sad, Serbia	**SOIL CHARACTERISTICS OF PLUM ORCHARDS WITH INDICATION OF GEOGRAFICAL ORIGIN**
10:45-11:00	**Radomir Ljupkovich** Department of Chemistry, Faculty of Science and Mathematics, University of Niš, Serbia	**COMPOSITES OF GRAPHENE-OXIDE AND TITANIA AS PROMISING PHOTOCATALYSTS FOR ORGANIC POLLUTANTS DEGRADATION**
11:00-11:15	**Flamur Sopaj** Chemistry Department of Natural Sciences Faculty, University of Prishtina, Kosovo	**FENTON AND ELECTRO-FENTON ADVANCED OXIDATION PROCESSES FOR ORGANIC POLLUTANTS REMOVAL FROM POLLUTED WATERS**
	High-end Dialogue	
11:20-12:20	**POSTER SESION – PART 1**	
12:30-13:30	***Lunch break, University lunch bar (First Floor-Campus 2)***	
ENVIRONMENTAL PROTECTION: critical issues concerning at national and regional scale ***Chairwoman Assoc. prof. Natalija Markova-Ruzdik***		
13:30-13:45	**Alen Mujčinović** University of Sarajevo, Faculty of Agricultural and Food Sciences, Sarajevo, Bosna and Hercegovina	**INTRODUCING CLIMATE OPTIMIZED PRODUCTION OPPORTUNITIES FOR WESTERN BALKAN ECONOMIES**
13:45-14:00	**Elena Doneva** Faculty of Natural and Technical Sciences, Goce Delcev University, Stip, North Macedonia (students' oral presentation)	**INDOOR AIR QUALITY IN HOMES USING BIOMASS FOR HEATING AND COOKING**
14:00-14:15	**Kristina Panev** UNILAB, Faculty of Agriculture, Goce Delcev University, Stip, North Macedonia (students' oral presentation)	**DETERMINATION OF CHLOROPHYLL IN A WATER SAMPLE**
	High-end Dialogue	
14:15-14:30	**Filip Andonovski** **Some practical aspects:** **"SOLAR HEATER AND AIR PURIFIER"** **AGRO SOLAR**	
14:40:15:00	***Coffee break***	
15:00-16:30	**POSTER SESION Part 2**	
16:30-17:00	**Experts' meeting-evaluation of poster presentations**	
17:00-18:30	**Students workshop** **"Eliminate & Minimize & Hazards & Pollution"** Laboratory for Environmental Chemistry (Part 1)	

19:00	***Dinner -Hotel Izgrev***
October 30th, 2021 (Saturday) 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 generation of 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***

Protocols for COVID safe conditions will be in accordance and within the published decision on preventive recommendations, interim measures, follow-up measures, purposeful protocols, plans and algorithms for action to protect the health of the population from the infectious disease COVID-19 caused by the SARS-CoV-2 virus, the cases and the period of their application, published on 15.10.2021 in the Official Gazette No. 234/21, Republic of North Macedonia.

CONTENTS

PLENARY LECTURES

PL1

GEOCHEMISTRY OF MAJOR AND TRACE ELEMENTS IN SOILS OF THE REPUBLIC OF NORTH MACEDONIA

Trajče Stafilov[1], Robert Šajn[2]

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Abstract

Beside the research activities on heavy metal pollution in specific areas in the Republic of North Macedonia, information about soil quality on a national level is limited. Therefore, a geochemical investigation of soil across the whole country were performed, and this information deficit is being addressed with this project which aims to prepare the first Geochemical Atlas of the Republic of North Macedonia. In this atlas, the basic geochemical properties of soils are described, as revealed by a detailed large-scale survey across the country and analyses of the findings. It will provide a sound, well-structured baseline of soil geochemical properties relevant to sustainable land use and soil management to decision makers in the Republic of North Macedonia in order to reduce the environmental, agronomic and health-related pressures. The project includes soil sampling and analysis from 1,024 locations with a grid of 5×5 km distance between the sampling locations. Each sample represents a mixture of five subsamples to the depth of 0–30 cm. Areas which are known as polluted areas (surroundings of mines, metallurgical factories or larger towns) are investigated taking additional samples on a much denser sampling grid (1×1 km or 0.5×0.5 km). All samples are analysed for contents of about 60 elements. For this purpose, several analytical techniques are applied: inductively coupled plasma – atomic emission spectrometry (ICP-AES), atomic absorption spectrometry (AAS), inductively coupled plasma – mass spectrometry (ICP-MS) and neutron activation analysis (NAA). All data are statistically processed, and appropriate maps of distribution are prepared for 39 chemical elements. Based on a comparison of statistical parameters, spatial distribution of particular elements and results of cluster and factor analysis, four main geochemical associations were identified: 1. The association connected with the Neogene and Quaternary volcanism (Ba, Be, Ce, Hf, K, La, Rb, Th, Tl, U, and Zr); 2. Association of siderophile elements (Co, Cu, Fe, Mn, Sc, Ti, and V); 3. Association connected with ophiolites and Mesozoic ultrabasic magmatic rocks of Vardar zone (Cr and Ni) and 4. Chalcophile (sulphide) elements (As, Bi, Cd, Pb, Sb, Sn, and Zn). The regional distribution was prepared according to the eight statistical regions in Macedonia, distribution according to 15 most common geological formation and distribution according to 13 pedological units.

Keywords: geochemistry, atlas, soil, major elements, trace elements, North Macedonia

PL2

DETERMINATION AND STATISTICAL ANALYSIS OF THE ATMOSPHERIC DEPOSIT OF ELEMENTS IN KOSOVO THROUGH MOSSES AS BIOMONITORS

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Abstract

Atmospheric deposition of chemical elements on the territory of Kosovo was studied using the already widely used technique of mosses as biomonitors. Moss samples (*Hypnum cupressiforme, Homalothecium sericeum* and *Pseudoscleropodium purum*) were collected from 45 locations, they were digested in a microwave digestion system and analyzed by inductively coupled plasma - atomic emission spectroscopy (ICP-AES) and inductively coupled plasma - mass spectrometry (ICP-MS). A total of 25 elements concentration in collected moss samples was determined: Al, As, Ba, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Sr, Ti, Tl, V and Zn. The obtained results were processed by multivariate statistical analysis, which resulted in four factors, one anthropogenic and three geogenic or mixed geogenic-anthropogenic.

Statistical analysis was performed to better present and explain the data, for eight heavy metals (Al, Cd, Cr, Cu, Fe, Ni, Pb, and Zn) as the potentially toxic elements. High concentrations of Pb, Zn, Cd, and Ni were found near industrial sites and in more densely populated areas. Principal component analysis (PCA) identified more polluted sites such as Zveqan, Stanterg, Prapashticë, Siboc, and Lupç. It was also found that Pb, Zn, Cd, Cr, and Ni are the heavy metals that affect these polluted sites the most. High contents of Cd were found in Kaçanik and Paldenicë, Te Kalaja-Artanë, Çikatovë, and Shalc, all sampling points found around industrial sights. The contamination factor (CF) and the polluted load index (PLI) were calculated. CF showed that only Cu, and Zn, had no or almost no contamination levels over the range of moss samples, while Cd and mainly Pb gave extremely high values for CF, indicating extreme contamination levels. The pollution load index also showed that only a few samples were slightly polluted, while most samples showed considerable and very high pollution levels.

Keywords: Kosovo; air pollution; elements; mosses; ICP-AES; ICP-MS; statistical analysis.

PL3

STUDY OF AIR QUALITY BY MOSS BIOMONITORING AND TRACE ELEMENTS CONTENT

Pranvera Lazo[1], Shaniko Allajbeu[1], Flora Qarri[2], Lirim Bekteshi[3], Trajce Stafilov[4]

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Abstract

Environmental pollution is associated with natural and anthropogenic emission sources of various pollutants, particularly toxic metals. Air pollution is a global problem and the continuous monitoring of air quality is necessary. This paper presents a picture of the air quality of Albania evaluated by moss biomonitoring and trace metals that pose risk for human health. *Hyppnumm cupressifforme* (Hedv.) sps. was used as a bioindicator, since it is widespread in Albania. Metals concentrations were determined by different instrumental analyses (ICP-AES, ETAAS, and CVAAS). The concentrations data onto ten elements in moss samples (As, Cd, Co, Cr, Cu, Fe, Hg, Ni, Pb, V, and Zn) were statistically processed to distinguish their concentration levels and the outlier points with high concentrations derived mostly from anthropogenic contributions. The data were statistically analyzed to understand spatial and temporal variability, the relationship between the elements, and to assess the most probable pollution sources. Significant variations were detected in the concentration data of the elements (except Cu, Fe, and Zn). The geochemically and mathematically processed data indicates high anthropogenic sources of Cr, Ni, and Co. The spatial distribution analysis identified the local enrichments of Cr, Ni, and Co stretched in the north-southeastern direction of Albania and affected by the soils geochemistry, mining and metal high-temperature processing, and mineral deposits of the area. Factor analysis and the inventory of emission sources made possible the identification of the sources of the elements under investigation.

Keywords: air quality, moss biomonitoring, trace metals, statistical analysis, emission inventory, instrumental ICP-AES, Albania.

PL4

SOIL CHARACTERISTICS OF PLUM ORCHARDS WITH INDICATION OF GEOGRAFICAL ORIGIN

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Abstract

Domestic or European plum is a leading fruit species in Serbia and traditionally one of the most important plant species. With 558 930 t in plum production, Serbia was ranked second in Europe and third in the world. Plum trees are grown across the whole territory of Serbia, but the most important areas of plum cultivation are central (Šumadija region) and western Serbia.

The subject of the study was the characteristics of agricultural soils under plum orchards, as well as the soils planned for the establishment of new orchards in the Šumadija region. A total of 106 samples were taken at two depths (0-30 and 30-60 cm) and analyzed. Parameters of soil fertility (main chemical properties), the content of available microelements (Fe, Mn, Zn, Cu, B) were examined in the scope of the research.

Soil quality in the studied area is primarily determined by the processes of pedogenesis, as well as cultivation practices and fertilization. On average, an acidic soil reaction with a very low content of carbonates and readily available phosphorus was found in all the analyzed samples. The content of humus, total nitrogen and readily available potassium were at a moderate level. Availability of microelements (copper, iron and manganese) was at the satisfactory level in all studied soils. The analysis of available boron (B) showed insufficient boron supply especially in deeper soil layers. Similar situation, although less pronounced, was found in the analysis of available zinc content in deeper soil layers.

Šumadija has great natural potentials, which provide a solid basis for future development and regional leadership in the production of traditional plum products. Variations in soil quality confirms that the optimization of water-air regime and soil fertility are the main requirements to achieve full yield potential.

Keywords: Šumadija region, plum production, soil quality

PL5

COMPOSITES OF GRAPHENE-OXIDE AND TITANIA AS PROMISING PHOTOCATALYSTS FOR ORGANIC POLLUTANTS DEGRADATION

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Abstract

Ultraviolet water treatment became the most effective method for water purification and disinfection with an efficiency of about 99.99%. Also, heterogeneous photocatalysis has been proven as very effective for wastewater treatment. Since photocatalysts can initiate reactions of decomposition organic contaminants under ultraviolet (UV) or sunlight irradiation without using chemicals or producing chemical wastes, photocatalytic reactions are considered a sustainable way to the removal of a variety of environmental pollutants. In photocatalytic treatment organic compounds can be completely mineralized with CO_2, H_2O and some mineral acids as final products. This is very significant because no waste is produced, or additional treatment is needed. So photocatalytic treatments are cheaper and more effective, and more eco-friendly processes for water purification.

Heterogeneous semiconductor photocatalysts (TiO2, ZnO, SnO2, ZrO2) are used as material for purifying water and air and degradation into less toxic organic compounds of a wide range of organic pollutants. Photocatalytic usage of semiconductors is followed by quick recombination of photoexcited electron/hole pairs, which results in low quantum efficiency and low photocatalytic activity. For these reasons, the use of co-catalysts and photocatalyst carriers is becoming more frequent. Recently, much emphasis has been placed on using graphene oxide (GO) supported semiconductor photocatalysts for photodegradation of organic dyes, water splitting of hydrogen evolution and CO2 photoreduction into hydrocarbon fuel, thanks to the favorable characteristics of the material itself.

Graphene oxide-based materials can be used as support or modifier of titanium dioxide-based photocatalysts. Graphene oxide significantly improves efficiency by shifting band gap to visible light region. Also, the graphene oxide component improves sorption characteristics of composites, so pollutant molecules become closer to photoactive centers on the surface of the catalysts. Composites of graphene oxide and photocatalytic semiconductors have future and represents a topic for further research.

Keywords: UV treatment, photocatalysis, titania, graphene oxide, graphene, water treatment

PL6

FENTON AND ELECTRO-FENTON ADVANCED OXIDATION PROCESSES FOR ORGANIC POLLUTANTS REMOVAL FROM POLLUTED WATERS

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Abstract

Advanced oxidation processes are environmentally friendly methods for organic pollutants removal form waters. They are based on the production of hydroxyl radicals as powerful oxidizing agents ($E^0_{(V/SHE)}$ = 2.8 V in acidic media), which oxidize effectively almost all of the organic pollutants. Fenton and electro-Fenton processes are advanced oxidation methods which are studied widely for their organics oxidation capacity.

Fenton process is a chemical method for organic pollutants destruction using the Fenton's reagent, a mixture of hydrogen peroxide H_2O_2 and iron Fe^{2+} ions which react at pH 3 to give hydroxyl radicals $^{\bullet}OH$. Then $^{\bullet}OH$ oxidizes organic pollutants present in the solution. The first attack $^{\bullet}OH$ leads to the transformation of organic pollutants to fragments which have different chemical properties than the initial molecule, so it is sad that the molecule has been degraded. But hydroxyl radicals permanently attack any organic fragment created in the solution by degradation, until they are transformed to CO_2 and H_2O – molecules that are not harmful for the environment (except CO_2 greenhouse effect). Electro-Fenton operates similarly, only it is more efficient because the Fenton's reagent is produced directly in the solution which is being treated. The production of Fenton's reagent is done electrochemically. H_2O_2 is produced on the cathode form the reduction of oxygen, whereas Fe^{2+} is added in very small quantities as catalyst which reacts with H_2O_2 to produce hydroxyl radicals. Then Fe^{3+} is reduced to Fe^{2+} again on the cathode, and continues to react with hydrogen peroxide giving hydroxyl radicals

Keywords: Fenton, electro-Fenton, hydroxyl radicals, organic pollutants.

PL7

INTRODUCING CLIMATE OPTIMIZED PRODUCTION - OPPORTUNITIES FOR WESTERN BALKAN ECONOMIES

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Abstract

Globalisation brings broad range of positive but also negative effects, and some of most prominent negative effects include strong deruralization (according to UN, 2018 it is expected that almost 80% of the population will live in urban regions by 2050), growth of megacities with all the consequences (UN, 2019), the dominant role of vertically integrated companies, long value chains and unequal power distribution among stakeholders, food waste (WEF, 2012), GHG emissions (UN & FAO, 2018) and, health-related problems such as the increase in obesity worldwide (OECD, 2020). Western Balkan economies also continues to struggle with a wide range of problems, ranging from political, to social, economic, and environmental ones. The high unemployment rate among the youth population (10-30%), strong depopulation rate, migration and outmigration trends, "brain drain" (WB, 2020), but also a wide range of environmental degradation problems (air, soil, water, etc.) and many other are key one to be considered trough different types of private and public policies. Following global trends, the global/regional/national food value chains are already transforming towards a more sustainable one (Willer & Lernoud, 2016; Eyhorn et al., 2019). This transformation results in multiple new concepts/business models such as geographical identification of products (PDO, PGI, TSG), short/localized agri-food systems, organic/ecological production systems (Fluery, 2016), and one of them is also "climate-optimised food production" (Giseke et al., 2015), a concept widely known as Urban Agriculture (UA). UA concept gain on popularity recently (Orsini et al., 2013; Piorr et al., 2018), indicating an ongoing change in attitudes toward current lifestyle. UA is already producing 15-20% of the global food supply, while engaging 25-30% of urban dwellers worldwide (Goldstein et al., 2017; Giseke et al., 2015) and, attracting more and more people with emphasis on responsible trade, consumption, practice-based and citizen-led movement (Skar et al., 2020), that aims to achieve balance between food security and quality along with sustainability, decreasing the environmental footprint, increasing productivity and generally improving quality of life.

Keywords: climate-optimized food production, urban agriculture, food value chain transformation, sustainability, citizen-led movement.

ORAL PRESENTATIONS

POSTERS

OP1
INDOOR AIR QUALITY IN HOMES USING BIOMASS FOR HEATING AND COOKING

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The impact of indoor air quality (IAQ) on occupants' health and welfare is a subject that gathered the attention of the scientific community over the last two decades. Homes were found to be micro-environments with the highest contribution to the daily exposure, especially to particulate matter and VOC's. According to WHO, 3.8 million deaths every year, occur as a result of household exposure to smoke from dirty cookstoves and fuels, with particularly high risks among women and children's groups. Our study involves IAQ measurements in residential spaces in Skopje urban and sub urban area (Lisiche), using biomass for heating and cooking purposes. A total of 40 houses were included in preliminary program, with 21 passing QA/QC procedures and qualified for further analysis. Parameters measured include particulate matter (PM 1, PM 2.5, PM 4 and PM10), carbon dioxide, temperature, relative humidity and atmospheric pressure. Measurements were preformed using optical sensor (light scattering) for PM, NDIR sensor for CO_2, temperature and humidity combined resistance/capacitive probe for T(°C) and RH % and piezoresistive sensor for atmospheric pressure (Delta Ohm, HD 50). Monitoring was conducted for several consecutive days in order to avoid influence of different space usage habits and ambient pollution levels. The obtained results shows that 24 hours average PM10 concentration in homes heating with indoor stoves are in range of 200.1 ± 126.9 μg/m^3 (n = 17) while in homes using biomass with external heating systems the 24 hours average PM10 concentration were in range 14.7 ± 6.5 μg/m^3 (n = 4). In the same period (28.12.2020-28.01.2021), 24 hours average outdoor PM 10 concentrations at Lisiche station were 72.25 ± 57.19 μg/m^3. Data obtained, exhibit significantly higher indoor concentration for homes using indoor stoves, indicating indoor stoves as very significant source of indoor air pollution.

Keywords: PM10, air pollution, Skopje, stoves.

OP2

DETERMINATION OF CHLOROPHYLL IN WATER SAMPLE

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Abstract

Chlorophylls are ubiquitous pigments in the plant kingdom that play a key role in photosynthesis, a vital function for life on Earth. Increase in phytoplankton biomass is a direct consequence of advancing eutrophication. Although algae are a natural part of freshwater ecosystems, too much algae can cause aesthetic problems such as green scums and bad odors, and can result in decreased levels of dissolved oxygen.

Rivers and streams are monitored for excessive growth of phytoplankton due to high concentrations of plant nutrients. This excessive growth can lead to eutrophication of the river or stream and cause deadly fish kills. For similar reasons, lake, pond, and reservoir monitoring, including lake profiling studies, also observe excessive algae population distribution and growth. Algae control is a major concern in pond management, especially in smaller bodies of water, where excessive algae growth can quickly become a problem.

Measuring chlorophyll concentration is also a step in the process of screening/monitoring for nuisance algal blooms that may influence the taste and odor of drinking water sources. These blooms may actually create conditions that are toxic to fish, wildlife, livestock, and humans. Bodies of water used as drinking water sources are also monitored for phytoplankton concentrations for the early detection of algal blooms to minimize filtration system clogs.

There are various techniques to measure chlorophyll, including spectrophotometry, high-performance liquid chromatography (HPLC), and fluorometry. Spectrophotometry is the classical method of determining the quantity of chlorophyll in surface water.

UNILAB laboratory conducts water quality analysis, including a validated spectrometric method for determination of chlorophyll in surface and waste water samples. Quality assurance (QA) has become an increasingly important topic, as environmental monitoring bodies realize that accuracy of measurements can depend very much on how the measurement is taken.

This study presents the methodology for chlorophyll extraction from water samples and subsequent spectrometric determination of the extracted chlorophyll. Waters samples with higher concentrations of nutrients from fertilizers, septic systems, sewage treatment plants and urban runoff, usually have excess amounts of algae and increase concentrations of chlorophyll a.

Keywords: Chlorophyll, analytical challenges, surface water, waste water.

P1

LITHOLOGICAL DISTRIBUTION OF RARE EARTH ELEMENTS IN SOILS FROM THE LOCALITY OF THE ABOUNDED Sb–As–Tl MINE ALLCHAR, N. MACEDONIA

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Abstract

Although rare earth elements (REEs) are relatively rare in the Earth's crust, but they can be found concentrated in some ore deposits. In the Republic of North Macedonia, information on the distribution patterns of the REEs and speciation characteristics in soil is also very scarce, especially in mining localities. This study provides an overview of REEs distribution in the soil in the vicinity of the hydrothermal volcanogenic As-Sb-Tl deposit of Allchar, North Macedonia. The Allchar locality is a rare outcrop of antimony–arsenic–thallium mineralization, located on the northwestern edge of Kožuf Mountain, North Macedonia. It is a world-renowned locality as the richest deposit of thallium minerals and the largest number (12) of different thallium minerals. The contents of REEs were determined by inductively coupled plasma - mass spectrometry (ICP-MS). The content of light rare earth elements (LREEs) in the study area ranges from 8.92 to 188 mg/kg, while the content of heavy rare earth elements (HREEs) ranges from 1.95 to 42.7 mg/kg. It can be concluded that there is some enrichment of light REEs in the volcanic intrusive rocks of the Allchar mine area, including latite, quartz-latite, trachyte and occasional andesite and dacite. The spatial distribution of HREEs is closely related to the lithology of the region, particularly the sandstone and claystone, followed by layered and massive carbonate rocks (limestone, dolomite, marble) that occurred in the Middle and Upper Triassic.

Keywords: rare earth elements, soil, lithological distribution, ICP-MS, Allchar deposit, North Macedonia

P2

POLAROGRAPHIC STUDY OF HEAVY METALS (Cu, Ni and Cr) COMPLEXES WITH ORGANIC LIGANDS

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Abstract

Modern electrochemical research greatly promotes environmental water chemistry. The sensitive voltametric techniques are much useful for metal speciation in natural waters, dominated by complexation with organic compounds. The determination of stability constants of complexes of metal ions with different ionic species present in natural waters is still interest of many environmental electrochemists.

The objective of this work was investigation of heavy metal complexes with organic ligands. We investigated the complexation of Ni (II), Co (II) and Cr (III) metal ions with ethylenediaminetetraacetic acid (EDTA), nitrilotriacetic acid (NTA) and aniline, using differential pulsed polarography. The measurements were made in perchlorate solutions with concentration C=0.1 mol/dm^3, at pH = 4 and pH = 6. The concentration of metal ions was constant C = 1x10^{-4} mol/dm^3 and was titrated by complexing agents (EDTA, NTA and aniline) in concentrations of C = 1x10^{-5} mol/dm^3, until complete complexation of the metal ions. Experimental measurements proved that EDTA and NTA form very stable complexes with heavy metal ions, which appear at much more negative reduction potentials compared to the reduction of the metal ions investigated: Ni (II), Co (II) and Cr (III). While aniline forms labile complexes and do not appear as separate polarographic waves but coexist with metal ion waves. From the experimental data, by measuring the change in the reduction potential of metal ions, and metal complexes with organic ligands, we calculated the stability constants of complexes formed, and our results are very close with values from the literature. The complexation of metal ions is greater in solutions with pH=6, compared to pH=4, as the result of the influence of H^+ ions.

Keywords: heavy metals, natural water, complexation, polarographic wave, reduction potential, stabile complexes.

P3

PREVENTIVE MEASURES FOR WATER PROTECTION OF POLLUTION FROM THE CATCHMENT OF THE RIVER LOSANA – DELCHEVO

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Abstract

Protecting the surface and groundwater of some water source from pollution is a very complex problem. Many processes and factors have an impact on the change of water quality from the source, primarily anthropogenic factors that are a consequence of human activity.
The artificial accumulation Losana is used for water supply of the city of Delchevo and other settlements in the municipality of Delchevo. The terrain where the intake is located is a lower catchment area of the river Losana.

Based on the hydrological, geological, geomorphological analyze and other data as well as based on the existing legislation in Macedonia for preventive protection of water used from the reservoir Loshana for water supply of Delchevo and other settlements in this municipality is proposed about the reservoir to single out three protection zones:
- narrower protection zone - I, zone
- wide protection zone - II, zone
- wider protection zone - III, zone

A narrower protection zone covers the area immediately around the enclosure which is fenced with a metal mesh fence. In this zone are prohibited all activities except those related to the capture, preparation and transport of water in the treatment system.

The wide protection zone covers several hectares of hilly-mountainous area (about 1.5 km^2)

The wider protection zone is the largest and covers several hectares of hilly-mountainous area (about 9.5 km^2). In this zone, as in the previous one, the construction of industrial, tourist, catering, sports-recreational, agricultural and other facilities is prohibited, as well as performing activities whose wastewater and other waste materials may endanger the quality, health and the capacity of the waters from the catchment area of the river Losana.

Keywords: pollution, water protection, preventivne mesaurment, Losana river

P4

A STUDY OF ENDRIN AND PERMETHRIN PESTICIDES REMOVAL FROM AQUEOUS SOLUTIONS BYFOUR ALBANIAN NATURAL CLAYS

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Abstract

Organic pollutants such as pesticides, present a major concern when reaching water systems since they are proved to be persistent and highly toxic. Natural soil components, such as clays, have recently drawn increasing attention regarding their promising potential as adsorbents on the process of removing contaminants from the environment. Taking advantage of their properties, we studied the granulometry and the adsorptive capacity of four Albanian natural clays (Brari, Currila, Dardha, Prrenjasi) toward endrin and permethrin pesticides. The granulometric analysis of the clay samples was performed by Andreasen pipette and Torsion balance techniques. Integral and differential distribution charts obtained from measured data reveal the presence of the fraction with a mean diameter below 4 μm as the major constituent of Dardha and Currila clays. Brari and Prrenjasi clays contain a higher percentage of particles with mean diameters varying between 8 to 14 μm.

The adsorption behavior and the adsorption capacity of the Albaninan natural clays were studied for pesticide concentrations varying below their solubility limit in water. The overall adsorption process is analyzed based on the function types resembling four mostly used isotherms: Freundlich, Langmuir, Temkin and Dubinin-Radushkevich models for a selected pesticide concentration and a variable time as well as for a selected time against variable pesticide concentrations. The adsorption mechanism was examined using the pseudo-first-order and pseudo-second-order kinetic models. The interpretation of the results, evidenced the adsorption process of Brari and Currila clays as the fastest despite their low adsorption capacities. While Dardha and Prrenjasi clays, which show better adsorptive properties, the adsorption process occurs slowly.Prrenjasi clay showed adsorption superiority for endrin and permethrin with approximately 10 times higher adsorbed amounts for permethrin.

Keywords: Organic pollutants, pesticides, clays.

P5

POTENTIALLY TOXIC ELEMENTS IN AGRICULTURAL SOIL OF CENTRAL SERBIA

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Abstract

The group of potentially toxic elements (PTEs) i.e. heavy metals have dual role in soil as nutrients and/or as toxicants. The aim of this study was to determine the concentrations of PTEs in agricultural land for the Central Serbia from aspect of safety food and feed production. The total of 95 soil samples were taken from topsoil 0-30 cm, from area belonging of 6 statistical districts in the Central Serbia. The collected samples were analyzed for basic soil parameters and PTEs (As, B, Co, Cr, Cu, Mn, Ni, Pb, and Zn) total (HNO_3+H_2O_2) and available (EDTA) concentration by ICP-OES technique and total Hg (by Direct Mercury analyzer from solid samples). According to the determined concentration of As, B, Cd, Cu, Pb, Zn, and Hg, none of the tested samples exceeds the maximum allowable concentration (MAC) for agricultural land. The detected concentration of Co and Mn is at the ordinary level for agricultural land (elements with no prescribed limit in agricultural land). According to the concentration of Cr and Ni, 10 and 35 tested soil samples have a higher concentration than the MAC, respectively. The increased content of Cr and Ni in the soil is of geochemical origin, which is in line with previous research. The median values for total concentration of observed PETs were: 9.5 (As); 6.8 (B); 11.7 (Co); 51.5 (Cr); 28.2 (Cu); 613.4 (Mn); 42.6 (Ni); 20.9 (Pb); 87.1 (Zn) and 0.06 (Hg) mg kg^{-1}. According to established statistically significant correlations, some of observed PTEs have positive correlation with silt and clay fractions, while correlation with sand is in negative. Beside this, concentration of B, Co, Cr, Cu, Ni, Pb, Zn are in positive correlation with organic matter content. Only Mn concentration was in negative correlation with pH soil reaction, while B, Cr, Cu, Ni, and Hg were in positive ratio, which is attributed to the predominantly acidic reaction of the observed samples. Based on present research of PTEs presence in soil, agricultural land in Central Serbia have no limitations for healthy food/feed production.

Keywords: soil, potentially toxic elements, PTE, agricultural land

P6

CHARACTERIZATION OF MERLOT WINES BASED ON PHENOLIC COMPOSITION DETERMINED BY HPLC-DAD-ESI-MS AND MS/MS TECHNIQUE

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Abstract

The concentration of phenolic compounds in wine depends on many factors, such as the variety, climate, soil, oenological practices applied for winemaking, aging and storage conditions. The purpose of this investigation was to determine the detailed phenolic profile of Merlot wines (vintage 2008), produced in Tikveš wine region in Republic of N. Macedonia. High-performance liquid chromatography with diode array detection coupled to mass spectrometry (HPLC-DAD-ESI-MS/MS) was used to identify and quantify the phenolic compounds in wines. Identification of the individual phenolic compounds was carried out by comparison of their UV/Vis spectra and retention times with those of the available standards, as well as by comparing the ESI-MS and MS/MS data with the standards analyzed under the same experimental conditions and those found in the literature. Different families of phenolic compounds were considered: anthocyanins, vitisins, hydroxyphenyl-pyranoanthocyanins, flavonols, hydroxycinnamic acids derivatives and stilbenes. With regards to pigments, malvidin-3-glucoside and its 3-acetylglucoside and 3-*p*-coumaroylglucoside derivatives were the major anthocyanins, while vitisin A and 10-DHP-pyranomalvidin-3-glucoside (pinotin A) were the dominant pyranoanthocyanins. Obtained results are significant data for the Macedonian winemaking industry to understand the nature and content of phenolic compounds in Merlot wines, as the most important components that influence the color, stability and sensorial properties of wines.

Keywords: Phenolic compounds, HPLC-DAD-ESI-MS/MS, wine, Vranec.

P7

ADSORPTION OF HEAVY METALS (Cu, Cd, Pb AND Zn) FROM AQUEOUS SOLUTIONS USING ORANGE PEELS

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Abstract

Industrial and agricultural wastes pollute water with heavy metals, which reach tissues through the food chain. Among different types of pollution, the industrial wastes constitute the major sources of metal pollution. Adsorption is one the physico-chemical treatment processes found to be effective in removing heavy metals from aqueous solutions. A wide variety of materials have been studied to generate low-cost adsorbents, some of which are agricultural (or agro-industrial) by-products and wastes. The use of such materials as low-cost adsorbents has double benefits to the environment. Some of the agricultural by-products that have been studied lately are wood, rice, potato peel, grape stalks, etc.

The main objective of this study was to evaluate the capacity of orange peels, for removing metals: Cu (II), Cd (II), Pb (II) and Zn (II), from aqueous solutions. The bio-sorbent after being thoroughly ground and cleaned was treated with nitric acid solution (C=0.4 M); and with sodium hydroxide solution (C=0.4 M). We measured 0.05g of orange peel and treated them by metal solutions with concentration C = 0.5 and $1x10^{-3}$ M (in pH=4 and pH=6), measuring the adsorption for different times: 5, 10, 20 and 30 minutes. We have used as the research methods: differential pulsed polarography and cyclic voltammetry. The results of metal adsorption, are better in solutions with pH = 6, compared to those with pH = 4. The capacity of orange peels for removing of metal solutions $C=0.5x10^{-3}$ M were: 83.5%; 76%; 69% and 46%, for Cu; Pb; Zn and Cd, respectively.

Keywords: heavy metals, pollution, adsorption, orange peel, differential pulsed polarography.

P8

REGIONAL WASTE MANAGEMENT IN REPUBLIC OF NORTH MACEDONIA: CASE STUDY FOR EAST AND NORTH-EAST PLANNING REGION

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Abstract

Solid waste management remains an issue of significant importance for the Republic of North Macedonia, especially in a period when the country makes significant steps towards EU approximation. Despite harmonized national legislation, very little has been accomplished to comply with numerous EU Directives or Regulations, especially with Wastes Framework Directive (98/2008), which sets a series of very ambitious targets. The current system for waste management in the Republic of North Macedonia is primarily focusing on waste collection and disposal. Regular waste collection services are mainly limited to urban areas, providing up to 90% coverage in the cities and their outskirts. The National Waste Management Strategy foresees establishment of 5-7 regional landfills according to EU standards.

Waste management services in the East and North-East region, do not comply with national and international regulations now. They are incomplete, contain only inefficient waste collection and poorly controlled or uncontrolled landfill, without source separation schemes as defined in EU waste directives. East Region includes 11 municipalities, with 9 non-standard municipal landfills and around 70 dump sites, while North-East region includes 6 municipalities with 5 non-standard municipal landfills and around 40 dump sites. The total amount of generated municipal waste in Republic of North Macedonia in 2020 was 913 033 tonnes; the annual amount of municipal waste was 452 kg per person. Most of the collected municipal waste (99.8%) is landfilling.

In 2009, the Government adopted a Decision to establish integrated waste management system in the East and North-East region through public financing, while in 2019, was decided to be formed regional company for waste management in East, North-East planning region and Municipality of Sveti Nikole. The location of regional landfill will be on a hilly part, above the Ovchepole valley, 15 km Northeast of the Sveti Nikole, near the village Meckuevci. Within regional landfill following facilities for waste treatment will be established: mechanical-biological treatment (MBT), bio-stabilization, materials recovery (MRF) and small composting facility. New regional landfill should be built until 2025 with capacity of about 47000 t/year. This paper analyzes the benefits in terms of quality of life and environmental impact after the construction of the regional landfill for the East and North-East region.

Keywords: dump site, non-standard landfill, Sveti Nikole, Meckuevci, waste treatment

P9

A STUDY ON THE ELEMENTS CONTENT IN HONEY SAMPLES IN THE TERRITORY OF KOSOVO

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Abstract

The objective of the study was investigation of the macro and micro elements composition of the multifloral fresh honey, produced in different regions of Kosovo. Samples of fresh honey were collected in 99 sampling points, during July to September 2019. The samples were mineralized by microwave digestion, and in total 27 elements analyzed by plasma spectrometry (ICP-AES and ICP-MS). Three groups of elements of mixed origin were identified through factor analysis; the first is with mostly anthropogenic origin Mo, Pb, Sb, Se, Ti and Tl and the two other groups are mixed anthropogenic and geogenic origin As, K, Mg, Mn and P and Ag, Al and Li. Some of the element's levels in honey produced in Kosovo were determined to be within the following mean ranges: 970, 110, 75, 65, 56, 4.6, 2.9, 2.8, 2.4, and 2 mg/kg, for K, Ca, P, Mg, Na, Fe, Ba, Zn, Mn and Cu, respectively. In addition, it was found that the average contents of some heavy metals are as follows: Cd - 23 µg/kg, Cr - 0.38 mg/kg, Pb - 0.20 mg/kg, and As - 6.8 µg/kg, which are under the limit permitted according to the Food and Agricultural Organization and World Health Organization (FAO/WHO) codex Alimentarius CXS 193–1995.

Keywords: Kosovo, honey, macro and micro elements, microwave digestion, ICP–AES, ICP–MS.

P10

INFLUENCE OF DIFFERENT VINIFICATION TECHIQUES ON THE PHENOLIC CONTENT OF VRANEC WINES

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Abstract

Vranec is the most important red grape variety in Macedonia, representing about 70 % of red varieties grown in the country. From this grape variety, high quality red wines are produced, with a characteristic and deep purple colour, rich with phenolic compounds. Phenolic compounds such as anthocyanins, flavonoids and tannins are important constituents of red wine contributing to the taste, color, mouthfeel and quality. They are also associated with the health-promoting properties of red wine. The proportion of the different polyphenols in wine depends on grape variety, maturity, temperature of maceration and fermentation and the type of vinification. In this study, total phenols (TP), total antocianins (TA) and colour parameters of *Vitis Vinifera* red wines Vranec from vintage 2020, produced in the Republic of N. Macedonia, have been evaluated. The wines have been produced with three winemaking techniques, including classical fermentation, roto process and punch down technique, in order to study and compare the effect of vinification on the phenolic compounds. Total phenols were determined using the Folin-Ciocalteu method and expressed as gallic acid equivalents (GAE, mg/l) [1]. Determination of the total anthocyanins was realized by the method proposed of Di Stefano et al. [2]. The samples were diluted with a solution consisting of 70/30/1 (*v/v/v*) ethanol/water/HCl (concentrated) and the absorbance was measured at 540 nm. Colour parameters, including color intensity (CI) and hue (H) were determined by direct measurement of the wine absorbance at 420 nm, 520 nm and 620 nm. It was found that the applied vinification technique has an influence of the phenolic content, observing highest content of TP and TA in Vranec wines produced with punch down technique (TP: 1720 mg/l, TA: 254 mg/l) in comparison to Vranec wines produced with a roto technique (TP: 1222 mg/l, TA: 242 mg/l) and classical fermentation (TP: 1198 mg/L, TA: 211 mg/L). It was concluded that the punch down process gave the best results and highest content of total phenols, anthocyanins and colour parameters, in comparison with the other two techniques of vinification.

Keywords: Total phenols, anthocyanins, winemaking, Vranec, spectrophotometry.

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P11

BIOACCUMULATION OF SOME METALS IN THE ENDEMIC PLANT *STACHYS SCARDICA* IN THE REGION OF PRISHTINA, KOSOVO

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Abstract

The objective of this study was investigation of potential for bioaccumulation of some metals by the plant *Stachys scardica*, as an endemic plant species which grown in serpentine soils in the region of Prishtina. We analysed 11 metals (K, Ca, Mg, Fe, Na, Mn, Ni, Cu, Cr, Pb and Zn) in serpentine soil and plant organs in the endemic plant *Stachys scardica* from three localities: Llapushnik, Golesh and Badovc. Four to five subsamples were collected in an area 50x50 m^2, the plant samples were put in the paper bags of 1 L and the soil samples of 1 kg were put in plastic bags. Three main parts of the plants were taken for analysis: root, stem, and leaf. They were prepared in a standard procedure involving cleaning, drying, and digested in the microwave digestion system. The metals' content was measured by a flame atomic absorption spectrometer (FAAS). The mean content of metals (in mg/kg) in soil samples decreased in order: 45597 (Fe)> 45255 (Mg)> 6461 (Ca)> 2565 (Mn) > 2132 (K) >1888.9 (Ni) >1622.5 (Na) >1487.9 (Cr) >131.8(Zn) > 91.22 (Pb) > 31.29 (Cu), and the ration Mg/Ca was 7. The values of bioaccumulation factor for potassium were between 1.15 to 3.32; for calcium in leaf were up than 1, copper between 0.37 to 0.78; and for zinc from 0.16 to 0.49. The mean values of translocation factor were ranged: 2.51, 2.15, 0.93, 0.93, 0.92, 0.55 and 0.37; for Ca, Mg, K, Mn, Zn, Cu and Zn, respectively.

Keywords: Endemic plant, serpentine soil, metals, translocation factor, Kosovo

P12

DISTRIBUTION CHARACTERISTICS OF TRACE ELEMENT CONTENT IN PELAGONIA TOBACCO GROWING REGION

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Abstract

Content of the 18 anthropogenic and crustal elements (Ag, Al, Ba, Cd, Cr, Cu, Li, Fe, Mn, Na, Ni, Pb, V, Sr, N, P, K and Zn) were obtained in the tobacco and corresponding soil samples from 9 municipalities from Pelagonia region. Pseudototal (aqua regia extraction) and DTPA (diethylenetriaminepentaacetic acid) extractable content was analyzed by atomic emission spectrometry with inductively coupled plasma (ICP-AES). The objective was to determine the distribution and intensity of accumulation of trace elements in the tobacco plants. Relationship with ambient soil properties and chemical composition of tobacco plants was studied by statistical models (lognormal, factor and correlation analyses). According to factor analyses trace elements are found in three geogenic and two mixed (geogenic-anthropogenic) associations. Correlation analyzes of soil variables (OM, clay, pH) show poor, moderate to strong correlations with all analyzed elements. Clay revealed strong positive correlations ($P<0.01$) with contents of Co, Cu, Ni, Pb, and Zn. Most of the lithophile elements have a predominant positive correlation. Availability ratios (available content/pseudo total content) of selected variables show that trace elements content in soil is relatively stable over the study area and a considerable available amount of K and P comes from outside input. Calculated biological accumulation factor shows that oriental tobacco accumulates greater amount of Cu, Cd and Zn. Also, availability of studied elements is in the following order: Cu>Cd>Mn>Pb>Ni>Zn>Sr>Ba>Fe>Na>Al. It can be concluded that given data may be separated due their natural and anthropogenic contributions. It has been shown that multivariate analyses application can contribute to the establishment of the soil quality baseline and management of regional environment.

Key words: tobacco, trace elements, distribution, analyses, Pelagonia

P13

ASSAY OF ORGANOCHLORINE PESTICIDES AND POLYCHLORINATED BIPHENYLS IN AIR AND SOIL SAMPLES FROM THE AREA AROUND A HCH DUMP SITE

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Abstract

Environmental pollution remains the world's greatest problem facing humanity, and the leading environmental causes of morbidity and mortality. It is a major problem that affects biodiversity, ecosystems, and human health worldwide by contaminating air, soil and water. In order to deal with the pollutants in the environment, it is necessary to understand their structure and properties, to identify their sources and exposure routes and to propose measures for safe remediation of the environment.

The serious problem facing the environment is the presence of the potentially hazardous persistent organic pollutants (POPs). In this study, samples of soil and air were collected in different locations in Skopje to characterize the status of POPs, including organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs). A low-volume air sampler was operated to collect air samples from three different locations, whereas fifteen top soil samples were taken from the same area. The analysis was performed using gas chromatography with electron capture detector (GC-ECD).

The concentrations of total HCH, PCB and OCP in air samples ranged from 8.22 to 72.8, 16.8 to 21.2 and 57.3 to 66.2 ng/m^3, respectively. In soil samples their content ranged from 1.04 to 20678.8, 1.49 to 29.4 and 1.76 to 154.8 μg/kg for total HCH, PCB and OCP, respectively. The content of HCHs was highest in the soil sample collected near the former chemical plant OHIS (up to 20678.8 μg/kg). In two other locations the values for HCH were higher that intervention values according to Dutch standards.

Keywords: organochlorine pesticides, polychlorinated biphenyls, OCP, PCB, GC-ECD, HCH

P14

CALCINED CLAY CEMENT MANUFACTURING (LC^3)

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Abstract

As world population is expected to reach 9 billion by 2050, infrastructural changes should be done which require huge quantity of construction material such as cement. During cement manufacturing is released up to 60 % of CO_2, consequently there is a need for alternative binders. LC^3 or Limestone Calcined Clay cement is a modern cement,which consists of 50% clinker, 15% limestone,30% calcined clay and 5% gypsum.In this case,as the clinker content is reduced,CO_2 emissions are reduced too.The LC^3 technology promises a sustainable growth of economics around the world by reducing up to 40% CO_2 emissions compared to Ordinary Portland Cement (OPC) at lower investment and production costs.It is a low carbon, sustainable, cost effective technology that doubles the efficiency of the existing cement factories. The increase in demand of cement in coming decades might not be reached with existing alternative binders of fly ash and GGBS, so limestone and clay are the best supplementary cementous materials that are naturally available.In this work, the potential use of two thermally activated kaolinite clays as pozzolanic materials coming from different deposits of Albania,is studied. Both kaolinitic clays have different chemical composition. After thermal treatment and grinding, their pozzolanic properties were studied on blended cement containing 30% of calcined clays and the results were compared with that of OPC concrete (CEM I 42.5 R).The compressive strength of the mortars was tested after 2,7 and 28 days, concluding that the mortars containing calcined clay developed high resistance to compression,but less than that of the CEM I 42.5R.After 28 days it was seen that the mortars containing calcined clay reached approximately 80% of the control sample resistance.These results are promising but the influence of more factors such as alkaline activation of clays,kinetics of the calcination process, optimal temperature, calcination time,influence of grinding time on laboratory mills, fineness and specific surface area,as well as the mineralogical phase of the calcined clay samples, should be further studied.To conclude,based on literature data the study of calcined clays found in our country presents a good potential for the partially replacement of clinker in cement.

Keywords: LC3, Clinker, Calcined clay, Compressive strength, Ordinary Portland Cement,Pozzolanic materials.

Acknowledgement: The authors are thankful to the specialists of Cement Factory in Elbasan for their assistance during all the experiments.

P15

TOTAL BACTERIAL COUNT IN RAW MILK FROM THE FARMS FROM REGION "OVČE POLE", REPUBLIC OF NORTH MACEDONIA

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Abstract

Dairy product quality assurance begins at the farm and ends in the hands of the consumer. In this regard, raw milk quality is essential and is closely monitored. Raw milk must also meet other quality standards; it should be free of drug residues, free of added water and free of sediment, contaminants and other abnormalities. The overall condition and cleanliness of the dairy farm, as determined by routine inspections, are also considered. Although regulatory requirements have been instrumental in ensuring the quality of raw milk, most segments of the dairy industry feel that more stringent standards. This research study presents an insight into the number of bacteria as indicators of the quality of raw milk from the Ovče Pole region. For the needs of this research, an analysis was made of 1320 samples for the presence of bacteria in raw milk. According to European milk quality standards, in the biggest part of the samples, presence of bacteria does not meet the standard. From the analyzes made by the milk producers that were the subject of analysis in this research, it can be concluded that they do not adhere to good agricultural practice, the level of milk contamination is high due to poor hygiene, improper handling of milk after milking and insufficient education of farmers for hygiene in primary production.

Keywords: total bacterial counts, raw milk, farms in the Ovče Pole region

P16

BIOACCUMULATION OF SOME METALS IN THE PLANT *SEDUM OCHROLEUCUM* IN THE REGION OF PRISHTINA, KOSOVO

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Abstract

The aim of this research was investigation of potential for bioaccumulation of some metals by the plant *Sedum ochroleucum* which grown in serpentine soils in the region of Prishtina. We analysed 11 metals (K, Ca, Mg, Fe, Na, Mn, Ni, Cu, Cr, Pb and Zn) in serpentine soil and plant organs in the plant from three localities: Llapushnik, Golesh and Badovc. Four to five subsamples were collected in an area 50x50 m^2, the plant samples were put in the paper bags of 1 L and the soil samples of 1 kg were put in plastic bags. Three main parts of the plants were taken for analysis: root, stem, and leaf. They were prepared in a standard procedure involving cleaning, drying, and digested in the microwave digestion system. The metals' content was measured by a flame atomic absorption spectrometer (FAAS).

The mean content of metals (in mg/kg) in soil samples decreased in order: 67029(Mg) > 50542 (Fe) > 6088 (Ca) > 2706 (Mn) > 2462 (Ni) > 1950 (Cr) >2132 (K) >1209(Na) > 198.3(Zn) > 111.9 (Pb) > 25.8 (Cu), and the ration Mg/Ca was 11. The mean values of bioaccumulation factor were: 2.0, 0.95, 0.49 and 0.22; for K, Ca, Cu and Zn respectively. The translocation values for root to leaf transfer, ranged: 0.93-2.36 for calcium, 1.02-2.87 for magnesium, 0.82-1.62 for copper, and for zinc 1.16-1.51.

Keywords: serpentine soil, metals, FAAS, bioaccumulation factor, translocation factor, Kosovo

P17

HUMUS CONTENT IN DIFFERENT SOIL TYPES IN VOJVODINA PROVINCE, SERBIA - ANTHROPOGENIC INFLUENCE

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Abstract

The region of Vojvodina administratively belongs to Serbia (northern part), while its geomorphological position is in the southern part of Central-European Pannonian Plain. Besides other pedogenetic factors (parent material – mostly loess, relief – mostly flat, climate – semiarid and the period i.e. duration of pedogenesis), the formation of soils in this region was affected mostly by organisms and human.

Natural environment affected the formation of soils through natural herbaceous vegetation represented by steppe grassland, which leaves a large amount of well-distributed alkaline organic matter in soils, causing the development of soil types well-supplied with organic matter. The main soil-forming process was accumulation of humus. The main formed soil types are Chernozems and Humogleys - Hydromorphic black soil (FAO soil types Vertisols and Gleysols).

The effect of man as a pedogenic factor was visible in the last 100 years. Deep tillage was performed during the period of intensive agriculture, along with soil aeration and intense mineralization of soil organic matter. Mineral fertilizers were preferred over organic fertilizers, which disturbed the natural cycling of soil organic matter, resulting in significant decrease of its content.

Many systemic soil analyses have been carried out since 1950s in order to determine the dynamics of soil organic matter content in the region of Vojvodina. During 1950s and 1960s, analyses were conducted for the purpose of creating a pedological map. The network of soil samples (over 1300) was established in early 1990s, while sampling and analyses were repeated in early 2010s. Research results revealed the decrease in organic matter content by about 0.38% until 1990s, and henceforth by an additional 0.5%, depending on different soil types.

The significance of organic matter content to soil fertility created the need for increased future application of organic fertilizers, as well as more rational soil tillage, higher amounts of applied green manure, etc.

Key words: pedogenic factors, soil types, organic matter

P18

DEVELOPMENT OF *BOTRYTIS CINEREA* UNDER REDUCTION OF PESTICIDES TREATMENTS IN MACEDONIAN VITICULTURE PRODUCTION

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Abstract

The amount of pesticide residues in food items found in fresh fruit, such as grapes throughout the World is a highly documented problem. The necrotrophic fungi as it is gray mold or *Botryotinia fuckeliana* (de Bary) Whetzel (syn. *Sclerotinia fuckeliana* (de Bary) Fuckel) (anamorph *B. cinerea* Pers.), according to taxonomic characteristics, belongs to the genus *Botryotinia* (family *Sclerotiniaceae*) feed on dead host cells and cause necrosis by secreting toxins and cell wall-degrading enzymes (CWDEs), on the grapes (*V.vinifera subsp. sativa*) and other fresh products. *B.cinerea* causes an increase in the number of chemical treatments just before harvest and calls into question the environmental and health value of the product. Therefore, an attempt was made to create a forecasting model for *Botrytis* which is based on the relationship between relative humidity and the temperature in the vine canopy, and the aim was to create a graph where the curve will represent the tendency of *B. cinerea* to develop. The forecasting model for Botrytis was applied at the white varieties Smederevka and Zilavka and based on the data obtained was made ANOVA statistical test which proves the reliability of the model. On the localities, Smilica and Sopot, Kavadarci, Republic of Macedonia, are the experimental fields that were observed for three consecutive years (2017 till 2019). The aim of this research was to predict the development of *B. cinerea* and accordingly to reduce using of pesticides just before grape harvest.

Keywords: pesticide residues, *B. cinerea*, forecasting model for botrytis, ANOVA statistical test

P19

SOMATIC CELL COUNT AND PRESENCE OF AFLATOXIN M1 IN RAW MILK FROM THE FARMS FROM REGION "OVČE POLE", REPUBLIC OF NORTH MACEDONIA

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Abstract

Somatic cell count is the common method for determination of raw milk quality. An increased amount of somatic cells results either from an inflammatory process due to the presence of an intramammary infection or, under non-pathological conditions, from physiological processes such as estrus or advanced stage of lactation. Monitoring of somatic cell numbers has been simplified by automated cell counters that allow large numbers of milk samples to be evaluated quickly. Monitoring individual quarters or composite samples from all four quarters provides specific information that is helpful in making treatment and culling decisions. Aflatoxins (AFs) are secondary metabolites produced by *Aspergillus flavus*, *Aspergillus parasiticus*, and *Aspergillus nominus* fungi under impropriate growing and storage conditions. The AFs consisted of Aflatoxin B1, B2, G1, and G2 may contaminate food and feed. Maize grains and other feedstuffs such as corn silage, soybean, and press cakes from oil plants can be commonly contaminated by *Aspergillus* spp. The object of this study was determination of somatic cell count in 478 samples as well as identification and quantification of aflatoxin M1 in 60 samples of of raw milk from the "Ovče Pole". The results from this study indicated acceptable count of somatic cells in 95.5 % of the samples from raw milk while in 2 samples of raw milk, the amount of aflatoxin M1 was above limits with highest amount of 0,58 mg/kg raw milk.

Keywords: somatic cell count, aflatoxin M1, raw milk, farms in the Ovče Pole region

P20

USE OF REAL TIME METHODS FOR DIFFERENT INVESTIGATION AT ENVIRONMENTAL PROTECTION

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Abstract

Real time PCR (Polymerase Chain Reaction) or qPCR is a method by which the amount of the PCR product can be determined, in real-time, and is very useful for investigating gene expression. The main advantages of qPCR are that it provides fast and high-throughput detection and quantification of target DNA sequences in different matrices. The lower time of amplification is facilitated by the simultaneous amplification and visualization of newly formed DNA amplicons.

The development and application of molecular methods for the detection of pathogens has significantly changed the diagnosis and control of plant diseases, various environmental samples, including hosts tissues, soil, water and air. With Real-time PCR method, it is possible not only to identify and detect the presence or absence of the target pathogen, but it is also possible to quantify the amount present in the sample allowing the quantitative assessment of the number of the pathogen in the sample. Detection and accurate identification of plant pathogens is one of the most important strategies for controlling plant diseases to initiate preventive or curative measures. Molecular techniques of plant disease detection have been well established, particularly the development of real-time PCR technology have resulting in more convenient, effective, and specific assays have opened the door to greater use of these tests for detection and identification phytopathogenic microorganisms. And the result can be expressed on the same day, and it is possible to perform a simultaneous quantification of more than one pathogen in a single assay. Therefore, it can be a useful tool for monitoring microbiological quality in environmental samples, controlling plant diseases, fast detection of microorganism in soil, water…

Keywords: Real time PCR, molecular methods, plant diseases, environmental samples, plant disease detection, target pathogen, phytopathogenic microorganisms

P21

STUDY OF RELATIONSHIP BETWEEN YIELD AND YIELD RELATED COMPONENTS IN SPRING BARLEY VARIETIES USING MULTIVARIATE ANALYSIS

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Abstract

The aim of this paper was to study the relationship between grain yield and yield related components in spring barley varieties using multivariate analysis. Five spring barley varieties (Makedo, Xanadu, Josefin Variety, Gladys Variety and Scarlet Variety) were used as an experimental material. Only Makedo was domestic variety and the other spring barley cultivars were introduced. The field trial was carried out on the experimental field area in Probištip, Republic of North Macedonia, during two growing seasons (2013 and 2014). Two row barley varieties were arranged in a randomized complete block design with three replications. The size of experimental plot for each variety and replication was 5 m^2. During the vegetative period, all recommended agronomic practices were applied for growing crop. Grain yield and some important yield associated traits, like number of spikes per m^2, plant height, number of grains per spike, 1 000 grain weight and hectoliter weight were evaluated. Makedo variety showed the highest value for grain yield (6 844 kg/ha), followed by Xanadu (6 638 kg/ha). Also, Makedo has the highest values for number of spikes per m^2 and the number of grains per spike. Principal component analysis (PCA) was utilized to examine the variation and to estimate the contribution of each trait to total variability. Two main components with Eigen value greater than one contributed 82.46% variability existing in the barley varieties for yield contributing traits. PC1 accounted 59.92% of the total variability and the traits like number of spikes per m^2, grain yield and number of grains per spike were positively contributing to the first main component. The second PC accounted 22.53% of the variation and 1 000 grain weight was the main highly positively trait of PC2. Only Makedo variety showed positive values among both main components. Grain yield showed positive correlations with number of spikes per m^2 (r= 0.795) and number of grains per spike (r =0.632).

Keywords: Spring varieties, barley, principal component analysis, correlation

P22

ANALITCAL CHALLENGES FOR DETERMINATION OF ELEMENTAL IMPURITIES IN PHARMACEUTICAL PRODUCTS

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Abstract

Elemental impurities include catalysts and environmental contaminants that may be present in drug substances, excipients, or drug products. These impurities may occur naturally, be added intentionally, or be introduced inadvertently. Elemental impurities in pharmaceutical formulations can interfere with drug efficacy or have a toxic effect on the patient. Elemental impurities have multiple entry points during drug development and are poorly regulated. Regulators have issued guidelines — such as ICH Q3D, USP 232 and USP 233 Elemental Impurities - for monitoring a range of metal elemental impurities in pharmaceutical materials using inductively coupled plasma (ICP). Main aspect is given for the first class of elements As, Cd, Pb and Hg. These elements are considered as Significantly toxic to humans, limited or no use in the manufacture of pharmaceutical, require evaluation during the risk assessment across all potential sources of the production process and routes of administration. Control of elemental impurities in pharmaceutical materials is currently undergoing a transition from control based on concentrations in components of drug products to control based on permitted daily exposures in drug products. ICP–MS systems are capable of measuring multiple elements in a single acquisition while providing high-throughput capabilities with each analytical cycle being completed within 3–5 min. Measurements can be performed at very low detection limits and over a wide range of concentrations from 0.5 ppt to 500 ppm. The technique has definitive, multiple isotope identification capabilities, meaning that it is less prone to spectral interferences, whereas matrix-derived spectral interferences can be eliminated by using a collision–reaction cell (CRC). In addition, ICP–MS requires the use of only small sample volumes and is easy to use, stable, and reliable.

Keywords: ICP-MS, trace elements, pharmaceuticals.

P23

CANNABIS-WINE, A NEW WORLD TREND OR STORY WITH A QUICK END

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Abstract

The combinations of herbs with alcohol and wine are as old as mankind. The need for sedatives and painkillers has long resulted from the mixing of herbs and alcohol, today's trend is a leap into another era of wine. The trend of popularizing Cannabis (*Cannabis sativa* L.) as a medicine and plant that can be most persistent in the fight against climate change and described as a modern savior of the 21st century, results in a cannabis-infused wine product. The big jump in the cannabis industry globally, even in our country, are just one of the indicators of its progression. Will consumers' need for tasty and relaxing drinks make or break, will the trend of cannabis as a lifeline for the globe continue, are these conclusions real, proven, and most importantly needed, or is it just a momentary euphoria that will end quickly? We will leave this on the time.

Legislation is being adapted in favor of cannabis all over the world, more and more cannabis infused products are appearing on the market. The story of cannabis has two sides, the side where the plant saves the world from climate change and pollution and the other where its cultivation requires huge resources of water, energy, use of pesticides, which in turn have a counter-effect.

The trend called Cannabis-Wine needs to be thoroughly investigated deep to the roots, and explanation to be given.

Our research has shown that the current trend and progression in the cannabis industry in Macedonia, as well as the wine industry which is one of the main agricultural branches in the country provides an opportunity for development of this type of product. The development of this trend on a global level will be reflected in our region.

Keywords: cannabis, wine, trend, medicine, climate change

P24

AGROCHEMICAL SOIL PROPERTIES AFTER CULTIVATION AND HARVEST OF WHEAT

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Abstract

In this study, the data from agrochemical analysis of 168 agricultural soil samples from six fields after wheat cultivation and harvest are presented. The soil samples were analyzed in order to determine the status of agricultural soils for pH, EC, total nitrogen, readily available forms of phosphorus (P_2O_5) and potassium (K_2O) and humus for the purpose of understanding and promoting good agricultural practice and environment protection.

The analyzed parameters showed that the pH values of soil samples were in range 6.81 to 7.27, while the EC values varied from 0.08 to 0.17. The results of total nitrogen were in the range from 0.09 to 0.13%, the readily available P_2O_5 from 4.55 to 8.17 mg/100 g, while readily available K_2O ranged from 24.91 to 33.83 mg/100 g soil. The most of soil samples were supplied with 1.45 to 1.79% humus. The analyzed data shows the nutritional status of the soil and applied agricultural practices. Furthermore, recommendations for application of soil fertilizers were given based on analyzed parameters and the content of available nutrients.

This study implies that continual, appropriate, and deliberate analysis and interpretation of soil quality are needed in order agricultural producers to use soil resources more efficiently with optimized fertilizer quantities which will bring higher yields, reduced production costs and reduced environmental pollution.

Keywords: wheat, pH, EC, nitrogen, phosphorus, potassium, humus

P25

IMPORTANCE OF HAZELNUT (*CORYLUS AVELLANA*) AND MOST COMMON DISEASES IN CULTIVATION IN THE REPUBLIC OF NORTH MACEDONIA

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Abstract

Hazelnut (*Corylus avellana*), which fruits are called hazelnut, is a tree of the family *Corylaceae* or *Betulaceae*, which grows mostly as a shrub, and less often as a lower tree, up to 7m high. Hazelnut has a great economic importance in human nutrition and in the confectionery industry, but it is also used as a decorative species in landscape architecture.

Hazelnut is a fruit that requires probably the least protection, but as more and more new plantings are being planted, it is very possible, as in the case of nuts, for diseases and pests to appear, which will significantly affect the health and yield of hazelnuts. The specific conditions required by this crop are increasingly a problem in the regions where it is grown. Climate problems affecting certain regions are causing enormous damage to culture. The hot waves, storms and droughts that result from climate change cause a number of diseases in hazelnuts such as powdery mildew**,** bacterial blight, grey mold, leaf spot and others. Alternatives are sought in regions where the impact of climate change is less so that this crop can be grown, experiment with hybrid seedlings that are more resistant to disease and more.

These perennial crops are very important, they have the properties to filter surface water, prevent erosion, as well as their ability to decompose carbon from other plants. There are more than 800 hectares of hazelnut plantations in our country.

The main aim of this research was to identify the most significant causal agent of hazelnut diseases in the region of Eastern part of North Macedonia, on around 200-300 hectares. The appearance of the powdery mildew produced by the fungus ***Phyllactinia guttata (Scientific name Phyllactinia corylea)*** in the period 2020/21, showed a significant losses in hazelnut production.

Keywords: hazelnut, meaning, diseases, climate change, regions, *Phyllactinia guttata*

P26

DETERMINATION OF QUALITY AND ANTIOXIDANT ACTIVITY OF TRADITIONAL HOMEMADE FRUIT VINEGARS PRODUCED WITH DOUBLE SPONTANEOUS FERMENTATION

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Abstract

The quality and antioxidant potential of six traditional homemade vinegars produced using traditional methods was object of this study. The physicochemical characterization of vinegars produced from apple (*Malus domestica*), raspberry (*Rubus idaeus*), blueberry (*Vaccinium myrtillus*), blackberry (*Rubus fruticosus*), rose hip (*Rosa canina*) and persimmon (*Diospyros kaki*), was performed by measuring the ethanol content, total acidity, pH and dry matter in different vinegar production steps throughout a double spontaneous fermentation process, i.e., without any addition of yeasts or acetic acid bacteria. A spontaneous fermentation of fruits for vinegar production encompasses initially an alcoholic fermentation for 24 days, where fructose, glucose and sucrose, as most abundant sugars, are broken down into carbon dioxide (CO_2) and ethanol as main metabolic compounds, as well as other metabolic by-products and volatile com- pounds in trace amounts. The highest total phenolic compounds were measured by vinegar produced from rose hip (20.2 mg of gallic acid/mL) while the lowest concentration was determined for apple vinegar (0.29 mg of gallic acid/mL). The results from total phenolic com- pounds were in strong correlation with the antioxidant capacity. In this way, the use of traditional processes for the production of fruit vinegars proved to be very promising in terms of producing differentiated vinegars and, concomitantly, reaching high levels of health-promoting antioxidant capacities.

Keywords: homemade vinegars, double fermentation, quality, total phenolic content, antioxidant activity

P27

THE IMPACT OF AUTOCHTHONOUS AND COMMERCIAL YEAST STRAINS ON FERMENTATION AND QUALITY OF WINES PRODUCED FROM VRANEC GRAPE VARIETY FROM TIKVEŠ WINE-GROWING REGION, REPUBLIC OF NORTH MACEDONIA

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Abstract

The increasing usage of traded selected yeasts for winemaking leads inevitably to a loss of the autochthonous yeast populations naturally present in regional grapes and, consequently, drives to the potential loss of genetic diversity and heritage. Over the last few years, increasing interest among scientists and winemakers has been observed in exploiting autochthonous yeast strains. After isolation and the selection of yeast strains with good phenotype and technological characteristics, they can be further employed in winemaking processes with high potential to be successful. The object of this study was the impact of newly isolated autochthonous yeast strains called F-8 and F-78 on the fermentation and quality of wines from Vranec grape varieties. The fermentation process and quality of the produced wines were compared to the wines produced from the same grape varieties, but with a commercial yeast strain (D-80). The fermentation process was undertaken at 23–25◦C for 16 days. The highest alcohol content was detected in Vranec wine fermented with autochthonous F-8 yeast strain. Conversely, Vranec wine fermented by the F-78 yeast strain contained the lowest alcohol content (14.11%). The low sugar amount (2–3 g/L) in both grape varieties is indicated the production of dry wines. Unlike the alcohol content, Vranec wine produced by commercial yeast strain D-80 indicated the highest concentration of total phenolic compounds (1450 mg/L) and total anthocyanins (572 mg/L), while the lowest concentrations were observed in wine fermented by autochthonous yeast strain F-78 (1612 mg/L and 470 mg/L, respectively).

Keywords: autochthonous F-8 and F-78 yeast strains, commercial yeast strain D-80, fermentation, Vranec wines,

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PHYSICO-CHEMICAL CHARACTERIZATION, FATTY ACID COMPOSITION AND THERMAL STABILITY OF COLD-PRESSED SUNFLOWER OILS OBTAINED FROM 17 NEWLY CULTIVATED HYBRIDS FROM THE REGION OF NORTH MACEDONIA

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Abstract

Edible oils obtained from plants and oilseeds represent ester mixtures derived from glycerol with chain of fatty acids. Cold-pressed sunflower oils are rich in oleic and linolenic fatty acids. Oleic acid is monounsaturated fatty acid less susceptible to undesirable changes during deep-frying in comparison to polyunsaturated fatty acids.

The main object of this study was determination of physicochemical parameters such free fatty acids, peroxide value, saponification value, iodine number, density, oxidative stability and fatty acid composition on cold-pressed oils from 17 newly cultivated hybrids from sunflower from the region of North Macedonia. Results from fatty acid methyl esters indicated Experto hybrid as the high oleic sunflower hybrid with 86.2% of oleic acid. Moreover, iodine number for sunflower oil from this hybrid was 87.5 g I_2 per 100 g oil, which was expected due to the high level of monosaturated fatty acid. Negative correlation confirmed inverse relationship between the amounts of oleic acid and values of iodine number (r=-0.896). Opposite, positive correlation between iodine number and amount of linoleic acid (r=0.892) means that sunflower oils with higher value of iodine number will be thermally unstable and not suitable for deep-frying. Furthermore, the highest value for oxidative stability was measured for cold-pressed sunflower oils obtained from Talento, BG Fil and "Dijamantis hybrids (over 8, 9 and 5 h, respectively). According to the results from our study, we recommended the gap of oleic/linoleic acid as the most important for determination of thermal stability of sunflower oils. Finally, physicochemical parameters iodine number and oxidation stability can be significant parameters for prediction of the dominance of fatty acids in sunflower oil.

Keywords: cold-pressed sunflower oils, 17 hybrids, free fatty acids, fatty acid composition, iodine number, saponification value, refractive index, oxidative stability.

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DIFFERENCES IN SOME QUALITY TRAITS BETWEEN RED AND YELLOW CHERRY TOMATO VARIETIES GROWN IN REPUBLIC OF MACEDONIA

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Abstract

Four red (*cerrasiformae*, *grandifolium*, *rocemigerum*, *pyriformae*) and two yellow colored (*cerasiformae*, *pruniformae*) cherry tomato varieties were investigated in this study regarding some physical and chemical properties like pH, total carbohydrates (TC), total acidity (TA), ascorbic acid (AA), ash (AS), moisture (M), and dry matter (DM) content. A non-parametric Mann–Whitney *U* test for independent samples was performed to identify statistically significant differences between red and yellow cherry tomato regarding investigated traits. Yellow investigated varieties showed higher values for TC, AS, DM and AA content while red cherry tomato varieties showed higher content for TA and M. Statistically significant differences were observed regarding the DM, M, AA, AS, and TA content between the majority of the varieties. The varieties of *cerasiformae* and *pruniformae*, and the varieties of *pyriformae* and *grandifolium* were most similar regarding the DM and M content. The AS content was statistically different between the varieties of *grandifolium*, *rocemigerum* and *pyriformae* while red and yellow varieties of *cerasiformae* and the two investigated yellow varieties, *cerasiformae* and *pruniformae where* similar regarding this traits. The variety of *cerasiformae* and *grandifolium* didn't differ in TA content. TC is a trait where the majority of investigated varieties didn't differ from each other. Differences were observed only between varieties of *pruniformae* and *rocemigerum*, and between *pyriformae* and the investigated yellow varieties, *cerasiformae* and *pruniformae*.

Keywords: ascorbic acid, ash, moisture, total acidity, total carbohydrates, Mann–Whitney *U* test.

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THE EFFECT OF GENOTYPE ON SOME QUALITY TRAITS IN RED CHERRY TOMATO

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Abstract

Four different varieties of red cherry tomatoes (*Lycopersicon esculentum* var. *cerasiformae*, *L. esculentum* var. *pyriformae*, *L. esculentum* var. *grandifolium*, and *L. esculentum* var. *racemigerum*) were evaluated for their potential to serve as a source of genes for improvement of some quality traits in cultivated varieties. Physical and chemical properties like pH, moisture (M), dry matter content (DM), ash (AS), titratable acids (TA), ascorbic acid (AA), and total carbohydrates (TCH) were investigated on the rape fruit at varieties grown under the same agro-ecological conditions. The mean values obtained for pH, TA, AA, DM, M, AS, and TCH were 4.52 ± 0.11, 0.56 ± 0.06%, 20.56 ± 1.32 mg/100 gfw, 7.14 ± 0.45%, 92.86 ± 0.45%, 0.65 ± 0.11 %, and 5.23 ± 0.80 %, respectively. Statistically significant differences were observed in AA and AS content in all varieties. Varieties of *pyriformae* and *grandifolium* significantly differ regarding pH, DM and M content. The variety of *cerasiformae* showed the greatest content of DM, AS, and AA, and the lowest content of moisture and TA. The greatest content of TCH and moisture was observed at the variety of *grandifolium*. The highest AA and the lowest moisture content in the variety of *cerasiformae* indicate that this variety will have a longer shelf life compared to other investigated varieties and according to the other investigated quality traits it can be considered that this variety is the most promising source for genes that control AA, DM, and AS content in the fruit.

Keywords: LSD, one way ANOVA, Kruskal-Wallis test, Physical properties, Chemical properties.

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FAST TRACE METALS DEPOSITION IDENTIFICATION IN CROSS-IDENTIFICATION ANALISIS USSING ELECTRONIC MICROSCOPY

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Abstract

Bryophytes accumulate heavy metals by several mechanisms, but the initial and frequently limiting step is reversible adsorption on the cell surface. Adsorbed metals can be trapped as particulate matter within the surface layer, dissolved in liquids or deposits surrounding cells (intercellular fraction), bound in exchangeable form to exchange or chelating sites on the cell wall and outer surface of the plasma membrane (extracellular fraction) or transported inside the cells and held in soluble or insoluble form (intracellular fraction). The extracellular accumulation of heavy metals is mediated by the ion exchange process and the formation of complexes between the metals and the organic functional groups in the cell walls of bryophytes. The great binding capacities of mosses for some heavy metals are often attributed to the functional groups of polygalacturonic acid and related polymers in the cell walls. Experiments exploring the acid-base properties of the mosses resulted in the detection of several possible functional groups involved in the binding of heavy metals.

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. The scanning electron microscopy (SEM) is used for observation of specimen surfaces. When the specimen is irradiated with a fine electron beam (called an electron probe) secondary electrons are emitted from the specimen surface. Topography of the surface can be observed by two-dimensional scanning of the electron probe over the surface and acquisition of an image from the detected secondary electrons.

This chemometric model, unlike the typical analysis with existing chemical instrumentation techniques, does not require chemical destruction of the sample and additional costs for chemical agents. But on the other hand this model is suitable for screening for large areas in order to identify critical areas. Quantitative chemical analysis still remains an irreplaceable identification method for determining the multi-element distribution in the environment.

Keywords: moss, trace elements, air depositions, toxic elements, SEM.

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ONE FACTORIAL ANOVA IN ASSESSMENT OF GROUNDWATER QUALITY IN VULNERABLE AREA OF AGRICULTURE POLLUTION

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Abstract

Arsenic polluted groundwater was found in the Strumica region located in the south-east part of the Republic of North Macedonia where an intensive agriculture production is concentrated. Out of 185 samples collected from boreholes, 64 samples have arsenic in concentrations greater than 10 µg/L, from which 30 samples have a concentration greater than 50 µg/L with a maximum concentration of 176.56 µg/L. Pollution mostly occurs in the groundwater located in the central part of the valley characterized by alluvial plains and young aquifer. Around 57% of the polluted samples have origin from groundwater with a depth greater than 40 m. Reductive environment, high Fe, Mn, HCO_3^- concentrations as well as low SO_4^{2-} and NO_3^- content in polluted samples suggests that reductive dissolution is a major mechanism by which arsenic is released into the groundwater. Highly polluted samples are characterized by high concentrations of Mn and Fe. Other investigated ions are present in low concentrations. Single factorial ANOVA showed significant differences between As concentrations in shallow and deep groundwater. Multivariate factor analysis was performed to identify the covariance structure between the investigated variables. Arsenic was positively correlated to HCO_3^- and Mn in groundwater with depth lower than 40 m and with HCO_3^-, Ca, and Mn in groundwater with depth greater than 40 m suggesting that arsenic is mobilized in groundwater by reductive dissolution of Mn oxides from the bedrock.

Keywords: arsenic, shallow groundwater, deep groundwater, reductive dissolution.

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MEDICAL CANNABIS: HISTORY AND CURRENT USE, CHALLENGES AND RISKS

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Abstract

Cannabis is the most commonly cultivated, trafficked, and abused illicit drug worldwide; according to the World Health Organization (WHO), marijuana consumption has an annual prevalence rate of approximately 147 million individuals or nearly 2.5% of the global population. The use and acceptance of medicinal cannabis continues to evolve, as shown by the growing number of states now permitting use for specific medical indications. The Food and Drug Administration (FDA) has considered how it might support the scientific rigor of medicinal cannabis claims, and the review of public data regarding safety and abuse potential is ongoing**.** Cannabis and cannabinoid agents are widely used to alleviate symptoms or treat disease, but their efficacy for specific indications is not well established. For chronic pain, the analgesic effect remains unclear.

The regulation of cannabis therapy is complex and unique; possession, cultivation, and distribution of this substance, regardless of purpose, remain illegal at the federal level, while states that permit medicinal cannabis use have established individual laws and restrictions on the sale of cannabis for medical purposes.

The limited availability of clinical research to support or refute therapeutic claims and indications for use of cannabis for medicinal purposes has frequently left both state legislative authorities and clinicians to rely on anecdotal evidence, which has not been subjected to the same rigors of peer review and scrutiny as well-conducted, randomized trials, to validate the safety and efficacy of medicinal cannabis therapy.

Despite lingering controversy, use of botanical cannabis for medicinal purposes represents the revival of a plant with historical significance reemerging in present day health care. Legislation governing use of medicinal cannabis continues to evolve rapidly, necessitating that pharmacists and other clinicians keep abreast of new or changing state regulations and institutional implications.

Keywords: medicinal plant, plants extract, cannabis plant, legislation

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