

EIGHTH INTERNATIONAL SCIENTIFIC  
CONFERENCE  
**JUNE 5th – WORLD  
ENVIRONMENT DAY**

# THE BOOK OF ABSTRACTS

**05 - 07 June, 2024, Bihać, Bosnia and Herzegovina**

**Our Land. Our Future**  
We are  
**#GenerationRestoration**



**WORLD  
ENVIRONMENT  
DAY**

**UN**  
environment  
programme

**Kingdom of  
Saudi Arabia**  
2024

**University of Bihać  
Biotechnical Faculty**

**Year 7 ♦ No. 7 ♦ 2024.**

Eighth International Scientific Conference  
"June 5th - World Environment Day"



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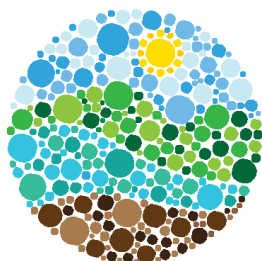
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The **Eighth International Scientific Conference „June 5th - World Environment Day“** was organized by the Biotechnical and Technical Faculty of the University of Bihać, University of Nova Gorica-Laboratory for Environmental and Life Science, Karlovac University of Applied Sciences and University Metropolitan Beograd/Faculty Of Applied Ecology – Futura, in cooperation with the Ministry of Construction, Urban Development and Environmental Protection of Una-Sana Canton, as well as with the help of the following sponsors:

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Bihać, June 2024.

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**CONTENTS:**

**ECOSYSTEM PROTECTION**

1. SIGNIFICANCE OF THE INVENTORY OF FOREST FRUIT TREES IN PRESERVING THE BIODIVERSITY OF THE JAVORNIK MOUNTAIN ..... 1  
Sead Noćajević, Muhamed Omerović, Mensur Noćajević
2. CONTEMPORARY APPROACHES TO COMBAT INVASIVE ALIEN SPECIES PAPER TITLE ..... 3  
Mirjana Bartula, Ivana Šekler, Slobodan Stefanović, Slobodanka Pavlović
3. BIOAVAILABILITY OF LEAD IN SOIL SOLUTION ..... 4  
Husejin Keran, Amra Odošević, Indira Šestan, Sead Čatić, Melisa Ahmetović
4. IMPORTANCE OF WETLANDS – RAMSAR SITE BARDAČA, CASE STUDY ... 5  
Vera Nikolić, Rajko Roljić, Dragana Šnjegota
5. THE AESTHETIC POTENTIAL OF THE LEDENICA CAVE AS A FACTOR IN THE PROTECTION AND VALUATION OF THE KARST ECOSYSTEM ..... 7  
Svjetlana Kodžo, Slobodanka Pavlović
6. PREVENTING BIODIVERSITY LOSS: RESTORING WETLANDS WITH THE HELP OF 'EGG BANK' - THE CASE OF THE RAMSAR SITE "BARDAČA WETLANDS" (BOSNIA AND HERZEGOVINA) ..... 9  
Dragana Miličić, Dejan Dmitrović, Goran Šukalo
7. THE EBRU IN ECO FASHION ..... 11  
Dejla Ramić, Amela Mlivić, Amra Felić
8. EXPLORING THE AQUATIC INVERTEBRATE COMMUNITY OF THE ENDANGERED REVA BOG NEAR BELGRADE, SERBIA ..... 12  
Dragana Miličić, Vukašin Gojšina, Ana Marić, Vera Nikolić, Vojislav Sokolović, Tamara Karan-Žnidaršić
9. UTILIZATION OF CHEAP AGRICULTURAL BY-PRODUCT – PUMPKIN PEEL AS A BIOSORBENT AND SOIL FERTILIZER ..... 14  
Dragana Marković Nikolić, Milena Nikolić, Aleksandar Zdravković, Ljiljana Stanojević, Dragan Cvetković, Goran Nikolić
10. MAJOR BIOTIC & ABIOTIC STRESSES IN PLANTS - AN ENVIRONMENTAL PERSPECTIVE ..... 16  
Elif Çatıkkaş, Hakan Ulukan
11. ECO - FRIENDLY PRACTICES IN FURNITURE ..... 17  
Selma Mujanić, Dejla Ramić, Nejra Alibašić

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

12. ANALYSIS OF TEMPERATURE AND PRECIPITATION MONITORING AS A CLIMATIC ELEMENT IN THE AREA OF BIHAĆ IN THE PERIOD FROM 2001 TO 2022 .....	19
Fatima Muhamedagić, Nedžad Voljevića, Bakir Krajinović, Velira Memić	
13. SOME PHYSIOLOGICAL IMPACTS OF CLIMATE CHANGE & GLOBAL WARMING IN LOCAL WHEATS ( <i>Triticum</i> spp.) .....	20
Elif Çatıkkaş, Hakan Ulukan	
14. SOURCE AND DEPOSITION OF MICROPLASTICS AS POLLUTANTS OF AGRICULTURAL SOIL .....	21
Nevres Hurić, Vedran Stuhli, Mirsad Džambić, Zahida Ademović	
15. ICHTHYOFAUNA DIVERSITY IN THE PROTECTED AREA OBEDSKA BARA IN SERBIA .....	23
Vera Nikolić, Dubravka Škraba Jurlina, Ana Marić, Tamara Kanjuh, Vojislav Sokolović, Predrag Simonović	
16. MATERIAL, TECHNICAL AND LABORATORY CAPACITIES FOR THE RADIOCHEMICAL MONITORING ESTABLISHMENT OF THE UNA-SANA CANTON .....	24
Halid Makić, Jasmin Emrić, Elvisa Hodžić, Jasmina Ibrahimpašić, Emir Dizdarević	
17. EFFICIENCY OF ELECTROFISHING AND GILLNETS IN THE ĆELIJE RESERVOIR: A COMPARATIVE STUDY .....	26
Ana Marić, Vera Nikolić, Dubravka Škraba Jurlina, Vojislav Sokolović, Tamara Kanjuh, Predrag Simonović	
18. CHARACTERIZATION OF PM10 SOURCES IN A PRE-ALPINE VALLEY WITH TRAFFIC, BIOMASS BURNING AND INDUSTRIAL SOURCES .....	28
Kristina Glojek, Vy Dinh Ngoc Thuy, Manousos Ioannis Manousakas, Jean-Luc Jaffrezo, André S. H. Prévôt, Griša Močnik	

**ENVIRONMENT, NUTRITION AND HEALTH**

1. THE IMPACT OF GENETIC FACTOR ON INDIVIDUAL NUTRITIONAL NEEDS .....	31
Huska Jukić, Amina Seferagić, Azira Hrnjica, Sara Redžić, Samira Dedić	
2. ANTIMICROBIAL ACTIVITY IN CITRUS PEEL .....	33
Aida Džaferović, Samira Dedić, Huska Jukić	

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

3. AN OVERVIEW OF VARIATIONS IN SYNTHETIC APPROACHES FOR THE PREPARATION OF (BENZ)IMIDAZOLIUM SALTS: BIOACTIVITY AND GREEN SOLVENT PERSPECTIVES .....	34
Enis Šuta, Sead Ljubijankić, Nevzeta Ljubijankić	
4. HEAVY METALS CONTAMINATION IN URBAN SOIL OF LUKAVAC AND NON-CARCINOGENIC AND CARCINOGENIC HUMAN HEALTH RISK ASSESSMENT .....	35
Abdel Đozić, Hana Alihodžić, Indira Šestan	
5. NOVEL ANALYTICAL TECHNIQUES FOR FAST SCREENING IN ENVIRONMENTAL MONITORING AND FOOD QUALITY CONTROL .....	36
Mladen Franko	
6. CATEGORIZATION OF PATIENTS AND IDENTIFICATION OF HEALTH CARE NEEDS .....	38
Sena Našić, Sulejman Kendić, Alen Lonić	
7. PHYTOACCUMULATION OF CADMIUM AND LEAD BY MINT (lat. <i>Mentha piperita L.</i> ) .....	39
Minela Čejvan, Vedran Stuhli, Jasmina Ibrahimpašić, Ekrem Pehlić	
8. COMPARATIVE ANALYSIS OF ANTIBACTERIAL EFFECT OF CRANBERRY TEA VS CRANBERRY FRUIT ON GRAM-NEGATIVE BACTERIA USING AGAR WELL METHOD .....	41
Ena Konjalić, Elida Avdić, Amna Moro, Aja Borić, Irma Mahmutović- Dizdarević	
9. ISOLATION AND IDENTIFICATION OF BETA-CAROTENE FROM CARROTS	
Aida Smajlagić, Majda Srabović, Melita Huremović, Ekrem Pehlić, Zahida Ademović, Ermina-Čilović Kozarević .....	43
10. EFFECT OF FOSFOMYCIN ON BIOFILM FORMATION IN GRAM-POSITIVE BACTERIA USING MICROBROTH DILUTION AND TISSUE CULTURE PLATE METHODS .....	44
Aida Lavić, Irma Mahmutović-Dizdarević, Hana Brekalo	
11. EFFECT OF FOSFOMYCIN ON BIOFILM FORMATION IN GRAM-NEGATIVE BACTERIA USING MICROBROTH DILUTION AND TISSUE CULTURE PLATE METHODS .....	46
Emina Pramenković, Hata Džino, Samra Međedović	
12. EFFECT OF FOSFOMYCIN ON THE RESISTANCE PATTERNS OF GRAM-NEGATIVE BACTERIA TO DIFFERENT CLASSES OF ANTIBIOTICS USING THE BAUER-KIRBY DISK DIFFUSION METHOD .....	48
Ilderina Jusufović, Elida Avdić, Lamija Vrtić, Samra Međedović	

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

13. EFFECT OF FOSFOMYCIN ON THE RESISTANCE PATTERNS OF GRAM-POSITIVE BACTERIA TO DIFFERENT CLASSES OF ANTIBIOTICS USING THE BAUER-KIRBY DISK DIFFUSION METHOD ..... 50  
Ilderina Jusufović, Elida Avdić, Lamija Delić, Samra Međedović
14. BENEFITS OF USING FRESH CHOKEBERRY AND CHOKEBERRY PRODUCTS ..... 52  
Aleksandra Šupljeglav Jukić, Jasna Hasanbegović Sejfić, Lejla Škaljić, Semina Hadžiabulić
15. METAL CHELATING CAPACITY OF MELATONIN PRE-TREATED LEMON BALM AND VALERIAN PLANTS ..... 54  
Elvisa Hodžić, Sebila Rekanović, Anita Vuković, Dinko Bećirspahić
16. BUFFERING CAPACITY OF FERMENTED MILK DRINK WITH THE ADDITION OF ROYAL JELLY ..... 55  
Adnan Omanović, Alena Terzić, Adna Zeljković, Almir Đogić, Azra Družić, Edina Šertović
17. SENSORY PROPERTIES AND ACCEPTABILITY OF BEE POLLEN IN FUNCTIONAL FERMENTED DAIRY PRODUCTS ..... 56  
Ema Demirović, Nejla Kahrić Muratović, Enesa Aganović, Mirza Dizdarić, Edina Šertović
18. ETIOLOGY OF ORIGIN FOR STROKE ..... 58  
Anes Budimlić, Enver Budimlić, Sulejman Kendić, Huska Jukić
19. INFLUENCE OF CHOLESTEROL AS A RISK FACTOR FOR CARDIOVASCULAR DISEASES ..... 59  
Anes Budimlić, Enver Budimlić, Sulejman Kendić
20. CHARACTERIZATION OF GREEN-METHOD SYNTHESIZED GOLD NANOPARTICLES USING AQUEOUS EXTRACTS OF *RUBUS SPP.* LEAVES .... 60  
Marija Tasić, Ljiljana Stanojević, Jelena Stanojević, Sanja Petrović, Goran Nikolić, Dragan Cvetković
21. COLOR AND ACCEPTABILITY OF COOKIES WITH POLLEN ADDITION .. 62  
Azra Družić, Adna Zeljković, Alena Terzić, Melisa Oraščanin
22. RHEOLOGICAL PROPERTIES, COLOR, AND ACCEPTABILITY OF HOMEMADE KETCHUP COMPARED TO COMMERCIAL ..... 63  
Adnan Omanović, Alena Terzić, Adna Zeljković, Melisa Oraščanin
23. SPECTROPHOTOMETRIC DETERMINATION OF IRON IN DRINKING WATER ..... 65  
Aldina Baltić, Ekrem Pehlić, Asmir Aldžić, Aida Šapčanin, Majda Srabović
24. AIR QUALITY COMPARISON IN UNA-SANA, ZENICA-DOBOJ AND TUZLA CANTON FROM 2020 TO 2023 ..... 66  
Minela Čejvan, Majda Huskić, Selma Prošić, Zlata Ibrišimović-Subašić



Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

25. MONITORING OF CLIMATE ELEMENTS AND AIR QUALITY INDEX IN THE CITY OF BIHAĆ IN 2023 .....	68
Asmir Aldžić, Aldina Baltić, Jasmin Toromanović, Emra Toromanović	
26. MALACHITE GREEN ADSORPTION BY <i>AMORPHA FRUTICOSA</i> L. ACTIVATED CARBON .....	69
Ines Cindrić, Lidija Jakšić, Elizabeta Zandona, Marijana Blažić	
27. INHIBITION OF CHOLINESTERASE AND $\alpha$ -GLUCOSIDASE ENZYMES BY WATER EXTRACTS OF FIVE <i>CENTAUREA</i> SPECIES .....	70
Olivera Politeo, Kristina Kardum, Mirko Ruščić, Mejra Bektašević	
28. PHYSICAL, CHEMICAL AND MICROBIOLOGICAL ANALYSIS IN SAMPLES OF BOTTLED WATER IN BOSNIA AND HERZEGOVINA .....	72
Asmir Aldžić, Melisa Halilović, Aldina Baltić, Irma Mahmutović-Dizdarević, Benjamin Muhamedbegović	
29. GROUNDWATER - HOW WELL DO WE KNOW AN IMPORTANT STRATEGIC RESOURCE AND HOW CAN WE LEARN MORE ABOUT IT? .....	74
Jasmina Kožar Logar, Katarina Kovačić	

**SUSTAINABLE ANIMAL AND PLANT PRODUCTION**

1. INFLUENCE OF CULTIVATION SYSTEM ON STRAWBERRY QUALITY AND YIELD .....	77
Dinko Bećirspahić, Azra Skender, Zineta Vuković, Semina Hadziabulić, Jasna Hasanbegović	
2. THE IMPACT OF THE FEEDING LAYING HENS ON EGG QUALITY CHARACTERISTICS .....	79
Suzana Jahić, Sebila Rekanović, Samira Hotić	
3. POWDERY MILDEW OF BULBOUS WILD BARLEY ( <i>Hordeum bulbosum</i> ) IN BİNGÖL UNIVERSITY CAMPUS AREA, TÜRKİYE .....	80
İşıl Saraç Sivrikaya, Arzu Çelik Oğuz, Aziz Karakaya	
4. MOLECULAR DETECTION AND IDENTIFICATION OF SELECTED ISOLATES <i>ALTERNARIA</i> SPP. ....	81
Mehira Perviz, Vojislav Trkulja, Osman Perviz	
5. SUSTAINABLE FOOD SYSTEMS AS PART OF THE GREEN DEAL .....	83
Azira Hrnjica, Huska Jukić, Suad Habeš, Aida Džaferović	
6. EFFECT OF VERMICOMPOST ON ROOTING OF <i>NERIUM OLEANDER</i> CUTTINGS .....	84
Alisa Hadziabulić, Elma Temim, Semina Hadziabulić, Jasmina Aliman, Dženan Vukotić	

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

7. ANTIOXIDANT ACTIVITY OF PURPLE BASIL (*OCIMUM BASILICUM L.*, VAR. *PURPURASCENS*) ESSENTIAL OIL AND HYDROLATE ..... 85  
Aleksandra Milenković, Ljiljana Stanojević, Jelena Stanojević, Dragan Cvetković, Lidija Milenković, Goran Nikolić
8. A CONTRIBUTION TO THE KNOWLEDGE OF THE REPRODUCTIVE BEHAVIOR OF CATTLE AND SHEEP AS A PARAMETER OF SUSTAINABILITY IN ANIMAL PRODUCTION ..... 87  
Husein Vilić, Refik Šahinović
9. CONCENTRATION OF VITAMIN C IN LEAVES OF LIMEIRA LETTUCE DEPENDING ON DEVELOPMENT PHASE ..... 89  
Vildana Jogić, Jelena Nikitović, Merima Toromanović, Subha Avdić
10. MORPHOLOGICAL CHARACTERISTICS OF CORNELIAN CHERRY GENOTYPES (*CORNUS MAS L.*) FROM THE KONJIC AREA ..... 90  
Semina Hadžiabulić, Jasna Hasanbegović, Jasmina Aliman, Azra Skender, Dinko Bećirspahić

**FOREST MANAGEMENT**

1. COMPARATIVE ANALYSIS OF SOIL QUALITY FOR BEECH GROWTH IN THE AREAS OF NATIONAL PARKS KOZARA AND SUTJESKA, BASED ON TAKSATION DATA .....93  
Mirsad Ičanović, Mihajlo Marković, Đorđe Topić, Husnija Kudić
2. COMPARATIVE PHYSICAL CHARACTERISTICS OF WOOD SPECIES FROM ZAGROS FORESTS ..... 95  
Redžo Hasanagić, Leila Fathi, Selma Mujanić
3. ENVIRONMENTAL IMPLICATIONS OF WOOD MODIFICATION PROCESSES  
Redžo Hasanagić, Selma Mujanić, Damir Hodžić ..... 96
4. THE INFLUENCE OF NATURAL DISTURBANCES ON THE HARVEST PLAN AND TIMBER PRODUCTION FROM MOUNTAINOUS FORESTS ..... 97  
Igor Stankić, Zlatan Lonić, Sara Bašanović, Vanja Jurišić
5. ACORN WEEVIL - *CURCULIO GLANDIUM* (MARSHAM) (COLEOPTERA: CURCULIONIDAE) IN UNA-SANA CANTON (B&H) ..... 99  
Zemira Delalić

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

**WASTE MANAGEMENT**

1. OPTIMIZATION OF THE PROBLEM OF THE LOCATION OF TRANSFER STATIONS IN THE SYSTEM OF INTEGRAL WASTE MANAGEMENT ..... 102  
Fatka Kulenović
2. THE ROLE OF DIGESTATE IN THE CIRCULAR ECONOMY ..... 103  
Mihaela Grubišić Šeba, Marin Miletić
3. SPATIAL-PLANNING ASPECT OF WASTE MANAGEMENT IN VARAŽDIN COUNTY ..... 104  
Melita Srpak, Silvija Zeman, Vladimir Križaić, Darko Pavlović
4. PRODUCTION OF CEMENT CLINKER USING RECYCLED GLASS ..... 106  
Ervin Karić, Zehrudin Osmanović, Damir Mulamehmedović, Elma Bajrić, Berina Hadžalić, Hanka Hadžić
5. ANALYSIS OF SOIL COMPOSITION NEAR THE CITY WASTE LANDFILL. 107  
Ajla Japić, Merima Toromanović
6. QUANTIFICATION OF THE ENVIRONMENTAL BENEFITS OF THE INTRODUCTION AND IMPLEMENTATION OF THE ISO 14001 STANDARD IN THE MEAT INDUSTRY SHOWN BY MONITORING THE CONCENTRATIONS OF PHOSPHORUS AND SULFUR COMPOUNDS IN WASTEWATER ..... 109  
Faris Muminović, Halid Makić, Jasmina Ibrahimpašić, Husejin Keran, Amela Semić, Toni Babić
7. DANGERS FROM CONSTRUCTION A RADIOACTIVE WASTE STORAGE CENTRE AT THE ČERKEZOVAC SITE, TRGOVSKA GORA, THE REPUBLIC OF CROATIA ..... 111  
Draženko Bjelić, Borislav Malinović, Tijana Đuričić

**ENERGY EFFICIENCY AND RENEWABLE ENERGY SOURCES**

1. ASSESSMENT OF *ARUNDO DONAX* IN A CONTINUOUS BIOGAS PRODUCTION SYSTEM ..... 114  
Vanja Jurišić, Ana Matin, Ivan Brandić, Ivana Tomić, Igor Stankić, Karlo Špelić
2. CONSTRUCTED WETLAND AS A PRODUCT ..... 116  
Sabina Bišćević

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

**LEGAL AND ECONOMIC REGULATIONS IN ENVIRONMENTAL PROTECTION**

1. CRIMINAL OFFENSES AGAINST THE ENVIRONMENT IN THE REPUBLIC OF SERBIA ..... 118  
Ivana Šekler, Mirjana Bartula, Slobodan Stefanović, Nikola Petrić
2. THE MECHANISM OF CROSS-BORDER SETTLEMENT OF CARBON EMISSIONS AND ITS IMPORTANCE IN THE EUROPEAN GREEN DEAL ..... 119  
Ermin Bajramović, Emir Bajramović
3. COUNCIL OF EUROPE AND ENVIRONMENTAL PROTECTION ..... 120  
Nikola Findrik, Suan Islamović
4. APPLICATION OF BENCHMARKING IN NATIONAL PARKS ..... 121  
Ramiza Hamulić
5. CONSEQUENCES OF HUMAN ACTIVITIES ARE ENDANGERING AND DESTROYING THE ENVIRONMENT ..... 122  
Esad Bajramović, Senada Pobrić, Fadil Islamović, Atif Hodžić
6. THE IMPACT OF TRAFFIC NOISE IN THE UNA-SANA CANTON ..... 124  
Medina Mešić
7. UNDERSTANDING SOUVENIRS IN TOURIST CONSUMPTION OF EU TOURISTS IN BOSNIA AND HERZEGOVINA ..... 125  
Berina Čatić, Denis Berberović, Ikbala Makić
8. COMPARATIVE ANALYSIS OF ENVIRONMENTAL LEGISLATION IN BOSNIA AND HERZEGOVINA ..... 127  
Anita Ramulić-Mujkić, Fatima Muhamedagić

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# **ECOSYSTEM PROTECTION**

**SIGNIFICANCE OF THE INVENTORY OF FOREST FRUIT TREES  
IN PRESERVING THE BIODIVERSITY OF THE JAVORNIK  
MOUNTAIN**

Sead Noćajević, Muhamed Omerović, Mensur Noćajević

<sup>1</sup>University of Tuzla, Faculty of Technology, Tuzla, Bosnia and Herzegovina

sead.nocajevic@untz.ba

**Key words: forest fruit trees, inversion, biodiversity, Javornik Mountain, phytocenological recordings**

**ABSTRACT:**

*The area of Mount Javornik is rich in biological diversity of flora and fauna. Forest fruit trees are an important part of the natural biodiversity of forest ecosystems. The most important taxa of forest fruit trees are from the Rosaceae family: wild cherry, wild apple, wild pear. In addition to the mentioned taxa, there are taxa from other phytofamilies, walnut, acorn, partridge, checkertree and whitebeam, hawthorn and others.*

*The aim of the work is to see the importance of the inventory of forest fruit trees in the preservation of the biodiversity of the area, as well as to give a recommendation for the declaration of the future protected area of the Javornik Mountain. During the growing season of 2021, 2022 and 2023, several phytocenological recordings of forest fruit trees were taken in the researched areas. Based on a detailed inventory, we concluded that the following noble deciduous trees are most represented on Javornik mountain: wild cherry (*Prunus avium* L.), wild pear (*Pyrus communis* L.), wild apple (*Malus sylvestris* Mill.), walnut (*Juglans regia* L.), checkertree (*Sorbus torminalis*).*

*The wild cherry (*Prunus avium* L.) is the most abundant forest fruit tree, occurring as a single tree or in small populations. The multiple benefits of forest fruit trees are special during the flowering period, when they "decorate" the forest and its edges, provide the first honey "pasture", and in autumn some even earlier (wild cherry) bear fruits that feed many members of the forest fauna, especially birds. They are also important for humans*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*from nutritional, dietetic, pharmacological and bioenergetic aspects. Due to the threat of forest fruit trees, there are fewer and fewer of them in our forests, and they urgently need to be protected, by declaring the Javornik Mountain a protected area.*

**Type of presentation:** Oral



**CONTEMPORARY APPROACHES TO COMBAT INVASIVE ALIEN  
SPECIES**PAPER TITLE

Mirjana Bartula, Ivana Šekler, Slobodan Stefanović, Slobodanka Pavlović

Metropolitan University, Faculty of Applied Ecology "Futura", Belgrade, Serbia

mirjana.bartula@futura.edu.rs

**Key words: invasive alien species, biodiversity, IAS management**

**ABSTRACT:**

*Invasive alien species (IAS) are animal and plants species that are introduced accidentally or deliberately into a natural environment where they are not native. They often possess high reproductive rates, enabling them to rapidly establish populations and outcompete native species for resources. This competitive advantage results in significant adverse impacts on local biodiversity, exacerbating the vulnerability of native threatened species. IAS are considered to be one of the greatest threats to biodiversity, particularly through their interactions with other drivers of change. They hinder conservation efforts and the sustainable use of biodiversity and also impact the goods and services provided by ecosystems. IAS also harm human health and affect various economic sectors like agriculture, forestry, and fisheries by reducing productivity and obstructing waterways, which can hinder navigation. They may also reduce the recreational and aesthetic value of affected areas.*

*In response to the pressing need for comprehensive management strategies, a range of tools, spanning from legislative frameworks to practical field interventions, have been developed to combat IAS. This manuscript aims to furnish an overview of contemporary IAS management approaches implemented globally, with the intention of informing and guiding future efforts in this critical domain.*

**Type of presentation:** Oral



**BIOAVAILABILITY OF LEAD IN SOIL SOLUTION**

Husejin Keran, Amra Odobašić, Indira Šestan, Sead Ćatić, Melisa  
Ahmetović

University of Tuzla, Faculty of Technology, Tuzla, Bosnia and Herzegovina

husejin.keran@untz.ba

**Key words: bioavailability, lead, soil**

**ABSTRACT:**

*The application of different methods could provide the possibility for determination smaller amounts of soil constituents. According to that DPASV (Differential Pulse Anodic Stripping Voltammetry) method has been used to determine lead concentration in soil and other soil parameters, such organic matter, pH value, etc., and using available software to determine the its bioavailability in soil.*

*The aim of this research was to develop a model that can predict the release of lead (Pb) from soil in solution under the influence of various factors such as pH, organic matter content, soil texture and lead concentration.*

*The research results show that soil pH and organic matter content have a significant influence on release of lead, while soil texture may act as a moderating factor. Developed model shows high accuracy in predicting lead release under different soil conditions. These findings provide useful information for managing soil lead contamination and for developing strategies environmental protection.*

**Type of presentation: Poster**



**IMPORTANCE OF WETLANDS – RAMSAR SITE BARDAČA, CASE STUDY**

Vera Nikolić<sup>1</sup>, Rajko Roljić<sup>2</sup>, Dragana Šnjegota<sup>2</sup>

<sup>1</sup>University of Belgrade, Faculty of Biology, Belgrade, Serbia

<sup>2</sup>University of Banja Luka, Faculty of Natural Sciences and Mathematics, Banja Luka, Bosnia and Herzegovina

vera@bio.bg.ac.rs

**Key words: Ramsar site, Bardača, degradation, wetland**

**ABSTRACT:**

*Wetlands are among the most threatened habitats in the world. Wetlands are referred to as “biological super systems” because they produce large amounts of food that support a remarkable level of biodiversity. In terms of the number and variety of species they harbor, they are as rich as rainforests and coral reefs.*

*Wetlands are being degraded and destroyed faster than any other ecosystem on earth. Many important functions and values that wetlands provide have already been lost. Since the Ramsar Convention on Wetlands, more and more countries around the world have recognized the critical benefits of restoring and creating wetlands.*

*Bosnia and Herzegovina ratified the Convention on Wetlands of International Importance, especially as Waterfowl Habitat, better known as the Ramsar Convention, in 1992. Since then, three wetlands have been designated in Bosnia and Herzegovina under this convention: Bardača, Hutovo blato and Livanjsko polje, of which only Hutovo blato Nature Park – has the status of a protected area in Bosnia and Herzegovina.*

*Bardača Wetland (Bardača-močvarni kompleks). 02/02/07; 3,500 ha; 45°06'N 017°27'E, important bird sanctuary. The area is located in the floodplain of the Sava River near the border with Croatia. In addition to the natural features mentioned above, it should be emphasized that in the last 50 years, anthropogenic influence has ensured the survival and development of the ecosystem on the one hand and worsened it on the other. This conflict*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*between the various spatial influences is still present today. After privatization in 2012, nine out of 11 lakes were drained and fish farming was replaced by corn cultivation. If something does not change soon, Bardača could permanently lose its natural and cultural values as well as its status as an internationally important wetland. This shows that the responsible institutions do not have the power and influence to preserve our only international wetland.*

**Type of presentation:** Oral



**THE AESTHETIC POTENTIAL OF THE LEDENICA CAVE AS A  
FACTOR IN THE PROTECTION AND VALUATION OF THE  
KARST ECOSYSTEM**

Svjetlana Kodžo, Slobodanka Pavlović

Metropolitan University, Faculty of Applied Ecology "Futura", Belgrade, Serbia

boba.pavlovic@gmail.com

**Key words: Ledenica cave, karst ecosystem, aesthetic potential, ecosystem protection, sustainable tourism**

**ABSTRACT:**

*The Ledenica cave is a well-known underground form of the karst ecosystem, a speleological object, and one of the five Resanovacke caves. Due to its exceptional natural beauty, a wealth of ornaments, other functions, and general importance, it has been investigated through passive (examining the cave's physical characteristics) and active research (implementing interventions in the cave system) for tourist development.*

*The paper aims to analyze Ledenica's aesthetic potential as an essential factor in protecting and evaluating the wider karst area.*

*Based on the interpretation of previous research and observations in the field, an analysis of the morphological and aesthetic characteristics of the cave was carried out concerning the existing infrastructure and the experience of the cave environment. The general condition and threat of this protected "natural rarity and natural phenomenon" were discussed. The research covered the determination of the current level of tourism valorization and the perspective of the concept of sustainable use while considering that the primary goal is the protection of expressed specific features and associated biodiversity and habitats.*

*The research results underscore the crucial role of recognizing the Ledenica cave's aesthetic potential as a valuable resource within the framework of integral management and protection of the karst ecosystem. The adequate evaluation and presentation of this geological form's aesthetic features can contribute to its sustainable use and foster awareness of the importance of*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*preserving karst landscapes, instilling a sense of responsibility and motivation for environmental conservation. It can also bring economic benefits.*

**Type of presentation:** Poster



**PREVENTING BIODIVERSITY LOSS: RESTORING WETLANDS  
WITH THE HELP OF 'EGG BANK' - THE CASE OF THE RAMSAR  
SITE "BARDAČA WETLANDS" (BOSNIA AND HERZEGOVINA)**

Dragana Miličić<sup>1</sup>, Dejan Dmitrović<sup>2</sup>, Goran Šukalo<sup>2</sup>

<sup>1</sup>University of Belgrade, Faculty of Biology, Belgrade, Serbia

<sup>2</sup>University of Banja Luka, Faculty of Natural Sciences and Mathematics, Banja Luka,  
Bosnia and Herzegovina

draganam@bio.bg.ac.rs

**Key words:** Branchiopoda, 'egg bank', "Bardača Wetland", biodiversity protection

**ABSTRACT:**

*The "Bardača" Wetland is one of the three Ramsar sites in Bosnia and Herzegovina. This area has a variety of water bodies with different hydrological systems that harbour diverse, locally adapted flora and fauna. In general, the large branchiopod crustaceans (Branchiopoda) are considered the flagship group for such ecosystems. Branchiopoda have a limited and fragmented distribution pattern worldwide and are seasonally highly dependent on humidity. In the "Bardača" area, a total of nine large branchiopod taxa have been recorded so far. The species exhibit considerable ecological plasticity and can spend the unfavourable conditions as encapsulated embryos (the 'egg banks') in the soil. In spring 2021 and 2022, several samples of dried soil were taken from the already known biotopes in the village of Bajinci, both from the sites in the seasonally flooded zone and outside the flooded zone. A few samples from each habitat were doused with rainwater and incubated in plastic containers in a sunny place. In all experiments, hatching took place and the adults were collected after about one month. *Cyzicus* sp. Audouin, 1837, and *Leptesteria dahalacensis* (Rüppell, 1837) were collected in May from the drought samples taken from the seasonally flooded area. Also in May, *Eoleptesteria ticinensis* (Balsamo-Crivelli, 1859) and *Limnadia lenticularis* (Linnaeus, 1761) were collected, but from drought samples from outside the floodplain,*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*as well as several animals hatched and collected in June: E. ticinensis, L. lenticularis, L. dahalacensis and Branchipus schaefferi Fischer, 1834. The recovery of specimens from the 'egg banks' in the „Bardača Wetland” offers a good perspective for the future restoration of natural processes, habitat protection and species recovery. This could contribute to a better recognition of this area as a natural area of great importance in Bosnia and Herzegovina and help in its management and conservation.*

**Type of presentation:** Poster



**THE EBRU IN ECO FASHION**

Dejla Ramić, Amela Mlivić, Amra Felić

University of Bihać, Faculty of Technical Engineering, Bihać, Bosnia and Herzegovina

dejla.ramic@unbi.ba

**Key words: ebru, marbling, eco fashion, sustainability unique design**

**ABSTRACT:**

*This paper explores the possibilities of using the Ebru technique through sustainability and eco-fashion. Ebru art is a painting technique based on abstract forms that were originally used to make and decorate books. This technique is achieved through the use of paints that are applied to a water surface and then manipulated with different utensils or horsehair brushes to create different forms of design. Today, through the fusion of ebru art and eco-fashion principles, designers can create innovative and environmentally responsible clothing, as well as fashion accessories. Sustainability has become a key aspect of the fashion industry, and designers and consumers alike are looking for alternatives that prioritize environmental responsibility. Through this research, the potential of the ebru technique in the context of sustainable fashion practices will be highlighted elaborated, highlighting its potential to minimize waste, reduce the use of aggressive chemicals, utilise natural materials, but also to show innovative ways in which traditional techniques can be redesigned for a greener fashion future. The Ebru technique, which uses natural colors and environmentally friendly materials, is becoming more and more popular among clothing and textile designers today precisely because of its sustainable approach. By applying this technique, designers can promote the values of sustainable development and encourage fast fashion consumers to think about choosing clothes that are in line with the principles of environmental protection.*

**Type of presentation: Oral**





**EXPLORING THE AQUATIC INVERTEBRATE COMMUNITY OF  
THE ENDANGERED REVA BOG NEAR BELGRADE, SERBIA**

Dragana Miličić, Vukašin Gojšina, Ana Marić, Vera Nikolić, Vojislav  
Sokolović, Tamara Karan-Žnidaršič

University of Belgrade, Faculty of Biology, Belgrade, Serbia

draganam@bio.bg.ac.rs

**Key words: freshwater invertebrates, community richness, urban wetlands, conservation**

**ABSTRACT:**

*The Reva Bog is a remnant of swampy and flood-prone terrain, featuring ponds, marshes and numerous canalized rivers draining into the left bank of the Danube River near Belgrade. This study represents the first qualitative analysis of its aquatic invertebrate community, focusing on zooplankton populations in spring 2024. Sampling was carried out at selected sites from the surface to the bottom using plankton net. The collected individuals were preserved in ethanol and then identified and photographed in the laboratory under a stereomicroscope equipped with a digital camera.*

*The qualitative analysis revealed the presence of several taxa, with Cladocera and Copepoda being the predominant crustacean groups in the zooplankton. A cladoceran (*Simocephalus* sp.) and the copepod (*Cyclops* sp.) were found in the open water, while the specimens from the cladoceran family Chydoridae were found among the vegetation. Other organisms inhabiting aquatic plants were Tardigrada and Cnidaria. The latter taxon was represented by freshwater *Hydra* sp., which was conspicuously abundant. Several macroinvertebrate groups, including Gastropoda, were identified in the samples. The presence of *Gyraulus crista* at this site marks only one of the few occurrences of this snail recorded in the area. Other groups identified included Ostracoda, Isopoda, Oligochaeta, various hexapods, such as Diptera (*Chironomidae*) and mayfly (*Ephemeroptera*) larvae, Heteroptera (*Plea minutissima*) and water surface dwellers (*Collembola*).*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*Even if the results presented here are rather preliminary, they indicate a very potent and rich biocoenosis with the occurrence of several ecologically important taxa. However, most of the remaining ponds in the Reva marsh are already highly terrestrialised. Recently, there were plans to build a landfill site and an industrial zone next to the bog. Protests by citizens and environmental activists prevented the further filling of the Reva bog and signed a declaration in favour of the Reva as an urban green zone and part of the future "Danube Park" nature reserve.*

**Type of presentation:** Poster



**UTILIZATION OF CHEAP AGRICULTURAL BY-PRODUCT –  
PUMPKIN PEEL AS A BIOSORBENT AND SOIL FERTILIZER**

Dragana Marković Nikolić<sup>1</sup>, Milena Nikolić<sup>1</sup>, Aleksadar Zdravković<sup>1</sup>,  
Ljiljana Stanojević<sup>2</sup>, Dragan Cvetković<sup>2</sup>, Goran S. Nikolić<sup>2</sup>

<sup>1</sup>Academy Southern Serbia, Department of Technological Art Studies, Leskovac, Serbia

<sup>2</sup>University of Niš, Faculty of Technology, Leskovac, Serbia

goranchem\_yu@yahoo.com

**Key words: pumpkin peel, biosorbent, phosphates, nitrates, soil  
fertilizer**

**ABSTRACT:**

*The increasing generation of industrial and municipal wastewater becomes a serious problem for human health and the environment. Different conventional and modern improved processes are used for wastewater treatment. Due to high process costs and the complexity of sorbent regeneration procedures that cause secondary pollution, their application is currently limited. To overcome these disadvantages, dried pumpkin peel as a plant by-product with unique properties (hydrophilicity, adsorptivity and biodegradability) can be a good alternative for these purposes. The goal of this research is the development of a new cationic sorbent based on *Lagenaria vulgaris* lignocellulosic biomass (CLVB). The LVB biomass modification, by introducing quaternary ammonium groups (CTMAC reagent), increases the sorption capacity for phosphate and nitrate as the cause of eutrophication. The conducted research indicated the following optimal parameters of the sorption process: initial concentration of anions solution 30-50 mg/dm<sup>3</sup>, sorbent dose 5 g/dm<sup>3</sup>, pH=5-7, T=18-22 °C, t=30-40 min. Simple and cheaper production of sorbent, its reuse (by multiple sorption/desorption process) and high sorption efficiency (80-90% of removed anions), indicate that CLVB can be a competitive material applicable in water purification. In order to solve the problem of waste disposal, although it is biodegradable and harmless to the environment, the*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*biosorbent (enriched with N, P, K) and preconcentrated solution after desorption can be utilize to fertilizer or compost produce.*

**Type of presentation:** Poster

*Acknowledgements: This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia under the program of financing scientific research work, 451-03-65/2024-03/200133.*



**MAJOR BIOTIC & ABIOTIC STRESSES IN PLANTS - AN  
ENVIRONMENTAL PERSPECTIVE**

Elif Çatıkkaş<sup>1</sup>, Hakan Ulukan<sup>2</sup>

<sup>1</sup>Karamanoğlu Mehmetbey University, Ermenek Vocational School, Karaman, Türkiye

<sup>2</sup>Ankara University, Agriculture Faculty, Fields Crops Department, Ankara, Türkiye

eliffcatikkas@gmail.com

**Key words: stress factors, ecophysiological response(s), growth and development**

**ABSTRACT:**

*Biotic and abiotic factors reflect and specify the plants' morphology. They act generally biochemical and physiologically are called "stress". These factors hurt growth, development, quality, and quantity and can reduce average plant productivity by 65 to 87%, depending on the plants. They give various permanent or temporary damage(s) according to the length of exposed period, violence/density, developmental stage, age, etc. This review revealed that despite the technology level with modern scientific knowledge up to now, due to their complex structure, firstly taken response(s) have/have not yet fully understood and secondly any "resistant" or "tolerant" cultivar(s) has/have not been released/created up to now. This is clear that with the help of multi-disciplinary approaches, it is possible to be able to get any promising result(s) in the near future.*

**Type of presentation: Oral**



**ECO - FRIENDLY PRACTICES IN FURNITURE**

Selma Mujanić, Dejla Ramić, Nejra Alibašić

University of Bihać, Faculty of Technical Engineering, Bihać, Bosnia and Herzegovina

dejla.ramic@unbi.ba

**Key words: eco-friendly, natural resources, innovative materials**

**ABSTRACT:**

*Environmentally friendly furniture practices have become a major concern in modern times, due to their profound implications for environmental sustainability. The term "eco-friendly" means products or practices that are not harmful to the environment and aim to minimize their environmental footprint. Given the growing demand for furniture production worldwide, facilitated by fashion trends and a culture of single-use goods and fast consumption, it is vital to rethink the relevance of traditional production techniques and look for more sustainable alternatives. In this regard, this paper explores various environmental practices adopted in the furniture manufacturing industry to promote sustainability and environmental protection. The use of recycled materials, non-toxic finishes, energy-efficient production processes, and innovative design strategies are discussed. When it comes to sustainable design, choosing the right materials is key to reducing environmental impact and promoting a healthier planet. Environmentally friendly materials commonly used in sustainable design are wool, cork, bamboo, hemp, recycled paper composite, mycelium, recycled ocean plastic, algae-based bioplastics, and others. The research examines the use of innovative materials embedded in atypical sources such as avocados, mycelium, and pineapple for textiles. In addition to providing identical, if not higher, strength indices and meeting the visual requirements set for textiles, unusual materials reduce the need for petroleum products and combat pollution and environmental degradation caused by traditional textile production. The use of these materials in the manufacture of furniture is increasingly integrated. Indeed, environmental practices are essential to combat global warming and reduce the growth of waste that, at least*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*indirectly, becomes every piece or object made. Future generations will undoubtedly depend on natural resources, which the human generation must not exhaust. Inherent in the success and sustainability of most human industries, they require compliance with green and sustainable standards and, if possible, have a positive effect.*

**Type of presentation:** Oral



**ANALYSIS OF TEMPERATURE AND PRECIPITATION  
MONITORING AS A CLIMATIC ELEMENT IN THE AREA OF  
BIHAĆ IN THE PERIOD FROM 2001 TO 2022**

Fatima Muhamedagić<sup>1</sup>, Nedžad Voljevića<sup>2</sup>, Bakir Krajinić<sup>2</sup>, Velira  
Memic<sup>3</sup>

<sup>1</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

<sup>2</sup>Federal Hydrometeorological Institute, Sarajevo, Bosnia and Herzegovina

<sup>3</sup>Federal Hydrometeorological Institute, Bihać, Bosnia and Herzegovina

fatima.muhamedagic@gmail.com

**Key words: climate elements, monitoring, temperature, precipitation, amplitude**

**ABSTRACT:**

*In general, climate is a significant environmental factor and for some area it is determined by climatic elements. Climatic elements are at the same time the most significant limiting factors of those economic activities that take place in the environment but outdoors. So, for example, for agriculture and forestry, climatic elements can be a limiting factor.*

*The paper presents multi-year monitoring of climatic elements, namely temperature (°C) and precipitation (mm). Monitoring data were analyzed for the area of the meteorological station Bihać for the period from 2001 to 2022.*

*Analysis of the results for the area of Bihać showed a significant fluctuation of the analyzed climate elements. The amplitude of minimum air temperature values at 5 cm is 2.4°C (from 5.8°C to 8.2°C), and the average annual air temperature values at 200 cm is 2.8°C (from 10.4°C to 13.2°C). Also, the annual amounts of precipitation in the observed period from 2001 to 2022 have a significant fluctuation amplitude from minimum to maximum values, which is 1048.1mm and ranges from 886.2mm to 1934.3mm.*

**Type of presentation: Poster**



**SOME PHYSIOLOGICAL IMPACTS OF CLIMATE CHANGE &  
GLOBAL WARMING IN LOCAL WHEATS (*Triticum* spp.)**

Elif Çatıkkaş<sup>1</sup>, Hakan Ulukan<sup>2</sup>

<sup>1</sup>Karamanoğlu Mehmetbey University, Ermenek Vocational School, Karaman, Türkiye

<sup>2</sup>Ankara University, Agriculture Faculty, Field Crops Department, Ankara, Türkiye

elifcatikkas@gmail.com

**Key words: climate change, global warming, greenhouse gases (GHGs), local wheats, stress**

**ABSTRACT:**

*The water gap that appears suddenly is called drought at any time and in any place. This should be closed as soon as possible to be able to maximize production, i.e. water use efficiency (WUE), which means the amount of water used by the plant to produce (1) g dry matter. Due to, having resistance genes against stress factors and high nutrient profiles, local wheats should be always used as a parent/donor or genitor (especially for drought stress) in breeding programs. Scientific data show that the world the temperature will increase by the end of 2100 (1,4-5,8)°C and that many plants, ecology, ecosystems, and related stress factor(s) can be affected. Particularly climate change (CC) and global warming (GW); affect the physiology, growth, and development stages of wheat, the speed, and capacity of photosynthesis, the WUE value, the harvest and tresh. Local wheats, each one is a treasure; under the CC and the GW.*

**Type of presentation: Oral**

**SOURCE AND DEPOSITION OF MICROPLASTICS AS  
POLLUTANTS OF AGRICULTURAL SOIL**

Nevres Hurić<sup>1</sup>, Vedran Stuhli<sup>2</sup>, Mirsad Džambić<sup>3</sup>, Zahida Ademović<sup>4</sup>

<sup>1</sup>University Clinical Centre, Tuzla, Bosnia and Herzegovina

<sup>2</sup>Faculty of Tehnology, Tuzla, Bosnia and Herzegovina

<sup>3</sup>Federal Department of Inspection, Sarajevo, Bosnia and Herzegovina

<sup>4</sup>Faculty of Forestry, Sarajevo, Bosnia and Herzegovina

nevreshuric@yahoo.com

**Key words: microplastic, soil, plastic waste materials, pollution, food chain**

**ABSTRACT:**

*Microplastics (MPs), defined as synthetic solid particles or polymer matrices with a size range of 1µm–5 mm and insoluble in water are emerging and ubiquitous contaminants that have become an environmental challenge. Mulching films, disposable irrigation pipes, fruit protection films, and abandoned empty agrochemical containers contribute to agricultural soil MP pollution. MP accumulation in agricultural soil affects biophysico-chemical soil properties and the mobility of other pollutants which in turns can affect agricultural productivity and pose a risk to human and ecosystem health due to their potential to bioaccumulate in the food web.*

*The research methodology for the sources of microplastics in agricultural land would include to introduce producers as well as end consumers of agricultural products to the research plan, but also to the potential dangers, harms and consequences of the presence of microplastics in the soil on the ecosystem and human health.*

*The methods used during the research are extraction, separation, identification and microscopy of microplastics.*

*For the extraction of low-density plastics such as: PE, PP, PS, is used NaCl solution with 30% H<sub>2</sub>O<sub>2</sub> and for particles of already dense microplastics such as: PVC and PET.*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*Sampling of microplastics from agricultural land was carried out in a test conducted on soil samples in a greenhouse for growing strawberries, where the presence of microplastics in the tested sample was determined.*

*Proper plastic waste and waste water disposal is the main step in prevention and control of microplastic pollution in the future.*

**Type of presentation:** Oral



**ICHTHYOFAUNA DIVERSITY IN THE PROTECTED AREA  
OBEDSKA BARA IN SERBIA**

Vera Nikolić, Dubravka Škraba Jurlina, Ana Marić, Tamara Kanjuh,  
Vojislav Sokolović, Predrag Simonović

University of Belgrade, Faculty of Biology, Belgrade, Serbia

vera@bio.bg.ac.rs

**Key words: protected area, ichthyofauna, ecological parameters**

***ABSTRACT:***

*Freshwater fish have an essential part of ecosystem services in the continental environment. Indeed, ichthyofauna has an important socio-economic value and represents an essential component for the functioning of hydrosystem.*

*Protected areas are essential for the maintenance of biodiversity. This study focuses on the diversity of fish fauna, its conservation status and vulnerability in Obedska bara protected area.*

*Fish samples were collected between August 2023 and October 2023. using multi-mesh nets with mesh size of 10- 60 mm, as well as by electrofishing (HONDA 1.2 kW, 6 A) at the same two localities; Krstonošića okno and Vok chanel. Fish species were identified according to Simonović (2006)*

*The analysis of qualitative and quantitative composition of the ichthyofauna was used to calculate the Shannon's index  $\alpha$ -diversity ( $H$ ) according to the formula:  $H = -\sum (ni / N) * \ln (ni / N)$  where  $ni$  presents the number of individuals of one species and  $N$  presents the total number of individuals caught. Furthermore, Menchinik's richness index  $D$  ( $Mn$ ) was calculated according to the formula:  $d = (S-1) / \ln(N)$  where  $S$  presents the total number of species and  $N$  presents the total number of individuals caught.*

*The equitability ( $E$ ) can also be calculated, indicating the abundance of species at each point. The closer to 1, the greater the similarity among species abundances; if the value reaches 1, the species abundance is equal.*

**Type of presentation: Poster**

**MATERIAL, TECHNICAL AND LABORATORY CAPACITIES FOR  
THE RADIOCHEMICAL MONITORING ESTABLISHMENT OF  
THE UNA-SANA CANTON**

Halid Makić<sup>1</sup>, Jasmin Emrić<sup>2</sup>, Elvira Hodžić<sup>1</sup>, Jasmina Ibrahimpašić<sup>1</sup>, Emir Dizdarević<sup>3</sup>

<sup>1</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

<sup>2</sup>Parliamentary Assembly of Bosnia and Herzegovina

<sup>3</sup>State regulatory agency for radiation and nuclear safety

elly\_civic@hotmail.com

**Key words:** radionuclides, radiochemical monitoring, Gamma spectrometer

**ABSTRACT:**

*The release of radionuclides and their further fate and transport in the environment pose a public health concern. Environmental radiochemical monitoring is a key process to ensure that radioactive materials do not spread beyond controlled areas and to identify potential threats to the environment and human health. In addition, it enables monitoring of existing radioactivity in the environment in real time, determining the level of radioactive pollution and calculating the population's exposure to radioactive environmental pollution. Radiochemical monitoring involves taking samples of soil, water, food and biological samples to determine the level of contamination and identify sources of pollution.*

*Continuous monitoring and data analysis are key to identifying potential risks to the environment and human health and to taking appropriate protective measures. In addition to monitoring existing sources of radioactive contamination, it is also important to monitor possible new sources, such as nuclear accidents or disposal of radioactive waste. Radiochemical monitoring in a certain area requires the provision of material, technical and laboratory capacities. Laboratories should be equipped with advanced equipment for sample analysis, which includes, among other things, gamma spectrometers, alpha and beta spectrometers,*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*scintillation detectors, as well as sampling and preparing instruments. This paper presents the necessary material, technical and other resources for the radiochemical monitoring establishment, the methods of implementation, especially in the case of radioactive waste disposal.*

**Type of presentation:** Oral



**EFFICIENCY OF ELECTROFISHING AND GILLNETS IN THE  
ĆELIJE RESERVOIR: A COMPARATIVE STUDY**

Ana Marić, Vera Nikolić, Dubravka Škraba Jurlina, Vojislav Sokolović,  
Tamara Kanjuh, Predrag Simonović

University of Belgrade, Faculty of Biology, Belgrade, Serbia

vera@bio.bg.ac.rs

**Key words: electrofishing, gillnets, conductivity, average length, fisheries management**

**ABSTRACT:**

*This study compares the efficiency of electrofishing and gillnets in sampling fish populations in the Ćelije reservoir in 2011, 2016 and 2023. Differences between these methods were observed each year. Conductivity, temperature and pH were measured annually. For electrofishing, a Loncin device with a motor power of 2.2 KW, an output current of 220 V, a maximum power of 8 A direct current and a frequency of 10-60 Hz was used, covering an area of approximately 1000 m<sup>2</sup> each year. Gillnets with a length of 150 m and mesh sizes of 6 mm, 5 mm and 4 mm were left in the water for more than five hours each time. In 2011, nine species were sampled with electrofishing and seven with gillnets. In 2016, six species were sampled with electrofishing and seven with gillnets, while in 2023, seven species were sampled with electrofishing and six with gillnets. Two species were detected exclusively by electrofishing: the bleak *Alburnus alburnus* and the pumpkinseed *Lepomis gibbosus*, while two other species: Wels catfish *Silurus glanis* and common carp *Cyprinus carpio*, were only caught with gillnets.*

*The average fish length (mm) and weight (g) were significantly higher with gillnets than with electrofishing. While electrofishing is more efficient in catching a wider variety of species, especially smaller ones, it has limitations in effectively sampling bottom-dwelling species. Gillnets, on the other hand, allow for a more comprehensive assessment of bottom-dwelling fish populations, but may overlook smaller species. Understanding the strengths and limitations of each method is crucial for informed decision-*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*making in fisheries management and conservation. In conclusion, the combination of both methods allows for a more thorough assessment of fish populations and ecosystem health. This study emphasises the importance of using multiple sampling techniques for a comprehensive understanding of ichthyocenosis composition.*

**Type of presentation:** Poster





**CHARACTERIZATION OF PM10 SOURCES IN A PRE-ALPINE  
VALLEY WITH TRAFFIC, BIOMASS BURNING AND INDUSTRIAL  
SOURCES**

Kristina Glojek<sup>1</sup>, Vy Dinh Ngoc Thuy<sup>2</sup>, Manousos Ioannis Manousakas<sup>3</sup>,  
Jean-Luc Jaffrezo<sup>2</sup>, André S. H. Prévôt<sup>4</sup>, Griša Močnik<sup>1</sup>

<sup>1</sup>University of Nova Gorica, Centre for atmospheric research (CRA), Ajdovščina, Slovenia

<sup>2</sup>University of Grenoble Alpes, CNRS, INRAE, IRD, Grenoble INP, Grenoble, France

<sup>3</sup>NCSR DEMOKRITOS Institute of Nuclear and Particle Physics, Greece, Agia Paraskevi

<sup>4</sup>Laboratory of Atmospheric Chemistry, Paul Scherrer Institute (LAC-PSI), Villigen,  
Switzerland

kristina.glojek@ung.si

**Key words: positive matrix factorization (PMF), PM10 composition,  
metals, Xact, HVS digitel**

**ABSTRACT:**

*The contribution of traffic and wood burning to particulate matter (PM) across the Alps is widely recognized and studied. However, studies on valleys with cement production are scarce despite its large PM emissions and potential toxic properties. In this study, we aim to identify and chemically characterize PM10 sources in a pre-alpine valley influenced by cement industry. A comprehensive SA study on the local and regional PM sources and their size-segregated elemental fraction will be presented.*

*PM10 was sampled daily on quartz filters from November 2020 to November 2021 and analyzed for a large array of chemical species. Equivalent black carbon (eBC) measurements were taken with the Aethalometer AE33. Hourly elemental PM<sub>10</sub> and PM<sub>2.5</sub> composition was measured in parallel with two Xact 625i from February until May 2021. Positive Matrix Factorization (PMF) was used to determine the sources of PM10 (off-line PMF) with 24-hour time resolution, and of the elemental fraction of PM (on-line PMF) with 1-hour time resolution for the overlapping time period.*

*A combination of the different PMF models with various instrument data resulted in improved SA in terms of number of identified sources and their*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*uncertainties. Due to large number of samples, we were able to separate between the sources with strong seasonality and sources featuring stability throughout the year. The study disclosed two rarely encountered factors, i.e., chloride-rich (chlorine-rich in case of on-line PMF) and cement dust. We associate these two factors to different processes in the cement plant. The high-resolution on-line PMF enabled us to distinguish between regional and local sources. Furthermore, the size-segregated on-line PMF provided more speciated sources (heavy-duty and light-duty vehicles).*

*The outputs of the study provide vital information about the influence of cement production and are useful for PM control strategies and actions. Further work involves more detailed comparison of the sources and additional analysis of the samples around the cement industry.*

**Type of presentation:** Oral



**ENVIRONMENT, NUTRITION AND**  
**HEALTH**



**THE IMPACT OF GENETIC FACTOR ON INDIVIDUAL  
NUTRITIONAL NEEDS**

Huska Jukić<sup>1</sup>, Amina Seferagić<sup>1</sup>, Azira Hrnjica<sup>1</sup>, Sara Redžić<sup>1</sup>, Samira Dedić<sup>2</sup>

<sup>1</sup>University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina

<sup>2</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

oskvo.azirahrnjica@gmail.com

**Key words: gene, genetic variations, nutritional requirements, nutrigenetics, nutrigenomics, personalized nutrition**

**ABSTRACT:**

*The impact of genetic factors on individual nutritional needs is a complex area of research that underscores the significance of genetic variations in shaping an individual's response to nutrition. Genes control the body's ability to absorb, metabolize, and utilize nutrients from the food consumed. The diversity of genetic variations among individuals can result in different nutritional requirements and predispose individuals to specific diseases and dietary issues. Through the development of nutrigenetics and nutrigenomics, scientists have identified numerous genes and genetic variations that play a crucial role in determining how the body absorbs and utilizes nutrients. This knowledge opens the door to personalized nutrition, where dietary regimens are tailored to individual genetic profiles to achieve optimal well-being and disease prevention. The influence of genetic factors on individual nutritional needs also highlights the importance of moving away from the use of universal dietary guidelines. Instead, the approach to nutrition should be customized based on each person's genetic characteristics to achieve the best possible outcomes. Despite the challenges and uncertainties in this research area, the future of nutrition appears promising, as personalized nutrition has the potential to enhance the health and well-being of people worldwide.*

*The aim of this paper is to explore the impact of genetic factors on individual nutritional needs and provide an overview of how genetics shapes the body's*



Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*responses to nutrition, with an emphasis on the development of personalized nutrition for better health and disease prevention.*

**Type of presentation:** Oral



**ANTIMICROBIAL ACTIVITY IN CITRUS PEEL**

Aida Džaferović<sup>1</sup>, Samira Dedić<sup>1</sup>, Huska Jukić<sup>2</sup>

<sup>1</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

<sup>2</sup>University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina

aida.btf@gmail.com

**Key words:** *Escherichia coli*, citrus, antimicrobial activity, disk diffusion method

**ABSTRACT:**

*One of the greatest challenges in modern medicine is the emergence of antibiotic resistance. For this reason, there is increasing research on alternatives to antibiotics, as well as new unconventional mechanisms of antimicrobial action. Herbal preparations (extracts) are products used as one of the potential tools in the fight against antimicrobial resistance. This study investigated the antimicrobial activity of extracts obtained from the peels of various citrus fruits, namely: lemon (*Citrus limon*), orange (*Citrus aurantium*), pomelo (*Citrus grandis*), mandarin (*Citrus reticulata*), and grapefruit (*Citrus paradisi*), against *Escherichia coli* ATCC 25922. The research involved the preparation of methanol extracts from the peels of the mentioned citrus fruits and the determination of the antimicrobial activity of the obtained extracts using the disk diffusion method. These studies represent potential natural antimicrobial agents, and due to bacterial resistance to known antibiotics, there is a constant increase in global consumer demand for natural ingredients. The tested citrus peel extracts showed good antimicrobial activity. The highest mean inhibition zone value was shown by the mandarin peel extract (Latin: *Citrus reticulata*) at 22.76 mm. Slightly lower mean inhibition zone values were observed for lemon peel samples (Latin: *Citrus limon*), measuring 17.60 mm. Orange peel extracts (Latin: *Citrus aurantium*) exhibited a mean inhibition zone value of 14.075 mm. The mean inhibition zone value for grapefruit peel extract (Latin: *Citrus paradisi*) was the lowest at 10.090 mm, while it did not exhibit antimicrobial activity against the tested bacteria.*

**Type of presentation:** Poster

**AN OVERVIEW OF VARIATIONS IN SYNTHETIC APPROACHES  
FOR THE PREPARATION OF (BENZ)IMIDAZOLIUM SALTS:  
BIOACTIVITY AND GREEN SOLVENT PERSPECTIVES**

Enis Šuta<sup>1</sup>, Sead Ljubijankić<sup>2</sup>, Nevzeta Ljubijankić<sup>1</sup>

<sup>1</sup>University of Sarajevo, Faculty of Science, Sarajevo, Bosnia and Herzegovina

<sup>2</sup>University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina

nevzetalj@pmf.unsa.ba

**Key words: ionic liquids, bioactive (benz)imidazolium salts, green solvents, synthetic approach**

**ABSTRACT:**

*In addition to the fact that (benz)imidazolium salts have a significant application due to their ability to act as ionic liquids, in recent decades their biological activity has become more prominent. Imidazolium salts as well as their polymeric materials have been shown to have antitumor, antioxidant, antifibrotic and antimicrobial activity. The growing interest in evaluating this aspect of the application of these salts is based on the long-known toxicity of structurally simpler (benz)imidazolium salts. Ionic liquids are, according to their name, substances of ionic structure with a melting point below 100 °C with practically nonexistent vapor pressure and exceptional ability to dissolve substances of different structures and polarities. The largest portion of ionic liquids are (benz)imidazolium salts with inert anions, which are all properties that nominate them for green solvents in addition to their potential bioactivity. The issue of optimization of the conventional synthetic approach to (benz)imidazolium salts and its innovations will be the topic of this paper, bearing in mind that one of the main obstacles to the application of potentially active substances and their benefits is the profitability of the synthetic process.*

**Type of presentation:** Poster

**HEAVY METALS CONTAMINATION IN URBAN SOIL OF  
LUKAVAC AND NON-CARCINOGENIC AND CARCINOGENIC  
HUMAN HEALTH RISK ASSESSMENT**

Abdel Đozić, Hana Alihodžić, Indira Šestan

University of Tuzla, Faculty of Technology, Tuzla, Bosnia and Herzegovina

abdel.inzio@gmail.com

**Key words: heavy metals, pollution, urban soils, risk assessment**

**ABSTRACT:**

*The problem of exposing to heavy metals in soil for a long time is an important aspect of environmental studies. Concentrations of metallic elements (As, Ba, Cd, Co, Cr, Cu, Fe, Ga, Hg, Mn, Ni and Pb) were determined in soil samples collected in urban area of Lukavac city. Samples were taken at 18 positions to assess the environmental pollution status, non-carcinogenic and carcinogenic human health risk assessment. Pollution by these metals was examined by using several calculation methods: degree of contamination (DC), contamination factor (CF), ecological risk factor (ER), pollution load index (PLI) and geo-accumulation index (I Geo). The degree of contamination is the highest for Ni, 77% of the tested soil samples are contaminated with more than 200% of Ni. Enrichment factor revealed extremely contaminated with As, Cd and Hg, significantly enriched with Cr. According to CF, soil was classified as very highly contaminated with Cd and Ni, an considerable contaminated with As, Hg and Pb. Index of geo-accumulation shows that study area was extremely contaminated with Cd. The (ER) values for Cd was 9101 indicating that the risk level was very high. Results of (PLI) indicated very highly polluted with As, Cd and Hg. Carcinogenic risk by ingestion (CRing) consumption of Pb, Ni and Cr in children was 4.5E-02, 5.4E-04 and 9.9E-04, respectively, while the lifetime carcinogenic risk (LCR) for all sampling points exceeded LCR limits for both, adults and children. Hazard quotient (HQ) trend in both adults and children was found in order HQing > HQderm > HQinh of soil for all metals.*

**Type of presentation: Oral**



**NOVEL ANALYTICAL TECHNIQUES FOR FAST SCREENING IN  
ENVIRONMENTAL MONITORING AND FOOD QUALITY  
CONTROL**

Mladen Franko

University of Nova Gorica, Nova Gorica, Slovenia

mladen.franko@ung.si

**Key words: fast screening, environmental monitoring, food safety, analytical techniques**

**ABSTRACT:**

*The need for analysis of large number of samples in short time poses new demands and challenges in development of analytical techniques and methods which could provide solutions to overcome the bottlenecks in chemical analysis of environmental, food, biomedical and other samples by conventional analytical methods. Over the last two decades new strategies emerged which intend to bypass the labour intensive and time consuming conventional analytical approaches by using a combination of so-called vanguard (screening) and rear-guard (conventional) analytical systems. The most notable differences from traditional analytical methods are reflected in the fact that screening methods frequently have a qualitative rather than quantitative emphasis, they involve little or no sample treatment, the underlying methods are rapid and their binary response requires confirmation by the use of a conventional alternative.*

*In this context it is very important that the analytical techniques applied in the screening methods are highly sensitive, require little sample treatment and handling, and enable automatic and fast completion of processes which provide the final analytical signal.*

*Recently, photothermal techniques such as thermal lens spectrometry (TLS) and microscopy (TLM), hyphenated to flow injection analysis (FIA) or microfluidics have shown great potential for fast screening of various analytes relevant for environmental monitoring and food quality control.*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*In this presentation, examples of recently developed fast screening methods based on TLS and TLM will be presented, with particular focus on the novelties introduced by  $\mu$ FIA-TLM, including low volume (sub- $\mu$ L) requirement and high sample throughput of up to 20 samples/minute. Applications such as determination of Cr(VI), microcystin and ammonia in waters, organophosphate insecticides and biogenic amines in food samples, as well as iron species (Fe(II), Fe(III)) in cloud water will be illustrated.*

**Type of presentation:** Oral



**CATEGORIZATION OF PATIENTS AND IDENTIFICATION OF  
HEALTH CARE NEEDS**

Sena Našić, Sulejman Kendić, Alen Lonić

University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina

sena\_nasic5@hotmail.com

**Key words: patient categorization, progressive care, nurse, critical factors**

**ABSTRACT:**

*Health care is the basic overall part of health care aimed at improving, preserving and restoring health. Its organized form represents one of the disciplines because the basic task of health care is to help individuals and groups to perform their physical, mental and social work as best as possible in different states of health.*

*The purpose of categorizing patients is to respond to the changing nature of health care requests. Patient categorization systems are based on a theoretical framework that reflects the concept of health care. Categorization does not necessarily mean that patients in the same category are identical, but that they are similar to each other, given certain characteristics, in relation to patients in another category. The aim of this paper is to show the real needs for nurses based on the calculation of required hours through categorization of patients and records of working hours, and to determine the share of patients whose care requires more complex procedures and interventions, which require a higher level of nurses' competencies. Therefore, to determine which patients need greater provision of health care and according to which criteria the categorization of such patients is made.*

*Categorization of patients is a relevant piece of information that gives an accurate insight into the number of nurses needed, and provides insight into the complexity and complexity of the interventions to be performed by the nurse.*

**Type of presentation:** Poster

**PHYTOACCUMULATION OF CADMIUM AND LEAD BY MINT  
(lat. *Mentha piperita* L.)**

Minela Čejvan<sup>1</sup>, Vedran Stuhli<sup>2</sup>, Jasmina Ibrahimpašić<sup>3</sup>, Ekrem Pehlić<sup>1</sup>

<sup>1</sup>University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina

<sup>2</sup>University of Tuzla, Faculty of Technology, Tuzla, Bosnia and Herzegovina

<sup>3</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

minela.cejvan@gmail.com

**Key words:** mint, contaminated soil, phytoremediation, phytoaccumulation factor, heavy metals

**ABSTRACT:**

*Heavy metals are an increasing problem for human health. This is the reason for many researches that are based on the elimination of heavy metals from the soil as a natural recipient of all anthropogenic substances that can also contain heavy metals. This study aimed to evaluate the behavior of mint (lat. *Mentha piperita* L.) under cadmium (Cd) and lead (Pb) soil contamination and their transfer from soil in plants compared with a control sample without metal addition. The experiment was performed in laboratory controlled conditions on 10 mint seedlings that were planted in 2,5 kg of soil and watered with a two metal and salt mixtures (hydrated cadmium sulfate -  $3\text{CdSO}_4 \cdot 8\text{H}_2\text{O}$  and lead nitrate -  $\text{Pb}(\text{NO}_3)_2$ ) for a period of three months. The results of metal concentration in mint plants showed that Cd and Pb were accumulated with average concentration of Cd 486,5 mg/kg and Pb 1531,6 mg/kg of dry matter of mint. The value of the phytoaccumulation factor for Cd was 8,0 and for Pb was 4,4. The highest value of the phytoaccumulation factor for Cd and Pb were detected in plant material of mint which had been watered with the smallest volume of heavy metal mixtures. In this study, extremely high concentrations of heavy metals were obtained in mint compared to plants grown in a conventional way, due to artificial soil pollution and limitations of space for root development in pots and constant root contact of mints with a mixture of heavy metals in an ionic highly mobile and reactive form of metal. Based on the results, mint*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*can be considered as hyperaccumulator of Cd and Pb despite significant impact on the growth and development that was observed on mint plants and phytotoxic effects that occurred on plants after three months of exposure.*

**Type of presentation:** Poster



**COMPARATIVE ANALYSIS OF ANTIBACTERIAL EFFECT OF  
CRANBERRY TEA VS CRANBERRY FRUIT ON GRAM-  
NEGATIVE BACTERIA USING AGAR WELL METHOD**

Ena Konjalić<sup>1</sup>, Elida Avdić<sup>2</sup>, Amna Moro<sup>3</sup>, Aja Borić<sup>1</sup>, Irma Mahmutović-  
Dizdarević<sup>4</sup>

<sup>1</sup>International Burch University, Sarajevo, Bosnia and Herzegovina

<sup>2</sup>Mostar Cantonal Hospital, Sarajevo, Bosnia and Herzegovina

<sup>3</sup>University „Džemal Bijedić“, Mostar, Bosnia and Herzegovina

<sup>4</sup>University of Sarajevo, Faculty of Science and Mathematics, Sarajevo, Bosnia and  
Herzegovina

ena.konjalic@stu.ibu.edu.ba

**Key words: cranberry, agar well, gram-negative bacteria**

**ABSTRACT:**

*The word "cranberry" originated from the Pilgrims, who called it "craneberry" because the small, pink blossoms seen in spring resemble the head and bill of a Sandhill crane. Cranberries come from North America, where they are native to the cooler regions of the continent. They grow naturally in acidic bogs, marshes, and wetlands in areas such as the northeastern United States and eastern Canada. Cranberries are also cultivated in other parts of the world with suitable climates, including parts of Europe and Asia. There are two known species of cranberry those are: American cranberry (*Vaccinium macrocarpon*) and the European cranberry (*V. oxycoccos*). For centuries, Cranberry (*Vaccinium macrocarpon*) has served dual purposes both as a food and as medicine. Cranberry's efficacy in treating urinary infections is widely acknowledged and supported by empirical evidence. This natural remedy has been consistently utilized to address urinary tract infections, showcasing its therapeutic potential and longstanding reputation as a reliable treatment option. Cranberries contain proanthocyanidins that interfere with the ability of bacteria to grow, specifically Gram-negative bacteria. These compounds may prevent the bacteria from sticking to the urinary tract walls, making it more difficult for them to cause*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*infections such as urinary tract infections (UTIs). Additionally, cranberries contain other bioactive compounds that may have antibacterial properties, further contributing to their potential effects against Gram-negative bacteria. In this experimental study, we employed the agar well technique to investigate the impact of various cranberry formulations on Gram-negative bacteria. Our approach involved examining multiple types of cranberries to distinguish their comparative efficacy in inhibiting the growth of Gram-negative bacterial strains. By analyzing the size and extent of inhibition zones produced by different cranberry forms, our aim was to identify the most effective form for combating Gram-negative bacterial infections.*

**Type of presentation:** Oral



## ISOLATION AND IDENTIFICATION OF BETA-CAROTENE FROM CARROTS

Aida Smajlagić\*<sup>1</sup>, Majda Srabović<sup>1</sup>, Melita Huremović<sup>1</sup>, Ekrem Pehlić<sup>2</sup>,  
Zahida Ademović<sup>4</sup>, Ermina-Čilović Kozarević<sup>3</sup>

<sup>1</sup> University of Tuzla, Faculty of Natural Sciences and Mathematics, Department of  
Chemistry, Tuzla, Bosnia and Herzegovina

<sup>2</sup> University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina

<sup>3</sup> University of Tuzla, Faculty of Pharmacy, Tuzla, Bosnia and  
Herzegovina

<sup>4</sup> University of Sarajevo, Faculty of Forestry, Sarajevo, Bosnia and Herzegovina

aidataletovic88@gmail.com

**Key words:** carotenoids, isolation, beta carotene, UV, TLC, FTIR

### **ABSTRACT:**

*Carotenoids are a group of natural pigments that are isolated from plants and are known for their great importance in maintaining human health. Beta carotene is an organic compound, from yellow to red-orange colour, which is found in many plants, fruits and vegetables. All carotenoids, especially beta carotene, which is the subject of this research, is used in the pharmaceutical, food and cosmetic industries. It is also important in medicine as it prevents the occurrence of many diseases. Beta carotene is a precursor of vitamin A and is used in various researches due to its strong antioxidant effect. The highest amount of beta carotene is found in carrots, followed by apricots, tomatoes, asparagus, broccoli, pumpkins, plums, etc. This plant pigment was isolated from carrots using a reflux extraction method using the organic solvents methanol and methylene chloride. The isolated carotenoid was confirmed by UV, TLC and FTIR methods. The absorption maxima of the UV spectrum of the isolated compound ( $\beta$ -carotene) range from 200 to 280 nm and 400 to 500 nm. The identification of beta carotene was done by analysis using the FTIR method where functional groups that are present indicate the isolated compound.*

**Type of presentation:** Poster



**EFFECT OF FOSFOMYCIN ON BIOFILM FORMATION IN GRAM-  
POSITIVE BACTERIA USING MICROBROTH DILUTION AND  
TISSUE CULTURE PLATE METHODS**

Aida Lavić<sup>1</sup>, Irma Mahmutović-Dizdarević<sup>2</sup>, Hana Brekalo<sup>3</sup>

<sup>1</sup>International Burch University, Sarajevo, Bosnia and Herzegovina

<sup>2</sup>University of Sarajevo, Faculty of Science, Sarajevo, Bosnia and Herzegovina

<sup>3</sup>Dzemal Bijedić University of Mostar, Mostar, Bosnia and Herzegovina

aida.lavic@stu.ibu.edu.ba

**Key words:** biofilms, antibiotics, fosfomycin, *Staphylococcus aureus*, MRSA

**ABSTRACT:**

*Biofilms, intricate microbiome structures adhering to surfaces, present a formidable challenge to antibiotic treatment due to their resilience against eradication. Comprising diverse bacterial colonies or single-cell groups, these biofilms contribute significantly to the chronicity of illnesses, necessitating urgent and effective antimicrobial strategies. However, in healthcare environments, the indiscriminate use of broad-spectrum antibiotics persists due to the inherent challenges in promptly identifying pathogenic bacteria and assessing their susceptibility to antimicrobial agents. This practice fuels the escalation of resistance levels, exacerbated by inadequate infection control measures that facilitate the dissemination of resistant strains among patients and their surroundings. Bacteria deploy an array of resistance mechanisms, including enzymatic inactivation and modification of antibiotic targets, as well as horizontal gene transfer, facilitating the rapid spread of resistance traits within bacterial populations. The development of antibiotic resistance typically involves an increase in the minimum inhibitory concentration (MIC) as a result of sustained alterations in bacterial physiology. Fosfomycin emerges as a promising candidate due to its demonstrated ability to penetrate biofilms, as evidenced by numerous in vitro and biofilm infection model studies. These investigations showcase fosfomycin's efficacy, either in isolation or in combination with other antibiotics, in reducing or eradicating clinically significant bacteria within*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*biofilms while inducing structural modifications in the biofilm matrix. This paper endeavors to evaluate the antimicrobial activity of fosfomicin against Staphylococcus aureus and methicillin-resistant Staphylococcus aureus (MRSA), shedding light on its potential as a therapeutic option for biofilm-associated infections caused by these pathogens. Such research holds significant implications for the development of effective strategies to combat biofilm-related chronic illnesses and address the emergence of antibiotic-resistant strains in healthcare settings.*

**Type of presentation:** Oral



**EFFECT OF FOSFOMYCIN ON BIOFILM FORMATION IN GRAM-  
NEGATIVE BACTERIA USING MICROBROTH DILUTION AND  
TISSUE CULTURE PLATE METHODS**

Emina Pramenković<sup>1</sup>, Hata Džino<sup>2</sup>, Samra Međedović<sup>2</sup>

<sup>1</sup>International Burch University, Sarajevo, Bosnia and Herzegovina

<sup>2</sup>Dzemat Bijedic University of Mostar, Mostar, Bosnia and Herzegovina

emina.pramenkovic@stu.ibu.edu.ba

**Key words: biofilms, *Escherichia coli*, ESBL, fosfomycin**

**ABSTRACT:**

*The broad-spectrum antibiotic fosfomycin has garnered significant interest due to its remarkable efficacy in inhibiting the formation of biofilms by Gram-negative bacteria. This heightened attention stems from the pressing need for novel therapeutic strategies against antibiotic-resistant strains, particularly those exhibiting extended-spectrum beta-lactamase (ESBL) resistance. In this study, we investigate the multifaceted mechanisms through which fosfomycin disrupts biofilm formation, focusing on its impact on Gram negative bacteria especially on *Escherichia coli* (*E. coli*) and ESBL strains. We explore the complex relationship between fosfomycin and biofilm formation and explain how it can prevent bacterial adherence in the early phases of biofilm formation. Fosfomycin's capacity to interfere with adhesion molecules on the bacterial surface serves as a critical barrier, preventing the establishment of robust biofilm structures in both *E. coli* and ESBL-producing strains. Furthermore, our findings underscore fosfomycin's ability to disrupt the synthesis of the extracellular matrix, a vital component that confers structural integrity to biofilms. Targeting important enzymes involved in matrix formation, fosfomycin efficiently reduces the cohesiveness of biofilm matrices, making both types of bacteria more susceptible to elimination. Comprehending the complex mechanisms that underlie fosfomycin's influence on biofilm formation in strains of *E. coli* and ESBL bacteria highlights the drug's potential as an effective adjuvant treatment for bacterial infections that exhibit biofilm formation. Our discovery opens the*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*door for the creation of novel antibacterial strategies targeted at successfully treating resistant biofilm-associated illnesses in a variety of bacterial populations by clarifying these mechanisms.*

**Type of presentation:** Oral



**EFFECT OF FOSFOMYCIN ON THE RESISTANCE PATTERNS OF  
GRAM-NEGATIVE BACTERIA TO DIFFERENT CLASSES OF  
ANTIBIOTICS USING THE BAUER-KIRBY DISK DIFFUSION  
METHOD**

Ilderina Jusufović<sup>1</sup>, Elida Avdić<sup>2</sup>, Lamija Vrtić<sup>3</sup>, Samra Međedović<sup>3</sup>

<sup>1</sup>International Burch University, Sarajevo, Bosnia and Herzegovina

<sup>2</sup>Mostar Cantonal Hospital, Sarajevo, Bosnia and Herzegovina

<sup>3</sup>Dzemat Bijedić University of Mostar, Mostar, Bosnia and Herzegovina

ilderina.jusufovic@ibu.edu.ba

**Key words: fosfomycin, gram-negative bacteria, antibiotic**

**ABSTRACT:**

*One of the main areas of focus for antimicrobial research is the impact of fosfomycin on the antibiotic resistance patterns of Gram-negative bacteria. Because of its distinct mode of action, fosfomycin is frequently used to treat infections brought on by gram-negative bacteria that are resistant to drugs. The purpose of this work is to use the Bauer-Kirby disk diffusion method to examine how fosfomycin affects the resistance patterns of gram-negative bacteria to various antibiotic classes.*

*Gram-negative bacteria (Escherichia coli ATCC 14169, 25922, and ESBL) were grown for the investigation and then exposed to fosfomycin. Following therapy, the bacteria's sensitivity to many more antibiotics of different classes was evaluated using the Bauer-Kirby disk diffusion method. We measured and compared the changes in the zones of inhibition surrounding the antibiotic discs to control groups that did not get fosfomycin treatment.*

*The zone of inhibition decreased from the positive control to the fosfomycin-treated groups, according to the results for all antibiotics. This implies that the bacteria's susceptibility to several antibiotics has been lessened by the presence of fosfomycin. A smaller zone of inhibition usually denotes reduced sensitivity or resistance, which in this instance may be brought about by fosfomycin's impact on the bacteria's pattern of antibiotic resistance. A notable exception was the antibiotic ampicillin, for which a tiny zone of*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*inhibition developed following fosfomycin administration, suggesting that the resistance pattern may have changed.*

*Overall, these findings suggest a potential antagonistic effect between fosfomycin and the tested antibiotics, which may have implications for their combined use in clinical settings. Further research is warranted to elucidate the underlying mechanisms and to explore the clinical relevance of these observations.*

**Type of presentation:** Oral



**EFFECT OF FOSFOMYCIN ON THE RESISTANCE PATTERNS OF  
GRAM-POSITIVE BACTERIA TO DIFFERENT CLASSES OF  
ANTIBIOTICS USING THE BAUER-KIRBY DISK DIFFUSION  
METHOD**

Ilderina Jusufović<sup>1</sup>, Elida Avdić<sup>2</sup>, Lamija Delić<sup>3</sup>

<sup>1</sup>International Burch University, Sarajevo, Bosnia and Herzegovina

<sup>2</sup>Mostar Cantonal Hospital, Sarajevo, Bosnia and Herzegovina

<sup>3</sup>University "Džemal Bijedić" Mostar, Mostar, Bosnia and Herzegovina

ilderina.jusufovic@ibu.edu.ba

**Key words: fosfomycin, gram-positive bacteria, antibiotic**

**ABSTRACT:**

*Modern antimicrobial research must comprehend how fosfomycin influences antibiotic resistance in Gram-positive bacteria. Because of its distinct mode of action, fosfomycin is becoming more and more useful in the treatment of illnesses brought on by Gram-positive bacteria that are resistant to drugs. This work provides crucial information for developing efficient antimicrobial treatments by examining how fosfomycin modifies the resistance patterns of Gram-positive bacteria to different antibiotic classes.*

*Various strains of Gram-positive bacteria, such as Methicillin-resistant Staphylococcus aureus, Staphylococcus aureus ATCC 6538, and Staphylococcus aureus ATCC 12393, were cultivated and subjected to fosfomycin. After that, the Bauer-Kirby disk diffusion method was employed to assess the susceptibility of the bacteria to several antibiotic classes. We measured and compared the changes in inhibition zone diameters surrounding the antibiotic discs to control groups that did not get fosfomycin treatment.*

*Results showed that, in most cases, inhibition zones in fosfomycin-treated samples were smaller than those in the positive control (without fosfomycin). This suggests that fosfomycin reduces susceptibility of Gram-positive bacteria to tested antibiotics, potentially decreasing the effectiveness of these antibiotics in the presence of fosfomycin. However, exceptions were noted*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*for Erythromycin (E15ug), Azithromycin (AZM15ug), and Streptomycin (S300ug), where S. aureus ATCC 12393 initially showed resistance but exhibited a small inhibition zone after fosfomycin treatment. Results also revealed that the zone of inhibition for the same strain of bacteria (S. aureus 12393) with respect to the antibiotic ampicillin (AMP 2ug) increased after treatment with fosfomycin, suggesting a unique response to fosfomycin treatment for this antibiotic. This implies a possible synergistic effect between fosfomycin and these antibiotics, suggesting that fosfomycin may enhance bacterial susceptibility to them.*

*These findings highlight the complex interplay between fosfomycin and antibiotics in Gram-positive bacteria, emphasizing the need for further research to optimize antimicrobial treatment strategies.*

**Type of presentation:** Oral





**BENEFITS OF USING FRESH CHOKEBERRY AND CHOKEBERRY PRODUCTS**

Aleksandra Šupljeglav Jukić<sup>1</sup>, Jasna Hasanbegović Sejfić<sup>1</sup>, Lejla Škaljić<sup>2</sup>,  
Semina Hadžiabulić<sup>1</sup>

<sup>1</sup>University Džemal Bijedić, Agromediterranean faculty, Mostar, Bosnia and Herzegovina

<sup>2</sup>University Džemal Bijedić, Economy Faculty, Mostar, Bosnia and Herzegovina

jasna.hasanbegovic89@gmail.com

**Key words: survey, producers, consumers, use of chokeberry**

**ABSTRACT:**

*In recent years, chokeberry has become increasingly popular as a berry fruit species that is attracting more and more attention among producers, consumers and medical professionals. The aim of this study was to examine different ways of using chokeberry and chokeberry products: user satisfaction, producer perspective, and the stance of medical experts, as well as the impact of this "super berry" on the human body and health. The research results indicate that chokeberry juice (60%) and syrup form (38.2%) are the most common products offered by producers on the market. The diversity of products allows for different options for consumption and meeting different consumer preferences. The survey also revealed that the majority of producers grow black chokeberry (34.5%), while (32.7%) of producers are dedicated to growing red chokeberry and the same amount to purple chokeberry. This indicates the variety of varieties available on the market, which can provide more opportunities for customization of cultivation according to specific conditions and consumer preferences. Respondents positively rated the effect of chokeberry on improving health, with most agreeing that chokeberry has a significant impact on strengthening the immune system, reducing lipids in the blood and urine, and helping to control glucose levels in the urine and blood. For producers, it is important to continuously monitor customer satisfaction to ensure the quality of products and services and develop strategies for improving offerings. It is particularly important to highlight that there has been an increase in the*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*consumption of chokeberry during and after Covid, which further speaks to the importance of consuming chokeberry for boosting and enhancing the immune system. Chokeberry has the potential to become an even more important fruit species in the food and pharmaceutical industries, and further research and public education can contribute to a better understanding and application of its health benefits for people.*

**Type of presentation:** Poster



**METAL CHELATING CAPACITY OF MELATONIN PRE-TREATED LEMON BALM AND VALERIAN PLANTS**

Elvisa Hodžić, Sebila Rekanović, Anita Vuković, Dinko Bećirspahić

University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

elly\_civic@hotmail.com

**Key words: lemon balm, valerian, heavy metals, chelation, pre-treatment**

**ABSTRACT:**

*Metal ions of iron ( $Fe^{2+}$ ) and copper ( $Cu^{2+}$ ) can catalyze the formation of free radicals. In living organisms, they are bound to proteins, which limits their participation in reactions that produce radicals and have an essential physiological function in living cells. Flavonoids have the ability to chelate metal ions, which contributes to their antioxidant activity in vitro, but it is not known whether they serve as effective metal chelators in vivo. They form a stable complex with transition group metals ( $Fe^{3+}$ ,  $Al^{3+}$ ,  $Cu^{2+}$ ,  $Zn^{2+}$ ) which depends on the nature of the molecule itself (catechol part), and the pH in which it is found. Chelation mainly takes place on the hydroxyl groups at positions 3' and 4' of the B ring, position 3 of the A ring hydroxyl group, and at positions 3 and 4 of the carbonyl group of the C ring. The ability to chelate  $Fe^{2+}$  ions by ethanolic extracts of valerian and lemon balm was determined by the method of Dinis et al. with certain modifications. According to the results obtained in the control plants, valerian leaf extract reached the maximum metal chelation capacity of 65.76% at an extract concentration of 1 mg/mL, while the lowest capacity was shown by the lemon balm root at 41.93%. In the roots of both plant species grown on soil contaminated with Cd and Zn, there is a statistically significant increase in the ability to chelate iron (from 0.5 to 34.5%). Melatonin is simultaneously involved in the relocation of heavy metals and thus contributes to the reduction of oxidative stress in plants.*

**Type of presentation:** Poster

**BUFFERING CAPACITY OF FERMENTED MILK DRINK WITH  
THE ADDITION OF ROYAL JELLY**

Adnan Omanović, Alena Terzić, Adna Zeljković, Almir Đogić, Azra Družić,  
Edina Šertović

University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

edina.sertovic@gmail.com

**Key words: sensory analysis, yogurt, buffering capacity, royal jelly**

**ABSTRACT:**

*The development of functional food is increasingly oriented towards the enrichment of products with bee products. Therefore, enriching yogurt with royal jelly would contribute to the creation of a new type of functional dairy products. The aim of the work was to evaluate the influence of the addition of royal jelly (RJ) on the buffering capacity and sensory properties of yogurt. Measurements were performed on three samples with different concentrations of royal jelly (RJ 0.4%, RJ 0.6% and RJ 0.8%) and on a control sample (K) without royal jelly. Fermentation of samples was carried out at +43 °C until coagulation and pH value 4.6. The characteristics of the obtained beverages were monitored during storage on the 21st day at +4 °C. In all samples, the pH value, buffer capacity, electrical conductivity, titration acidity, sensory properties and product acceptability were determined. The addition of royal jelly caused a shorter duration of fermentation (depending on the amount of royal jelly) compared to the control sample. The buffer capacity of yogurt samples is the highest in the range between pH 2-4 for all samples, electrical conductivity and titration acidity increase with storage time. The acceptability test showed good acceptance of the samples by potential consumers. Royal jelly has a positive effect on all tested properties of yogurt, and the results of sensory analysis show that yogurt enriched in this way could be accepted on the market as a functional food. Therefore, yogurts produced with the addition of royal jelly can be a good alternative to innovative functional food with acceptable product properties.*

**Type of presentation:** Poster

**SENSORY PROPERTIES AND ACCEPTABILITY OF BEE POLLEN  
IN FUNCTIONAL FERMENTED DAIRY PRODUCTS**

Ema Demirović, Nejla Kahrić Muratović, Enesa Aganović, Mirza Dizdarić,  
Edina Šertović

University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

edina.sertovic@gmail.com

**Key words: sensory analysis, yogurt, chemical composition, buffering capacity, bee pollen**

**ABSTRACT:**

*The aim of this paper is to evaluate the influence of bee pollen (PG) on the chemical and sensory properties of the fermented product. Given that both fermented products and bee pollen are beneficial for human health, this research aimed to evaluate the functional and sensory characteristics of fermented beverages based on cow's milk and different concentrations of bee pollen. Measurements were performed on three samples with different concentrations of bee pollen (BPG 0.4%, BPG 0.6% and BPG 0.8%) and on a control sample (K) without added bee pollen. Fermentation of samples was carried out at +43 °C until coagulation and pH value 4.6. The characteristics of the obtained beverages were monitored during storage on the 1st, 7th, 14th and 21st days at +4 °C. The pH value, buffer capacity, electrical conductivity, titration acidity, sensory properties and acceptability of the product were monitored for the produced milk drinks. The buffer capacity of yogurt samples is the highest in the range between pH 3 – 6 for all samples, electrical conductivity and titration acidity increase with storage time. The research results indicate a higher viscosity of yogurt with added pollen during a period of 21 days compared to the control sample without pollen. Samples of fermented beverages received the best assessment of their sensory properties on the seventh day of storage. The sensory properties of the samples were mostly influenced by the concentration of pollen. The acceptability test showed good acceptance of the samples by potential consumers. Enriching yogurt with bee pollen would contribute to*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*the creation of a new type of functional dairy products. Analyzing the results, it can be concluded that the pollen grain has a positive influence on the tested parameters, and that fermented dairy products with the addition of pollen can be potentially functional products.*

**Type of presentation:** Poster



**ETIOLOGY OF ORIGIN FOR STROKE**

Anes Budimlić<sup>1</sup>, Enver Budimlić<sup>2</sup>, Sulejman Kendić<sup>3</sup>, Huska Jukić<sup>3</sup>

<sup>1</sup>University of Bihać, Pedagogical faculty, Bihać, Bosnia and Herzegovina

<sup>2</sup>Health center Velika Kladuša, Bosnia and Herzegovina

<sup>3</sup>University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina

budimlicanes6@gmail.com

**Key words: etiology, stroke, atherosclerosis, cerebrovascular insult**

**ABSTRACT:**

*The main cause of stroke in the largest percentage is atherosclerosis. Atherosclerosis is a pathological focal thickening of the intima due to the accumulation of lipids, complex carbohydrates, blood and blood products, calcium and connective tissue, associated with changes in the media. Cerebrovascular insult - CVI (cerebral infarction, stroke, stroke, whiplash) is an acute cerebral incident triggered by a sudden increase in blood pressure due to an atherosclerotic altered blood vessel with a large narrowing of the lumen of the blood vessel (ischemic infarction) or, in rarer cases, caused by the bursting of an artery aneurysm or blockage cerebral artery by a blood clot that comes from another part of the body, most often from the heart or the arterial part of the bloodstream. Sudden interruption of blood flow through a certain part of the brain leads to temporary or permanent loss of consciousness, movement, thinking, memory, speech or sensation.*

**Type of presentation:** Poster



**INFLUENCE OF CHOLESTEROL AS A RISK FACTOR FOR  
CARDIOVASCULAR DISEASES**

Anes Budimlić<sup>1</sup>, Enver Budimlić<sup>2</sup>, Sulejman Kendić<sup>3</sup>

<sup>1</sup>University of Bihać, Pedagogical faculty, Bihać, Bosnia and Herzegovina

<sup>2</sup>Health center Velika Kladuša, Bosnia and Herzegovina

<sup>3</sup>University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina

budimlicanes6@gmail.com

**Key words: cholesterol, risk factors, cardiovascular diseases**

**ABSTRACT:**

*High cholesterol levels, inflammatory response and endothelial dysfunction play a key role in atherosclerosis and plaque formation, the most common cause of heart attacks and strokes. Endothelial dysfunction implies impaired functioning of the inner walls of blood vessels, among others, blood vessels of the heart. Diseases of blood vessels represent a major problem of modern humanity and tend to increase due to the modern way of life. The presence of risk factors, stress, pace of life, bad lifestyle habits result in an increased incidence of cardiovascular diseases. The main reasons for the frequency of occurrence of cardiovascular diseases are bad lifestyle habits, lack of adaptation to the stressful situations of the modern lifestyle, and above all, the connection of multiple comorbidities with risk factors.*

**Type of presentation: Poster**





**CHARACTERIZATION OF GREEN-METHOD SYNTHESIZED  
GOLD NANOPARTICLES USING AQUEOUS EXTRACTS OF  
RUBUS SPP. LEAVES**

Marija Tasić<sup>1</sup>, Ljiljana Stanojević<sup>2</sup>, Jelena Stanojević<sup>2</sup>, Sanja Petrović<sup>2</sup>,  
Goran Nikolić<sup>2</sup>, Dragan Cvetković<sup>2</sup>

<sup>1</sup>Innovation Center University of Niš, Niš, Serbia

<sup>2</sup>University of Niš, Faculty of Technology, Leskovac, Serbia

goranchem\_yu@yahoo.com

**Key words:** gold nanoparticles, biosynthesis, *Rubus spp*, EDX, XRD

**ABSTRACT:**

*Reducing agent and the synthesis method applied greatly affects the nanoparticle's characteristics and properties. Green nanobiotechnology represents a healthier option for synthesis as it uses environmentally safe methods. From the nano size point of view, it is increasingly attractive for various fields (biomedicine, microbiology, biology, etc.). In the biosynthesis of nanoparticles, various bioactive molecules from plants, such as proteins, vitamins, organic acids, carbohydrates, and secondary metabolites, act as bio-reductants, capping and stabilizing agents for chloride and nitrate precursors. The aqueous extract of wild blackberry (*Rubus spp*) leaves, obtained by maceration, was used for the stabilization of gold nanoparticles (AuNPs) at a temperature of 80°C. The obtained nanoparticles were characterized by energy-dispersive X-ray spectroscopy (EDX) and X-ray diffraction (XRD). EDS spectra confirmed the formation of AuNPs via peaks at 2.2 keV. The highest signal corresponds to elemental gold, and lower signals showed the presence of chlorine, most likely originating from chloroauric acid. XRD analysis confirms that the peaks of the synthesized nanoparticles with  $2\theta$  at about 38.2°, 44.4°, 64.6, 77.5° and 81.8° correspond to the reflection planes (111), (200), (220), (311), and (222), respectively with face-centered (111) plane as the most intense. The average crystallite size was  $18.7 \pm 2$  nm. The obtained nanoparticles should be*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*considered for further bioactivity investigation and potential applications in cosmetic preparations.*

**Type of presentation:** Poster

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**COLOR AND ACCEPTABILITY OF COOKIES WITH POLLEN  
ADDITION**

Azra Družić, Adna Zeljković, Alena Terzić, Melisa Oraščanin

University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

melissa.bajramovic@gmail.com

**Key words: cookies, pollen, color**

**ABSTRACT:**

*Cookies are popular bakery products primarily because of their quick consumption, long shelf life, and diverse taste and texture. The basic ingredients of these products include flour (TYPE – 500), margarine, sugar, water, and baking soda. However, consumers often consider these ingredients unhealthy, prompting numerous studies in recent decades to improve the nutritional value of cookies. Bee pollen is a potentially functional food ingredient due to its essential nutrients and wide range of bioactive compounds. In the study, cookies were prepared by replacing wheat flour with bee pollen in various ratios: 2%, 5%, and 10%. The sensory profile of the cookies was analyzed using qualitative descriptive analysis (QDA), and consumer acceptance and purchase intention were also evaluated based on responses from 16 participants. The highest satisfaction was expressed towards cookies with a 10% pollen addition (total satisfaction = 8.125), along with a pronounced intention to purchase this product. The color of the baked cookies was assessed according to the CIELab system, using the parameters  $L^*$ ,  $a^*$ , and  $b^*$ . Since pollen is darker than wheat flour, the brightness ( $L^*$ ) of each cookie was significantly lower compared to the control group. A decrease in cookie brightness was observed with increasing pollen concentration. The addition of pollen resulted in a significant increase in redness ( $a^*$ ) in the cookies, while the yellowness value ( $b^*$ ) also increased with increasing pollen concentration. These results suggest that flavonoids and carotenoids, the main pigments in pollen, are responsible for the increased redness and yellowness in pollen-enriched cookies.*

**Type of presentation:** Poster

**RHEOLOGICAL PROPERTIES, COLOR, AND ACCEPTABILITY  
OF HOMEMADE KETCHUP COMPARED TO COMMERCIAL**

Adnan Omanović, Alena Terzić, Adna Zeljković, Melisa Oraščanin

University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

melissa.bajramovic@gmail.com

**Key words: homemade ketchup, color, rheology, acceptability**

**ABSTRACT:**

*Ketchup, a popular condiment worldwide, is an essential ingredient in many recipes due to its distinctive flavor and texture. This study focuses on the rheological properties, color, and acceptability of homemade ketchup (Zmajevački kečap) compared to commercial variants. Rheological properties, reflecting material behavior under force, are crucial for ketchup quality, significantly influencing its texture and taste. Additionally, color is important as a key factor in quality assessment. Significant differences in viscosity and color were discovered between homemade and commercial ketchup. Homemade ketchup often tends to be thicker compared to commercial ones, possibly due to different production processes and ingredients. A consumer test involving 16 participants from the Biotechnical Faculty, University of Bihać, evaluated color, odor, taste, density, and overall acceptability. Results showed diverse preferences among participants. While some favored the richer taste of homemade ketchup, others preferred the milder taste of commercial varieties. Participant surveys also revealed that homemade ketchup may align more with salsa's sensory characteristics than traditional ketchup, indicating the subjective nature of product perception. Color analysis showed that homemade ketchup is brighter ( $L = 32.79$ ) and has more yellow tones ( $b^* = 9.25$ ) compared to commercial variants ( $L = 31.37$  and  $32.41$ ;  $b^* = 7.35$  and  $8.50$ ). Understanding these differences can aid in improving production and marketing strategies to better meet diverse consumer needs. In conclusion, this research highlights the complexity of ketchup perception among consumers and the importance of adapting production and marketing to*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*meet their varied preferences. Further research is necessary to deepen understanding and provide guidance for enhancing ketchup quality in the market.*

**Type of presentation:** Poster



**SPECTROPHOTOMETRIC DETERMINATION OF IRON IN  
DRINKING WATER**

Aldina Baltić<sup>1</sup>, Ekrem Pehlić<sup>1</sup>, Asmir Aldžić<sup>1</sup>, Aida Šapčanin<sup>2</sup>, Majda  
Srabović<sup>3</sup>

<sup>1</sup>University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina

<sup>2</sup>University of Sarajevo, Faculty of Pharmacy, Sarajevo, Bosnia and Herzegovina

<sup>3</sup>University of Tuzla, Faculty of Science and Mathematics, Tuzla, Bosnia and Herzegovina

pehlic\_ekrem@yahoo.com

**Key words: drinking water, iron, UV-Vis spectroscopy, water system**

**ABSTRACT:**

*Water is the basic unit of life, essential for flora and fauna and a basic need for human life. The safety of drinking water is a very important public health issue. Iron is a widespread element in the earth's crust, but it is generally found in low concentrations in natural water systems. A commonly used method for the determination of trace amounts of iron involves the complexation of Fe<sup>2+</sup> with 1,10-phenanthroline (phen) to produce an intensely red-orange colored complex. In this paper we have determined the iron content in the tap water from three different water systems (Pivnice, Musić, Bihać) using UV-Vis spectrophotometer. Concentration of iron were measured 170,3 µg/L for water system Bihać, 178,9 µg/l for water system Pivnice and 187,6 µg/l for water system Musić. The content of iron in all three samples were within the limits of the maximum permissible concentration values, prescribed by Ordinance on the health safety of drinking water in Bosnia and Herzegovina (200 µg/L), as well as by WHO Regulations (less than 0,3 mg/l). With this research, we have shown that our water supplies have satisfactory values of iron content, which makes them safe to drink.*

**Type of presentation: Poster**

**AIR QUALITY COMPARISON IN UNA-SANA, ZENICA-DOBOJ  
AND TUZLA CANTON FROM 2020 TO 2023**

Minela Čejvan<sup>1</sup>, Majda Huskić<sup>1</sup>, Selma Prošić<sup>1</sup>, Zlata Ibršimović-Subašić<sup>2</sup>

<sup>1</sup>University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina

<sup>2</sup>Quality Control Department, Spark Plugs and Industrial Ceramics Factory ENKER D.D,  
Tešanj, Bosnia and Herzegovina

minela.cejvan@gmail.com

**Key words:** air quality, monitoring, pollution, SO<sub>2</sub>, NO<sub>2</sub>, CO, PM<sub>10</sub>, PM<sub>2.5</sub>

**ABSTRACT:**

*Air quality impaired by the action of pollutants in concentrations that can significantly affect the quality of life, people's health or parts of the environment represents a public health problem of great importance and is associated with a series of harmful effects on human health. Air quality monitoring in the Federation of Bosnia and Herzegovina is the responsibility of the Federal Hydrometeorological Institute and the competent authorities of cantons and local self-government units. The operators that monitor ambient air quality at fixed locations in the Federation of Bosnia and Herzegovina are: Federal Hydrometeorological Institute, Institute of Public Health of Sarajevo Canton, Municipality of Kakanj, Metallurgical Institute „Kemal Kapetanović“ Zenica and Ministry of Physical Planning and Environmental Protection of Tuzla Canton.*

*In this paper, a comparison of data collected by the Federal Hydrometeorological Institute through automatic measuring stations was made. Three areas were observed: Una-Sana, Zenica-Doboj and Tuzla canton. The subject of comparison were concentrations of sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) and carbon monoxide (CO) from 18 locations of fixed automatic stations. Mean annual concentrations were monitored over a period of four calendar years, namely 2020, 2021, 2022 and 2023. The results show extremely high and health-threatening concentrations of particulate matter*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*in almost all locations. In some locations, health-threatening concentrations of sulfur dioxide and ozone have been recorded. Concentrations of nitrogen dioxide and carbon monoxide are within the maximum allowed concentrations and exceedances are extremely rare. Also, the air quality in the Una-Sana canton compared to the Zenica-Doboj and Tuzla cantons is satisfying in average annual concentrations.*

**Type of presentation:** Poster





**MONITORING OF CLIMATE ELEMENTS AND AIR QUALITY  
INDEX IN THE CITY OF BIHAĆ IN 2023**

Asmir Aldžić, Aldina Baltić, Jasmin Toromanović, Emra Toromanović

University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina

asmir.aldzic@unbi.ba

**Key words: air monitoring, air quality, climatic parameters, air quality index**

**ABSTRACT:**

*Clean air is the need of every living being on Earth. Along with the air, man inhales an increasing concentration of pollutants, which are the product of industrialization, traffic, accidents, but also everyday human activities. Air quality is the concentration of pollutants in the air over a period of time. Determination of air quality is preceded by air quality monitoring, which serves to preventively register exceeded limit values of air quality parameters affecting the health of the population and the environment. This paper presents the results of climatic parameters, namely: temperature, humidity, air flow rate, light intensity, ultraviolet (UV) and electromagnetic radiation, noise and pressure, which were measured to determine the physical state of the ground air layer. In addition to climatic elements, the results of measuring air quality parameters were presented, namely, concentrations as follows: particulate matter ( $PM_{2.5}$  and  $PM_{10}$ ), carbon monoxide (CO), ozone ( $O_3$ ), sulfur dioxide ( $SO_2$ ) and nitrogen dioxide ( $NO_2$ ), whose measurement is being performed by the Federal Hydrometeorological Institute of Bosnia and Herzegovina. The area of Una-Sana Canton and the city of Bihać in 2023 is not characterized by excessive pollution, except one day 17.10.2023. when concentration of CO (565) was indexed as dangerous but this does not diminish the need to establish an appropriate air quality management system. Air quality management in the city of Bihać is especially necessary in case of accidents, such as fires in factories and forest areas.*

**Type of presentation:** Poster

**MALACHITE GREEN ADSORPTION BY *AMORPHA FRUTICOSA L.*  
ACTIVATED CARBON**

Ines Cindrić, Lidija Jakšić, Elizabeta Zandona, Marijana Blažić

Karlovac University of Applied Sciences, Karlovac, Croatia

ines.cindric@vuka.hr

**Key words:** adsorption, *Amorpha L. Fructiosa*, dye, Malachite green

**ABSTRACT:**

*The increasing presence of synthetic dyes in wastewater poses a significant environmental challenge, necessitating the development of efficient and sustainable removal methods. This study investigates the use of activated carbon derived from plant *Amorpha fruticosa L.* commonly known as false indigo bush, for the adsorption of synthetic dyes from aqueous solutions. Batch adsorption experiments were conducted to evaluate the removal efficiency of commonly used synthetic dye malachite green (MG). Key parameters such as contact time, initial dye concentration, pH, and temperature were optimized to ascertain the maximum adsorption capacity. The adsorption kinetics followed a pseudo-second-order model, suggesting chemisorption as the primary mechanism. Equilibrium data were best fitted by the Langmuir isotherm model, indicating monolayer adsorption with maximum capacities of 270 mg/g MG.*

**Type of presentation:** Poster

**INHIBITION OF CHOLINESTERASE AND  $\alpha$ -GLUCOSIDASE  
ENZYMES BY WATER EXTRACTS OF FIVE CENTAUREA  
SPECIES**

Olivera Politeo<sup>1</sup>, Kristina Kardum<sup>2</sup>, Mirko Ruščić<sup>3</sup>, Mejra Bektašević<sup>4</sup>

<sup>1</sup>University of Split, Faculty of Chemistry and Technology, Split, Croatia

<sup>2</sup>University of Split, School of Medicine, Split, Croatia

<sup>3</sup>University of Split, Faculty of Science, Split, Croatia

<sup>4</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

mejra\_b@yahoo.com

**Key words:** Asteraceae, Centaurea, AChE, BChE,  $\alpha$ -glucosidase

**ABSTRACT:**

*Inhibition of important enzymes is one of the fundamental therapies for treating diseases such as Alzheimer's dementia and diabetes mellitus. Genus Centaurea is one of the most important genera of the Asteraceae family, with a large number of species. In Croatia there are around 80 species of this genus, of which 27 are endemic. In this study, the chemical and biological profile of the water extracts of five plants of the genus Centaurea was determined. The chemical profile of the extracts was determined by qualitative determination of secondary metabolites and by quantitative determination of the total phenol content and the total flavonoid content. Biological potential of the extracts were investigated in terms of the inhibition of acetylcholinesterase (AChE), butyrylcholinesterase (BuChE) and  $\alpha$ -glucosidase enzymes. Glycosides and saponins have been identified in plant water extracts, while alkaloids, tannins, steroids and terpenoids have not been identified. The results showed that all Centaurea plant water extracts contain a relatively small content of phenolic and flavonoid compounds. The extracts of *C. scabiosa* (36.6%) and *C. rhenana* (28.9%) showed a low inhibition of AChE (36.6% and 28.9%), *C. triumfetti* and *C. ragusina* showed a very low inhibition of AChE (3.2% and 9.7%), whereas *C. alba* did not inhibit AChE. *C. alba*, *C. rhenana* and *C. scabiosa* extracts poorly inhibited BuChE (11.1%, 3.1% and 2.9%), while *C. triumfetti* and *C.**

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*ragusina did not inhibit this enzyme. The C. scabiosa extract showed a moderate inhibition on  $\alpha$ -glucosidase (20.6%), C. rhenana extract showed a low inhibition (6.7%), while other tested extracts did not inhibit this enzyme. No significant inhibitory potential of extracts isolated from Centaurea plants on the enzymes AChE, BuChE and  $\alpha$ -glucosidase has been shown. It is necessary to perform further investigation by using other types of extracts of tested plants species.*

**Type of presentation:** Poster



**PHYSICAL, CHEMICAL AND MICROBIOLOGICAL ANALYSIS IN  
SAMPLES OF BOTTLED WATER IN BOSNIA AND  
HERZEGOVINA**

Asmir Aldžić<sup>1</sup>, Melisa Halilović<sup>1</sup>, Aldina Baltić<sup>1</sup>, Irma Mahmutović-  
Dizdarević<sup>2</sup>, Benjamin Muhamedbegović<sup>3</sup>

<sup>1</sup>University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina

<sup>2</sup>University of Sarajevo, Faculty of Science, Sarajevo, Bosnia and Herzegovina

<sup>3</sup>University of Tuzla, Faculty of Technology, Tuzla, Bosnia and Herzegovina

asmir.aldzic@unbi.ba

**Key words:** bottled water, chemical analysis, calcium, coliform, *Streptococcus faecalis*, public health

**ABSTRACT:**

*Bottled drinking water has recently been increasingly consumed by consumers in Bosnia and Herzegovina and monitoring of the health safety and quality of bottled water is a public health task of great importance. This paper presents the investigation of physical, chemical and microbiological parameters and the content of calcium ions (Ca<sup>2+</sup>) in 11 samples of bottled water available in markets. Six analyzed samples are natural spring water and five samples are natural mineral water. All samples are on the list of recognized natural mineral waters and natural spring waters in Bosnia and Herzegovina ("Official Gazette of B&H", No 1/23) published by the Food Safety Agency of Bosnia and Herzegovina. Physical and chemical parameters that were analyzed are temperature, concentration of hydrogen ions (pH value), electrical conductivity and oxygen saturation, and all measured values are within the permissible range prescribed by the Ordinance on natural mineral and natural spring waters ("Official Gazette of B&H", No 26/10 and 32/12). The content of calcium ions (Ca<sup>2+</sup>) in the tested samples ranges from 20 to 139 mg/l with a mean of 79,5 mg/l. The calcium content in most samples deviates from the value indicated on the packaging. Microbiological analysis was determined by the membrane filtration method. The presence of coliform bacteria was analyzed by seeding*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*on Chromogenic coliform (CCA) agar and Streptococcus faecalis on Slanetz and Bartley (SB) agar. The presence of coliform bacteria and Streptococcus faecalis wasn't found in these samples of bottled water.*

**Type of presentation:** Poster



**GROUNDWATER - HOW WELL DO WE KNOW AN IMPORTANT  
STRATEGIC RESOURCE AND HOW CAN WE LEARN MORE  
ABOUT IT?**

Jasmina Kožar Logar<sup>1</sup>, Katarina Kovačič<sup>2</sup>

<sup>1</sup>Jožef Stefan Institute, Ljubljana, Slovenia

<sup>2</sup>Slovenian Environment Agency, Ljubljana, Slovenia

jasmina.logar@ijs.si

**Key words: groundwater, water dating, tritium**

**ABSTRACT:**

*73% of the total surface area of the Earth consists of water but only 0.5% of the Earth's water is in the form of freshwater. The majority is groundwater, which represents the most important source of potable water. In Europe about 75% of drinking water supply depends on it. In Slovenia groundwater from shallow alluvial, fractured and karstic aquifers supply more than 97% of Slovenian population. With the rise of urbanization and intensive agriculture, with the use of pesticides and chemical fertilizers, groundwater is put under severe pollution pressure.*

*The knowledge and understanding of hydrogeological characteristics of groundwaters are therefore essential for their efficient protection and sustainable utilization. Usually chemical and stable isotope analyses are carried out for determination of groundwater hydrological status. Besides chemical and stable isotope data of the groundwater, also its radioactivity gives us important information about its condition.*

*For example, the radioactive environmental tracer tritium is used to estimate the mean age of groundwater. This is very important, when it is necessary to determine the vulnerability of the aquifer to contamination. Further, in the case of old groundwaters it can exclude the possibility of the groundwater being polluted by any anthropogenic sources.*

*The extended study of Slovenian aquifers covered the most representative lithological units that are found in Slovenia and were at the same time evenly distributed throughout the country. In total, 281 samples were measured*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*from 120 different locations. Based on tritium concentration, the simplified model to determine the transit time of groundwater was developed. Groundwaters were divided into 4 major categories, into groundwaters that are older than 100 years, groundwaters, where the older component prevails, groundwaters with the age between 30 and 60 years and recent groundwaters with age up to 15 years.*

**Type of presentation:** Oral





**SUSTAINABLE ANIMAL AND PLANT  
PRODUCTION**



**INFLUENCE OF CULTIVATION SYSTEM ON STRAWBERRY  
QUALITY AND YIELD**

Dinko Bećirspahić<sup>1</sup>, Azra Skender<sup>1</sup>, Zineta Vuković<sup>1</sup>, Semina Hadziabulić<sup>2</sup>,  
Jasna Hasanbegović<sup>2</sup>

<sup>1</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

<sup>2</sup>Dzemal Bijedic University of Mostar, Agromediterranean Faculty, Mostar, Bosnia and  
Herzegovina

dinkoxavi@hotmail.com

**Key words: strawberry, clery, cultivation system, high tunnels, open field**

**ABSTRACT:**

*The primary objective of this study was to investigate the differences in phenological and morphological-chemical characteristics of "Clery" strawberries cultivated under different cultivation systems (high tunnel cultivation compared to the standard open-field cultivation).*

*The obtained results indicate that the cultivation system factor had a statistically significant impact on all observed properties except for vitamin C content. Strawberries grown in high tunnels ripened earlier compared to those grown in the open field. Strawberries cultivated in high tunnels exhibited a higher number of plants per planting site and a greater yield per plant and planting site, compared to strawberries cultivated in the open field. Additionally, morphological fruit characteristics (weight, length, width, and fruit shape index) were higher in the high tunnel system compared to the open-field system. Higher values of chemical fruit properties such as dry matter content, vitamin C, and total acidity were obtained from fruits grown in the open field compared to those from high tunnels. The pH value of the fruit was higher in the high tunnel system compared to the open-field system.*

*The investigated "Clery" strawberry variety proved to be highly suitable for cultivation in the high tunnel system, enabling extended harvesting seasons, better yields, and improved morphological fruit traits. Moreover, the*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*chemical characteristics of the fruit were not compromised in quality compared to fruits grown in the open field. In a general sense, strawberry production in high tunnels holds great economic potential for small-scale farmers.*

**Type of presentation:** Oral



**THE IMPACT OF THE FEEDING LAYING HENS ON EGG  
QUALITY CHARACTERISTICS**

Suzana Jahić, Sebila Rekanović, Samira Hotić

University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

suzanajahic2002@gmail.com

**Key words: laying hens, garlic powder, egg quality characteristics**

**ABSTRACT:**

*A total number of 96 laying hens Isa Brown layers 28 weeks old divided into four equal groups were fed with designed meals for 4 weeks so that garlic powder was added to the standard feed mixture in concentrations of 2%, 4%, and 6%, and the fourth group was the control group without the addition of garlic powder. Diet and drinking water were provided ad libitum during the experimental period. It was examined the impact of adding garlic powder to the standard feed mixture on egg quality parameters such as egg mass and its components, egg shape index, yolk index, egg white height and value of Hogg units. The addition of the garlic powder in the standard feed mixture improves egg mass, as well as the mass of egg white and egg shell. The experimental group that took the addition of garlic powder of 6% in the standard feed mixture resulted in eggs of greater mass, greater mass of white and shell compared to the eggs of hens fed with the standard feed mixture ( $p < 0.01$ ). The feeding significantly enhanced the albumen height value, as well as Hogg unit values. This applies only to the group with 2% of share of garlic powder, where the increase of albumen height value was 1.417 mm, and increase in Hogg units values was 5.909, and to the group with 6% garlic powder share, where the increase in the albumin height value was 1.250 mm and the increase in Hogg units value was 4.964, while the treatment had no statistically significant effect on shape index and yolk index. Egg shell thickness increased compared to the control group, with a statistically significant increase ( $p < 0.05$ ) in the group receiving the 2% garlic powder supplement.*

**Type of presentation:** Poster

**POWDERY MILDEW OF BULBOUS WILD BARLEY (*Hordeum bulbosum*) IN BİNGÖL UNIVERSITY CAMPUS AREA, TÜRKİYE**

Işıl Saraç Sivrikaya<sup>1</sup>, Arzu Çelik Oğuz<sup>2</sup>, Aziz Karakaya<sup>2</sup>

<sup>1</sup>Bingöl University, Bingöl, Türkiye

<sup>2</sup>Ankara University, Ankara, Türkiye

karakaya@agri.ankara.edu.tr

**Key words:** *Hordeum bulbosum*, powdery mildew, Bingöl University, Türkiye

**ABSTRACT:**

*Bulbous wild barley (*Hordeum bulbosum*) is a common species found in Türkiye. This wild species can be utilized to enhance barley's ability to withstand both biotic and abiotic stress factors. In May 2023, a survey was conducted in the Bingöl University campus area located in Bingöl, Türkiye, to investigate the presence of powdery mildew disease caused by *Blumeria graminis* f. sp. *hordei* in *H. bulbosum* populations. In the Bingöl University campus area, 25 locations with dense *H. bulbosum* populations were examined, and it was found that powdery mildew was present in 24 of those locations. The percentages of diseased plants ranged from 0.25 to 46.25 for the disease in the affected areas. The severity values of the powdery mildew ranged from 1-9. *Hordeum bulbosum* populations in the Bingöl University campus area demonstrated a wide range of powdery mildew resistance.*

**Type of presentation:** Oral



**MOLECULAR DETECTION AND IDENTIFICATION OF  
SELECTED ISOLATES *ALTERNARIA SPP.***

Mehira Perviz<sup>1</sup>, Vojislav Trkulja<sup>2</sup>, Osman Perviz

<sup>1</sup>Agricultural Institute of Una Sana Canton, Bihać, Bosnia and Hercegovina

<sup>2</sup>Agricultural Institute of Republic of Srpska, Banja Luka, Bosnia and Hercegovina

<sup>3</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Hercegovina

mehirakapic@gmail.com

**Key words:** *A.dauci* isolates, *A.alternaria* isolates, PCR, primers, amplification, detection, identification

**ABSTRACT:**

*Previous research has shown that the morphological and breeding characteristics are not sufficient for the proper determination and characterization of Alternaria spp. fungi of the carrot pathogen. Polymerase Chain Reaction (PCR) was used in order to detect the obtained Alternaria spp isolates originating from Bosnia and Herzegovina and Serbia through molecular detection, as well as to confirm the results obtained by conventional phytopathological methods. A total of 50 monosporous Alternaria spp. isolates were selected for molecular identification, of which 25 isolates belonged to group A and 25 isolates to group B, as well as two reference isolates from Serbia, namely: CLA-108 (A. dauci) and Aa- 82 (A. alternata). After the extraction of the total DNA of the tested Alternaria spp. isolates, PCR reactions were performed with a pair of universal primers ITS1/ITS4 in order to obtain a specific DNA fragment that includes the ITS genomic region (part of 18S rRNA, ITS1, 5.8 rRNA, ITS2 and part of 28S rRNA) and visualization of the obtained products by electrophoretic separation in agarose gel was performed. In addition to standard primers that amplify the ITS region of the genome, specific primers with target sequences within this region were also used for the detection of individual species within the Alternaria genus, namely: 1) ADF2/ADR1, which amplify the ITS region of the rDNA of A. dauci species, and 2) AAF2/AAR3, which amplify the ITS region of rDNA of A. alternata species.*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*The analysis of amplified fragments of tested isolates originating from carrots revealed the occurrence of fragments of the expected size of about 545 bp in all tested isolates. The positive reaction that was obtained in all samples confirms that a phytopathogenic fungus occurred in each of the analysed samples. No amplification occurred in the negative control (C).*

**Type of presentation:** Oral



**SUSTAINABLE FOOD SYSTEMS AS PART OF THE GREEN DEAL**

Azira Hrnjica<sup>1</sup>, Huska Jukić<sup>1</sup>, Suad Habeš<sup>2</sup>, Aida Džaferović<sup>3</sup>

<sup>1</sup>University of Bihać, Faculty of Health Studies, Bihać, Bosnia and Herzegovina

<sup>3</sup>University of Sarajevo, Faculty of Health Studies, Sarajevo, Bosnia and Herzegovina

<sup>3</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

OSKVO.azirahrnjica@gmail.com

**Key words: European Green Deal, aquaculture, sustainability food system, climate change, insects food**

**ABSTRACT:**

*Emissions from the sectors of agriculture, forestry and land use are responsible for approximately a quarter of anthropogenic greenhouse gas emissions, and if they continue on the current trend they would prevent the achievement of the goals of the Paris Agreement. The European Green Deal defines the EU's future environmental policy to address the challenges of environmental protection in the face of climate change, and one of the essential elements of the Green Deal is a Farm-to-Fork strategy, with an emphasis on establishing an environmentally friendly food sector. Food production worldwide must be transformed in order to achieve the UN Sustainable Development Goals and to increase the level of resilience of production and processing activities to external factors.*

*The demand and need for food is growing as the world's population grows, but the amount of arable and pasture land supporting extensive agricultural production is decreasing due to increasingly noticeable climate changes (Ijaola et al. 2024). A part of the future demand for food and nutrition can be met by aquaculture, algae and insects, which, compared to livestock, represent an efficient way of producing protein with relatively low environmental costs.*

*This paper presents some important advantages and disadvantages of the mentioned food systems, as well as additional efforts that must be made in order to achieve the best possible sustainability and acceptability of these systems.*

**Type of presentation:** Poster





**EFFECT OF VERMICOMPOST ON ROOTING OF NERIUM  
OLEANDER CUTTINGS**

Alisa Hadžiabulić, Elma Temim, Semina Hadžiabulić, Jasmina Aliman,  
Dženan Vukotić

Džemal Bijedić University of Mostar, Agromediterranean Faculty, Mostar, Bosnia and  
Herzegovina

alisa.hadziabulic@unmo.ba

**Key words:** Nerium oleander, cuttings, vermicompost, rooting parameters

**ABSTRACT:**

*Nerium oleander as perennial ornamental plant is grown as a shrub or small tree worldwide in temperate and subtropical areas. Its propagation is usually done with its cutting and the rooting media is sand and peat. An investigation was carried out to study the effect of use of vermicompost based media on rooting of Nerium oleander cuttings. The rooting medias were combination of vermicompost and sand (pure sand, 50% sand 50% vermicompost, 70% sand 30% vermicompost, 30% sand 70% vermicompost, 20% sand 80% vermicompost). The cutting was taken from the central part of stem. The following root parameters were measured: percentage of rooting; no. of roots per cutting; Root Distribution Index (RDI); The number of new leaves per rooted cutting; total root length and no. of secondary and tertiary roots. The results showed that pure sand and mixtures with lower percentage of vermicompost favored percentage of rooting, the number of new leaves and all the other followed parameters.*

**Type of presentation:** Poster

**ANTIOXIDANT ACTIVITY OF PURPLE BASIL (*OCIMUM  
BASILICUM* L., VAR. *PURPURASCENS*) ESSENTIAL OIL AND  
HYDROLATE**

Aleksandra Milenković<sup>1</sup>, Ljiljana Stanojević<sup>1</sup>, Jelena Stanojević<sup>1</sup>, Dragan  
Cvetković<sup>1</sup>, Lidija Milenković<sup>2</sup>, Goran Nikolić<sup>1</sup>

<sup>1</sup>University of Niš, Faculty of Technology, Leskovac, Serbia

<sup>2</sup>University of Priština in Kosovska Mitrovica, Faculty of Agriculture, Lešak, Serbia

goranchem\_yu@yahoo.com

**Key words: Purple basil, essential oil, hydrolate, antioxidant activity**

**ABSTRACT:**

*Basil is the common name for all members of genus *Ocimum* (Lamiaceae), and it is one of the most popular herbs in the whole world. The aim of the study was to compare antioxidant activity of essential oil and hydrolate from purple basil leaves (*Ocimum basilicum* L. var. *purpurascens*) cultivated in south Serbia. The essential oil was obtained by Clevenger-type hydrodistillation with hydromodule 1:10 m/V. The qualitative and quantitative composition of essential oil was determined by GC/MS and GC/FID analyses. The antioxidant potential of essential oil and hydrolate was estimated by using the DPPH assay, while total phenolics and total flavonoids content of hydrolate was determined spectrophotometrically by using the Folin-Ciocalteu and AlCl<sub>3</sub> methods, respectively. The yield of essential oil obtained was 0.408 ml/100 g of plant material. The most abundant components of essential oil were linalool (56.8%), 1,8-cineole (10.7%), and  $\alpha$ -trans-bergamoptene (9.9%). Hydrolate showed better antioxidant activity (EC<sub>50</sub> value of 0.012 mg/ml) in comparison to essential oil (EC<sub>50</sub> value of 0.865 mg/ml). The total phenolics and total flavonoids contents were 214.97 mg GAE/g of dry hydrolate and 40.37 mg RE/g of dry hydrolate, respectively.*

*Purple basil leaves essential oil and hydrolate represent an excellent source of natural antioxidants and an alternative to synthetic antioxidants with potential application in phytopharmaceutical products. The results obtained for basil leaves hydrolate, which is a by-product during hydrodistillation,*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*and which, based on the obtained results, are a source of highly valuable bioactive components, phenols and flavonoids with good antioxidant activity, are particularly significant.*

**Type of presentation:** Poster

*Acknowledgements: This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia under the program of financing scientific research work, 451-03-65/2024-03/ 200133 and 451-03-66/2024-03/ 200133.*



**A CONTRIBUTION TO THE KNOWLEDGE OF THE  
REPRODUCTIVE BEHAVIOR OF CATTLE AND SHEEP AS A  
PARAMETER OF SUSTAINABILITY IN ANIMAL PRODUCTION**

Husein Vilić, Refik Šahinović

University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

husein.btf@gmail.com

**Key words: behavior, reproduction, cattle, sheep, sustainability**

***ABSTRACT:***

*Domestic animal production includes reproduction, which again depends on the animal's health. However, the animal's health depends on its ability to cope with the living conditions of the environment in which it is placed, as well as on the way the farmer treats it. Proper nutrition, supply of clean and safe water, care, accommodation, health condition and removal of stressogenic factors from the environment will significantly ensure quality reproduction of domestic animals.*

*Breeds of domestic cattle are reproductively active throughout the year, but there are certain seasonal variations in the values of the basic parameters, which measure the reproductive efficiency of both male and female animals. The basic elements of a bull's sexual behavior are: courtship, erection and protusion, jump on the female, intromission, ejaculatory stroke and ejaculation and ending from the jump. One of the basic characteristics of the sexual behavior of cows and heifers during estrus is that they jump on other cows and allow other cows to jump on them. As with most animals, sexual behavior in adult female cattle is manifested during a short estrous period, which is repeated every three weeks, except during the period when the female is pregnant.*

*The basic phases of the ram's behavior during the act of mating are: smelling the anogenital area of the female, pushing the female with his head and shoulders, jumping and ejaculation. External signs of estrus are quite pronounced in sheep. Therefore, it is not possible to establish estrus without a ram. The characteristic signs of mating behavior are as follows: the ewe in*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*estrus follows the male, pushes him with her neck and hips, makes quick movements with her tail and allows him to jump her, i.e. for the male to perform the entire act of mating.*

**Type of presentation:** Poster



**CONCENTRATION OF VITAMIN C IN LEAVES OF LIMEIRA  
LETTUCE DEPENDING ON DEVELOPMENT PHASE**

Vildana Jogić<sup>1</sup>, Jelena Nikitović<sup>2</sup>, Merima Toromanović<sup>1</sup>, Subha Avdić<sup>1</sup>

<sup>1</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

<sup>2</sup>University of Banja Luka, Agricultural faculty, Banja Luka, Bosnia and Herzegovina

vildana.ahmed@gmail.com

**Key words:** Lactuca, Limeria, beby leaf, vitamin C

**ABSTRACT:**

*The research determines the content of vitamin C from the "baby leaf" to the formed plant, as well as the content of other components: K, Ca, P, Mg and Fe. The Limeria lettuce hybrid was grown in a greenhouse according to the principles of classic conventional production. The content of vitamin C increases from the 30th to the 60th day of physiological maturity, the recorded value is 20.28 mg/100 g, and after 60 days of vegetation it decreases to a value of 18.75 mg/100 g. Other investigated parameters (K, Ca, P, Mg, and Fe), sugar and nitrite content show lower values in the young leaf in the interior of the salad compared to the outer, more developed leaves.*

**Type of presentation:** Poster



**MORPHOLOGICAL CHARACTERISTICS OF CORNELIAN  
CHERRY GENOTYPES (*CORNUS MAS L.*) FROM THE KONJIC  
AREA**

Semina Hadžiabulić<sup>1</sup>, Jasna Hasanbegović<sup>1</sup>, Jasmina Aliman<sup>1</sup>, Azra  
Skender<sup>2</sup>, Dinko Bećirspahić

<sup>1</sup>Dzemail Bijedic University of Mostar, Agromediterranean faculty, Mostar, Bosnia and  
Herzegovina

<sup>2</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

semina.hadziabulic@unmo.ba

**Key words: cornelian cherry, fruit weight, fruit length, fruit width**

**ABSTRACT:**

*The genus *Cornus* within family *Cornaceae* includes about 65 species of shrubs and trees, where the fruits and trees are used for decorative purposes.*

*This study was carried out on 10 local cornelian cherry (*Cornus mas L.*) genotypes grown in Konjic area in Bosnia and Herzegovina. Cornelian cherry fruits from these 10 genotypes were harvested and analyzed during the ripening period in 2021. Some physical characteristics of genotypes (fruit weight, fruit length and fruit width) were determined.*

*The representative sample represented 30 fruits of ten selected genotypes of cornelian cherry. The results showed that the average fruit weight ranged from 1.24-2.25 g, the average fruit width from 10.94-13.13 mm and the average fruit length from 13.53-17.73 mm.*

*The lowest average fruit weight was recorded in genotype G1 (1.24 g), while the lowest average fruit width (10.94 mm). The highest average fruit weight was recorded in genotype G7 (2.25 g), as well as the highest fruit width (13.13 mm). The highest average fruit length of the studied cornelian cherry genotypes had genotype G7 (17.73 mm), while the lowest average value of fruit length had genotype G1 (13.53 mm).*

*The present study showed that genetic resources even in a small area indicates a great phenotypic diversity among genotypes that may have*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*hidden important genes in them and may be important for breeding better varieties of cornelian cherry in the future as parental material.*

**Type of presentation:** Poster





## **FOREST MANAGEMENT**



**COMPARATIVE ANALYSIS OF SOIL QUALITY FOR BEECH  
GROWTH IN THE AREAS OF NATIONAL PARKS KOZARA AND  
SUTJESKA, BASED ON TAKSATION DATA**

Mirsad Ičanović<sup>1</sup>, Mihajlo Marković<sup>2</sup>, Đorđe Topić<sup>3</sup>, Husnija Kudić<sup>4</sup>

<sup>1</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

<sup>2</sup>University of Banja Luka, Faculty of agriculture, Banja Luka, Bosnia and Herzegovina

<sup>3</sup>Forest plan, Banja Luka, Bosnia and Herzegovina

<sup>4</sup>Second Secondary School, Velika Kladuša, Bosnia and Herzegovina

icanovicmirsad@yahoo.com

**Key words: National Park, Kozara, Sutjeska, soil, beech**

**ABSTRACT:**

*Forests represent the most complex terrestrial community of organisms and are considered a key component of landscape stability. Therefore, sustainable management has been regarded as one of the most important challenges for researchers in recent decades. The subject of research in this paper is two National Parks, namely NP Sutjeska and NP Kozara, both located in the II protection zone. The National Park "Sutjeska" is the oldest and largest national park in Bosnia and Herzegovina. The Park's area is 16,052.34 hectares, of which over 80% is covered by forests, while the rest consists of meadows, pastures, and clearings above the upper forest limit. Kozara Mountain was declared a National Park "Kozara" in April 1967. The current area of the park is 3,907.54 hectares. Beech in Southeastern European countries is one of the most valuable species of forest trees, but it has only received due attention in the last few decades. Research on the pedological properties of soils in the mentioned Parks was conducted on the same soil class (brown or cambic soils), on different parent substrates. Alongside the analysis of soil samples, a comparative assessment of beech condition was performed based on taksation data for the researched areas. All results were processed and presented through tables, graphs, and presented using GIS application. Traditional editing methods are sophisticated, facilitating, and significantly speeding up with great accuracy.*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*After the completion of soil analyses and processing of taksation data, it is concluded that the habitat quality in NP "Sutjeska" is better compared to the habitat quality in NP "Kozara".*

**Type of presentation:** Poster



**COMPARATIVE PHYSICAL CHARACTERISTICS OF WOOD  
SPECIES FROM ZAGROS FORESTS**

Redžo Hasanagić<sup>1</sup>, Leila Fathi<sup>2</sup>, Selma Mujanić<sup>1</sup>

<sup>1</sup>University of Bihać, Faculty of Technical Engineering, Bihać, Bosnia and Herzegovina

<sup>2</sup>Shahrekord University, Faculty of Natural Resources and Earth Science., Shahrekord, Iran

redzo.hasanagic@unbi.ba

**Key words:** Zagros Forests, wood species, physical characteristics, density, shrinkage

**ABSTRACT:**

*This paper presents a comparative analysis of the physical characteristics of three wood species, namely Persian oak (*Quercus brantii* Lindl.), hawthorn (*Crataegus azarolus* L.) and wild almond (*Amygdalus eburna*), grown in the Zagros Forests region. The study aims to provide insights into the physical properties (e.g. oven-dry density, basic density, volumetric shrinkage, and swelling). Through comprehensive research and analysis, the paper outlines the specific physical attributes such oven-dry density, basic density, volumetric shrinkage, and swelling of selected wood species. Three adult trees of each species were chosen, and samples were prepared from the breast height diameter to measure the properties. Maximum oven-dry density were identified in *Amygdalus scoparia*. The findings of this study contribute to a better understanding of the diverse range of wood resources available in the Zagros Forests, forest management practices and promote the conservation of biodiversity in the region.*

**Type of presentation:** Oral



**ENVIRONMENTAL IMPLICATIONS OF WOOD MODIFICATION  
PROCESSES**

Redžo Hasanagić, Selma Mujanić, Damir Hodžić

University of Bihać, Faculty of Technical Engineering, Bihać, Bosnia and Herzegovina

redzo.hasanagic@unbi.ba

**Key words: wood modification, environmental impact, sustainability, analysis, strategies**

***ABSTRACT:***

*Wood modification processes are crucial for enhancing the properties of wooden materials, but they can also have a significant impact on the environment. This paper explores various wood modification techniques, including thermal, chemical, and biological modification, and analyzes their environmental impact. We examine greenhouse gas emissions, chemical usage, and energy consumption in the process, as well as potential environmental side effects such as wastewater and waste materials. We also investigate possible environmentally sustainable alternatives and strategies to reduce the negative impacts of wood modification processes. Through a systematic analysis of environmental impacts, this paper provides a foundation for understanding the ecological aspects of wood modification processes and encourages the development of more sustainable approaches in the wood processing industry.*

**Type of presentation:** Poster



**THE INFLUENCE OF NATURAL DISTURBANCES ON THE  
HARVEST PLAN AND TIMBER PRODUCTION FROM  
MOUNTAINOUS FORESTS**

Igor Stankić<sup>1</sup>, Zlatan Lonić<sup>2</sup>, Sara Bašanović<sup>2</sup>, Vanja Jurišić<sup>3</sup>

<sup>1</sup>Energy institute Hrvoje Požar, Zagreb, Croatia

<sup>2</sup>ŠPD Una-San forest, Bihać / Bosanska Krupa, Bosnia and Herzegovina

<sup>3</sup>University of Zagreb Faculty of agriculture, Zagreb, Croatia

igor.stankic@gmail.com

**Key words: forest management, natural disturbances, weather extremes, sanitary felling, assortment structure**

**ABSTRACT:**

*The success of achieving goals in forestry operations depends on quality of multicriterial planning. Production in forestry takes place in large areas with the presence of various climatic factors. This complicates the planning and assumes higher production costs. The determination of annual cutting yield is a complex and comprehensive process, the realization of which needs to meet the requirements of sustainable forest management. There are regular fellings prescribed by the plan (regular yield) or sanitary fellings after the natural disturbances (sudden yield). The occurrence of sudden yield decreases the stability of the ecosystem and makes it difficult to manage due to the disturbed stand structure and health. Such stands are additionally exposed to various biotic and abiotic factors. The financial effect of timber production after sanitary felling is extremely negative. The reason for this is low timber volumes over a large area, with a lot of "idle" human and mechanized work. Sanitary fellings result in low quality timber logs, whether as the result of pests or weather extremes. The aim of investigation was to determine the production structure and performance of the production in the compartments where sanitary fellings were carried out. Results were obtained and then compared to the timber production from regular fellings. The analyses were carried out according to the timber volume and quality. In case of sanitary fellings direct production costs were higher and revenues*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*were lower. The planned financial income per 1 m<sup>3</sup> was higher than achieved, despite the higher production in total wood volume. In regular fellings timber production was higher than planned but financial income per 1 m<sup>3</sup> was lower than planned. The research points to dependence of the planning on the quality of input data and proposes improvements of planning process in case of fellings after natural disturbances and extreme weather events.*

**Type of presentation:** Oral



**ACORN WEEVIL - *CURCULIO GLANDIUM* (MARSHAM)  
(COLEOPTERA: CURCULIONIDAE) IN UNA-SANA CANTON  
(B&H)**

Zemira Delalić

Biotechnical faculty, University of Bhać, Bihac, Bosnia and Herzegovina

zemirabtf@gmail.com

**Key words:** *Curculio glandium*, oak , fruits, Una-Sana Canton

**ABSTRACT:**

*The Una–Sana Canton (the northwest part of Bosnia and Herzegovina) abounds in large forest areas, where grow oak (*Quercus ssp*). However, the plant has been endangered due to the negative effects of disease–causing agents, harmful insects, and human factors (uncontrolled forest logging). Moreover, the *Curculio glandium* causes significant damage on the acorn fruit. This study aims to analyze the emergence of the pest and the damage which it produces in the forest areas of the northwestern Bosnia and Herzegovina, precisely in Una–Sana Canton. The presence of the acorn weevil has been examined on samples taken from 14 locations in oak forests in the municipalities of Cazin, Velika Kladuša, Bosanski Petrovac i Bosanska Krupa. In order to research this phenomenon more precisely, each fruit has been cut, the larvae have been separated from it and damage in the inner part of the fruit has been observed. The number of larvae has been noted per a sample. The number of larvae has been noted per a sample. With respect to each sample, the mass of healthy and damaged part of the fruit has been measured. The number of larvae ranges from 5 to 23 per sample. The percentage of damaged fruit parts ranges from 15,0% to 62,0%. The reason for the increased presence of the acorn weevil (*Curculio glandium*) in the analyzed oak forest is in addition to the beneficial chemical composition of the fruit and the late detection of the presence of insect existing in severely large populations. The use of chemical preparations (pesticides) as a solution to this issue is environmentally unacceptable, especially on a larger area. It is mandatory to manually collect all the fruits that fall from the oak trees*



Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*ahead of time and, in addition, to stop the further development of the larvae. Significant results can be achieved by separating individual oak stands and changing the purpose of its use, as well as by combining the method with the limited use of pesticides.*

**Type of presentation:** Poster



## **WASTE MANAGEMENT**



**OPTIMIZATION OF THE PROBLEM OF THE LOCATION OF  
TRANSFER STATIONS IN THE SYSTEM OF INTEGRAL WASTE  
MANAGEMENT**

Fatka Kulenović

University of Bihać, Technical faculty, Bihać, Bosnia and Herzegovina

kulenovic.fatka@gmail.com

**Key words: communal waste, landfill, optimization, location problems, transferring stations**

**ABSTRACT:**

*The waste directives of the European Union and the Resolution on waste policy require member states and countries in transition to first of all reduce waste production, then to recycle, and purpose-built facilities with the most modern sophisticated technologies with the application of the "polluter pays" principle. According to the definition, municipal waste is household waste, as well as other waste that is similar in nature or composition to household waste. The increase in the amount of generated waste represents a growing and significant problem in the context of environmental protection and the population's health. The impact of municipal waste on the environment in USK is multiple negative. Waste is disposed of in unorganized landfills, while there is also an evident problem of inadequate organization of official locations of municipal and city landfills and low awareness of citizens about the need to preserve the environment and the negative consequences of waste on civilization. Optimization of the waste collection system in the world has been the subject of research for many years, but only in some segments of that system. Optimization in terms of the choice of transfer station locations with the alternative inclusion of mechanical-biological treatment (MBO) of waste at several locations will be the subject of interest in this work. The establishment of MBO could be considered one of the priorities, because the construction is much faster than the construction of the landfill itself, and they could be built one by one.*

**Type of presentation: Oral**



**THE ROLE OF DIGESTATE IN THE CIRCULAR ECONOMY**

Mihaela Grubišić Šeba, Marin Miletić

Energy Institute Hrvoje Požar, Zagreb, Croatia

mseba@eihp.hr

**Key words: digestate, fertilizer, circular economy, waste management**

**ABSTRACT:**

*Circular economy and renewable resource usage are some of the major goals in the EU strategies. Yet, few industries make it possible. One of them is biogas and biomethane plants. Up to 90% of the raw materials are returned as a by-product – digestate, while the energy from organic matter of raw materials has been used for the production of biogas (biomethane) or electricity and heat generation thereafter.*

*There are many advantages of digestate use – waste management, soil enrichment, lower GHG emissions, and less odour. However, the subsidizing policy for the construction of biogas and biomethane plants has been done for electricity or biogas (biomethane) generation, not for digestate production.*

*Even though Europe needs significant quantities of digestate, there are many controversies regarding digestate final use and its compliance with some EU directives and national laws that regulate the use of fertilisers in agriculture. This work gives an overview of digestate's benefits and existing regulations applicable to digestate usage in the EU. It explores the ways of proper waste management of manure and bio-waste via the final by-product – digestate, which is used as a raw material for land enrichment and circular economy goals enhancement. Amid ever-growing soil pollution and erosion, and waste management problems, the role of digestate might be crucial in the coming decades. The research gives some directions for economically aware decision-makers on better exploitation of produced digested in the Western Balkans in the future.*

**Type of presentation: Oral**



**SPATIAL-PLANNING ASPECT OF WASTE MANAGEMENT IN  
VARAŽDIN COUNTY**

Melita Srpak<sup>1</sup>, Silvija Zeman<sup>2</sup>, Vladimir Križaić<sup>2</sup>, Darko Pavlović<sup>3</sup>

<sup>1</sup>Varaždin County, Department of Physical Planning, Varaždin, Croatia

<sup>2</sup>Polytechnic of Međimurje in Čakovec, Čakovec, Croatia

<sup>3</sup>Plinacro d.o.o., Zagreb, Croatia

melita.srpak@gmail.com

**Key words: landfills, municipal waste, spatial planning documentation, Varaždin County, waste management**

**ABSTRACT:**

*The processes of globalization and industrialization, which shaped world history, had a significant impact on the dynamics of waste generation, disposal, collection and processing. Through time development, these processes have resulted in a greater amount of different types of waste, exposing the environment to serious challenges. The negative impact of this rapid growth of waste is manifested through ubiquitous pollution, which has serious consequences for the ecological environment, both for the human community and for all living organisms. In the light of global and European initiatives for sustainable development, Varaždin County as a regional unit acts as a unique key actor in achieving the goals of the circular economy and sustainable waste management. The aim of this work is based on statistical analysis, which will investigate, analyze and present the complexity of the challenges facing Varaždin County in the context of waste management in the midst of globalization and industrialization. The result of the work is based on the obligations of the County in the implementation of legal regulations, and at the same time the creation and implementation of Waste Management Plans as key instruments for achieving a sustainable balance between economic activity, environmental protection and social needs. The work highlights the importance of raising awareness among the population as a key factor in achieving a reduction in waste generation, while the promotion of circular economy and the creation of green jobs will*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*be recognized as a key element of the waste management strategy and plan. The interdisciplinary research approach combines economic, ecological and social aspects in order to achieve long-term sustainability of waste management in Varaždin County from a spatial-planning aspect through efficient and sustainable waste management.*

**Type of presentation:** Oral



## PRODUCTION OF CEMENT CLINKER USING RECYCLED GLASS

Ervin Karić<sup>1</sup>, Zehrudin Osmanović<sup>1</sup>, Damir Mulamehmedović<sup>2</sup>, Elma Bajrić<sup>1</sup>, Berina Hadžalić<sup>1</sup>, Hanka Hadžić<sup>3</sup>

<sup>1</sup>University of Tuzla, Faculty of Technology, Tuzla, Bosnia and Herzegovina

<sup>2</sup>Cement Lukavac d.o.o., Lukavac, Bosnia and Herzegovina

<sup>3</sup>Plastoflex d.o.o. Gračanica, Gračanica, Bosnia and Herzegovina

ervin.karic@untz.ba

**Key words:** cement clinker, recycled glass, environment, energy, emission of CO<sub>2</sub>

### **ABSTRACT:**

*This paper presents a review of research into the production of cement clinker using recycled glass. Cement is one of the world's most important and widespread building materials, requiring large amounts of raw materials and energy. Every saving on raw materials and energy during cement production is significant for the environment and profitability. Glass is a mixture of silicates, alkaline, and alkaline earth oxides. It is an inert and highly durable material resistant to water. EU countries recycle about 70% of glass packaging annually, while in Bosnia and Herzegovina, only 12% is recycled. Nine percent of a household's daily waste is glass. In Bosnia and Herzegovina, in 2022, 3,383.56 tons of glass were collected through public collection. Given that the production of cement is accompanied by the emission of CO<sub>2</sub> into the environment, the use of glass in cement production significantly reduces CO<sub>2</sub> emissions. Utilizing glass in the cement industry would have a dual impact: reducing waste glass and lowering the emission of harmful gases into the environment. Further investigation is necessary to determine which type of glass and composition are most favorable for use in cement clinker production and whether the resulting cement composition is satisfactory.*

**Type of presentation:** Poster



**ANALYSIS OF SOIL COMPOSITION NEAR THE CITY WASTE  
LANDFILL**

Ajla Japić, Merima Toromanović

University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

ajla.japic@gmail.com

**Key words: soil pollution, heavy metals, waste, city landfill**

**ABSTRACT:**

*Municipal waste is waste generated in households, public institutions, public areas and production plants. In our country, waste is currently disposed of in landfills. In Bosnia and Herzegovina, an increasing problem for the environment and human health is represented by wild landfills located near populated areas, as well as the fact that very little waste is reused.*

*In this paper, the composition of the soil surrounding the city landfill was analyzed. There is a large list of pollutants that easily accumulate in the surface layers of the soil and degrade its quality.*

*The experimental part of the paper referred to the analysis of physical and chemical properties of soil from two samples. Parameters such as: organic and mineral part of the soil, moisture, soil pH, carbonates, total lime, humus, nitrates, nitrites, phosphorus and concentration of heavy metals were determined. The analysis of the soil composition determined the amount of humus of 2.29% in the 0-30 cm layer in sample number 1 and 2.45% in the 0-30 cm layer in sample number 2. In the sample number 1, the concentration of nitrite was 1.4 mg/100g, and in the sample number 2 1.2 mg/100g, while the concentration of nitrates in the sample number 1 was 43 mg/100g and 51.1 mg/100g in sample number 2. The concentration of all heavy metals (Co, Cd, Pb, Fe, Zn) in both soil samples was in accordance with the prescribed values, except for the cadmium. The concentration of cadmium in sample 1 was 47mg/kg and in sample 2 2.8 mg/kg. Prescribed MAC value for cadmium is 1.5 mg/kg.*

*Research has established that dumping waste at the city landfill changes the composition of the land in terms of certain parameters where the quality of*



Eighth International Scientific Conference  
"June 5th - World Environment Day"

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*the land is impaired, but many parameter values were still within the limits of the prescribed values.*

**Type of presentation:** Poster



**QUANTIFICATION OF THE ENVIRONMENTAL BENEFITS OF  
THE INTRODUCTION AND IMPLEMENTATION OF THE ISO  
14001 STANDARD IN THE MEAT INDUSTRY SHOWN BY  
MONITORING THE CONCENTRATIONS OF PHOSPHORUS AND  
SULFUR COMPOUNDS IN WASTEWATER**

Faris Muminović<sup>1</sup>, Halid Makić<sup>2</sup>, Jasmina Ibrahimpašić<sup>2</sup>, Husejin Keran<sup>3</sup>,  
Amela Semić<sup>4</sup>, Toni Babić<sup>5</sup>

<sup>1</sup>AC Food d.o.o. Velika Kladuša, Bosnia and Herzegovina

<sup>2</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

<sup>3</sup>University of Tuzla, Faculty of Technology, Tuzla, Bosnia and Herzegovina

<sup>4</sup>University of Sarajevo, Faculty of Agriculture and Food Sciences, Sarajevo, Bosnia and  
Herzegovina

<sup>5</sup>FINRA University, Tuzla, Bosnia and Herzegovina

fari.muminovic25@gmail.com

**Key words: ISO 14001, internal benefits, external benefits, equivalent number of inhabitants, daily wastewater load**

**ABSTRACT:**

*ISO 14001 is the most well-known standard of the ISO 14000 series and sets out the requirements for all organizations to implement an EMS (Environmental Management System). The implementation of ISO 14001 brings to companies external and internal benefits. This paper quantifies the benefits of the implementation based on the assessment of the ecological harm of environmental pollution indicators, before and after the introduction and implementation of ISO 14001 in the company MS Alem d.o.o. Bosanska Krupa through phosphate and sulfur loading. The concentrations of total phosphorus (mg/l) and sulfate (mg/l) were measured and statistical processing was performed. The t-test of paired samples compared the values of the harmful equivalent (ENI), and it was shown that there is a statistically significant difference before and after the introduction of ISO 14001, for total phosphorus, Sig . = 0.006, at the level of statistical significance  $p = 0.05$ . For sulfates, it was proven that there is no statistically significant difference, Sig. = 0.185, at the level of statistical significance  $p=0.05$  (measured by the daily load of wastewater). It has been proven that there is a statistically significant difference in the distribution of the daily load of total*

*phosphorus expressed through ENI (equivalent number of inhabitants), before and after the introduction of ISO 14001,  $p = \text{Sig.} = 0.006$ . The Mann-Whitney test confirmed that the average values of the median daily load with sulfate compounds before and after the application of ISO 14001 do not statistically significantly differ,  $\text{Sig.} = 0.240$ , at the level of statistical significance  $p = 0.05$ . The Mann-Whitney U test confirmed the acceptance of the null hypothesis that the distributions of the daily load of wastewater with sulfate compounds are the same before and after the introduction of ISO 14001,  $\text{Sig.} = 0.310$ .*

**Type of presentation:** Oral



**DANGERS FROM CONSTRUCTION A RADIOACTIVE WASTE  
STORAGE CENTRE AT THE ČERKEZOVAC SITE, TRGOVSKA  
GORA, THE REPUBLIC OF CROATIA**

Draženko Bjelić, Borislav Malinović, Tijana Đuričić

University of Banja Luka, Faculty of Technology, Banja Luka, Bosnia and Herzegovina

drazenko.bjelic@tf.unibl.org

**Key words: radioactive waste, storage centre, disposal site, Čerkezovac, Trgovska gora**

**ABSTRACT:**

*The planned construction of the Radioactive Waste Storage Centre (RWSC) at the Čerkezovac location, Trgovska gora in Croatia raises serious concerns due to its proximity to protected areas, populated places, and drinking water sources. This paper provides an overview of available relevant information regarding the planning of the RWSC construction, as well as potential risks and long-term consequences that such a facility could have on the environment and local community, including the risk to the water supply of the Novi Grad municipality. The RWSC at the Čerkezovac military storage would feature a central storage for the storage of radioactive waste (RW) and spent sources (SS) generated by the use of radioactive materials in the Republic of Croatia, a long-term storage for low and medium radioactive waste (LMRW) from the Krško Nuclear Plant generated during regular operation and its decommissioning, and a built disposal site for LMRW.*

*What adds further concern is that the construction of an LMRW disposal site within the Centre is also planned. The location of the disposal site would be within the Čerkezovac military storage or at another site within the preferred location on Trgovska gora.*

*Although the treatment of RW is necessary to reduce the risks that radioactive materials pose, the Čerkezovac location planned for the construction of the RWSC is not the most suitable due to its geographical and ecological characteristics, seismic instability, as well as proximity to*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*protected areas and key drinking water resources. Negative impacts that the location of the Centre could have include: ecological contamination, health risks to humans, security risks, social and economic impacts, issues with long-term monitoring, and ethical problems (burden to future generations without their consent). It can be concluded that the Čerkezovac location is not the most suitable for such a Centre. Therefore, the need for detailed consideration of alternative locations before making a final decision on the construction of the Centre is emphasized.*

**Type of presentation:** Oral



**ENERGY EFFICIENCY AND RENEWABLE  
ENERGY SOURCES**



**ASSESSMENT OF ARUNDO DONAX IN A CONTINUOUS BIOGAS  
PRODUCTION SYSTEM**

Vanja Jurišić<sup>1</sup>, Ana Matin<sup>1</sup>, Ivan Brandić<sup>1</sup>, Ivana Tomić<sup>1</sup>, Igor Stankić<sup>2</sup>,  
Karlo Špelić<sup>1</sup>

<sup>1</sup>University of Zagreb, Faculty of Agriculture, Zagreb, Croatia

<sup>2</sup>Energy institute Hrvoje Požar, Zagreb, Croatia

vjurisic@agr.hr

**Key words: Arundo donax, biogas production, sustainability**

**ABSTRACT:**

*The increase in the production and consumption of biofuels has, for a long time, been mainly encouraged by policies that initially promote the use of biofuels regardless of origin of the raw material. Current EU legislative is focused on the sustainability of the energy production. Although corn silage has historically served as a primary raw material for biogas production, there is an obvious shift towards more sustainable sources, such as energy crop Arundo donax. To determine its potential as a possible transforming factor the production of biogas in the EU, the potential of the crop as a substrate for AD was assessed in this study. Biogas/biomethane production of A. donax and a mixture of corn silage and A. donax in two ratios (1:2 and 2:1) through the process of anaerobic digestion, along with COD, DM, VS, pH value, and FOS/TAC were continuously monitored. During the process, the comparative analysis accentuates the viability of both, A. donax and corn silage, as well as their mixtures as potent feedstocks for biogas production. The biogas yields ranged from 356.81 to 548.81 NL/kg VS. It was observed that a 100 % A. donax substrate exhibited a superior biogas yield initially, however, an intriguing boost in methane proportion was noted with a mixture at a 1:2 ratio, underlining the essence of the synergistic interaction between the feedstocks in methane production. Notably, the levels of H<sub>2</sub>S were within permissible limits, eliminating the need for further desulphurization procedures, which is important. Further studies are necessary to identify the optimal mixture ratios of corn silage and A. donax*

Eighth International Scientific Conference  
"June 5th - World Environment Day"

---

*that maximize biogas and methane production and should also explore the feasibility of storing the crop, considering the continuous process of AD and the seasonality of feedstock, to ensure more consistent and efficient biogas production.*

**Type of presentation:** Oral





**CONSTRUCTED WETLAND AS A PRODUCT**

Sabina Bišćević

University of Bihać, Faculty of Engineering, Bihać, Bosnia and Herzegovina

sabina.bm@hotmail.com

**Key words: constructed wetland, product, wastewater treatment, life cycle**

**ABSTRACT:**

*Constructed wetlands are engineered man-made systems that aim to simulate the self-purification of wastewater observed in nature when polluted water is released into natural ecosystems. The constructed wetland as an innovative and competitive product meets today's requirements, especially in light of the problem of waste management, i.e. untreated wastewater that causes damage to the environment. A product is a material result of production, everything that we can offer someone to satisfy their need or desire, i.e. a product is the final result of a production activity that exists even after the production process has been completed. The basic goal of production systems is to produce an adequate product, as requested and on time, with the least costs and maximum quality. The product in question aims at systemic control and the greatest possible improvement of the wastewater treatment system and, at the same time, reducing the harmful impact on the environment. The product life cycle goes through five characteristic stages: product development, introduction, growth, maturity and decline. The aim of this paper is to prove that the constructed wetland as a product, that is, as an innovative product, remains in its mature stage for a very long time, and as proof of this is the fact that this phase of the life cycle has been occurring in nature since the dawn of time. From all of the above, one can expect that the application of constructed wetlands will grow even more, and especially their application will be primarily oriented towards smaller capacities (up to approximately 2000 PE). In such conditions, constructed wetlands feature simple operation, high purification effect and relatively low costs of construction, operation and maintenance.*

**Type of presentation:** Poster

**LEGAL AND ECONOMIC REGULATIONS**  
**IN ENVIRONMENTAL PROTECTION**



**CRIMINAL OFFENSES AGAINST THE ENVIRONMENT IN THE  
REPUBLIC OF SERBIA**

Ivana Šekler<sup>1</sup>, Mirjana Bartula<sup>1</sup>, Slobodan Stefanović<sup>1</sup>, Nikola Petrić<sup>2</sup>

<sup>1</sup>Faculty for Applied Ecology Futura, Belgrade, Serbia

<sup>2</sup>Higher Public Prosecutor's Office in Belgrade, Belgrade, Serbia

ivana.sekler@futura.edu.rs

**Key words: criminal acts, environment, material damage**

**ABSTRACT:**

*Our environment is our planet Earth. During the development of the human population, first, as much as was necessary for survival and life was taken from the environment, and then people, in their desire to make a profit, began to take much more, thus disrupting the natural balance. Ecocentric behavior has brought man into a world that recognizes criminal acts against the environment, which are regulated by criminal law.*

*Through a review and comparative analysis of statistically available data on environmental crimes in recent years, which define eighteen crimes according to the Criminal Code of the Republic of Serbia, the authors of the paper provide an overview and analysis of the most common crimes, the material damage caused by these crimes, and the damage to life the environment and the health of all people. By comparing with the data of the countries of the region, behavioral trends were observed.*

**Type of presentation: Oral**



**THE MECHANISM OF CROSS-BORDER SETTLEMENT OF  
CARBON EMISSIONS AND ITS IMPORTANCE IN THE  
EUROPEAN GREEN DEAL**

Ermin Bajramović, Emir Bajramović

University of Bihać, Faculty of Technical Engineering, Bihać, Bosnia and Herzegovina

ermin.bajramovic@unbi.ba

**Key words: environment, european green deal, regulation, carbon emissions, products**

**ABSTRACT:**

*The European Green Deal is the sustainable development strategy of the EU for the 21st century. The central problem addressed by this strategy is the environment and climate change - how to develop the EU economy without accelerating climate change. The goal of this strategy is for Europe to become the first neutral continent with zero net greenhouse gas emissions by 2050. The European Green Deal covers all economic sectors, especially transport, energy, agriculture, building maintenance and construction, and industries such as steel, cement, and textile production, and chemicals. Greenhouse gas emissions do not stop at the EU borders. Both other countries and the countries of the Western Balkans are important partners of the EU in the context of trade and geopolitical value. By signing the Sofia Declaration 2020, the countries of the Western Balkans committed themselves to the implementation of the Green Agenda for the Western Balkans as a "map" for a series of concrete actions and measures aimed at low-carbon development of the region and economic growth in accordance with the principles of sustainable development. The existing European Emissions Trading System (ETS) covers EU countries, while the Carbon Border Adjustment Mechanism (CBAM) will apply to products manufactured outside the EU. The implementation of CBAM, a new carbon regulation that helps combat climate change, addresses the issue of carbon emissions. This paper will outline the CBAM implementation procedures and their importance in the European Green Deal.*

**Type of presentation:** Oral



Eighth International Scientific Conference  
"June 5th - World Environment Day"

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**COUNCIL OF EUROPE AND ENVIRONMENTAL PROTECTION**

Nikola Findrik, Suan Islamović

University of Bihać, Faculty of Law, Bihać, Bosnia and Herzegovina

findrik\_nikola@yahoo.com

**Key words: Council of Europe, right to a healthy environment, normative framework, conventions, criminal liability**

**ABSTRACT:**

*Although the European Convention for the Protection of Human Rights and Fundamental Freedoms (ECHR) does not guarantee the right to environmental protection as an independent right, the practice of the European Court of Human Rights (ECtHR) found cases that were in the function of environmental protection rights. Thanks to the extensive interpretation of the ECHR's provisions, ECtHR considered the right to environmental protection indirectly: through the right to life, the right to respect for private and family life and other rights guaranteed by the ECtHR. In addition to the above in terms of re-actualizing the relevant judicial practice, this paper provides an overview of the documents of the Council of Europe on environmental protection, especially the Convention on Civil Liability for Damage resulting from Activities Dangerous to the Environment, the Convention on the Protection of the Environment through Criminal Law, the Convention on the Conservation of European Wildlife and Natural Habitats and Council of Europe Landscape Convention.*

*Bosnia and Herzegovina is a member of the Convention on the Conservation of European Wildlife and Natural Habitats (ETS No. 104) and the Council of Europe Landscape Convention (ETS No. 176). The Convention on the Protection of the Environment through Criminal Law (ETS No. 172) has not entered into force, as only Estonia has ratified it to date. The Convention on Civil Liability for Damage resulting from Activities Dangerous to the Environment (ETS No. 150) also did not enter into force, as it was not ratified by any member state of the Council of Europe.*

**Type of presentation: Oral**

**APPLICATION OF BENCHMARKING IN NATIONAL PARKS**

Ramiza Hamulić

The Tax Administration of the Federation of Bosnia and Herzegovina - Velika Kladuša  
office

hamulic.ramiza7@gmail.com

**Key words: benchmarking, national parks, quality, tourism**

**ABSTRACT:**

*The term benchmarking appeared in countries with developed economies at the end of the 80s of the last century. Benchmarking is still an underutilized means of learning from the best in tourism, and especially in the development of national parks as destination centers. Benchmarking as a means of increasing the quality of services provided in the tourism of national parks in Bosnia and Herzegovina is not sufficiently represented, given that the quality of services is a key condition for to stay in a competitive market. An important task of organizations operating in the area of national parks involves monitoring the trends encountered in the market. The usage of benchmarking in national parks led to significant improvements in results compared to the competition, through a creative shift with the aim of seeking new knowledge, which indicated the importance of the cause of the problem, the range of efficiency, and the use of protection and management measures in protected areas. As an example of a competitive comparison, the Una National Park, the Plitvice Lakes in Croatia and the Skadar Lake in Montenegro were taken, and the activities that had an impact on increasing the tourist offer along with measures to preserve the environment and biodiversity were pointed out.*

**Type of presentation: Oral**



**CONSEQUENCES OF HUMAN ACTIVITIES ARE ENDANGERING  
AND DESTROYING THE ENVIRONMENT**

Esad Bajramović<sup>1</sup>, Senada Pobrić<sup>2</sup>, Fadil Islamović<sup>1</sup>, Atif Hodžić<sup>1</sup>

<sup>1</sup>University of Bihać, Technical faculty, Bihać, Bosnia and Herzegovina

<sup>2</sup>University Džemal Bijedić, Mostar, Bosnia and Herzegovina

bajramovic\_e@yahoo.com

**Key words: environmental protection, ISO standard, sustainable development, awareness, extinction of human beings**

**ABSTRACT:**

*Man and nature have developed and progressed in harmony for centuries. Nature helped man to survive, offered him its wealth and was selfless towards him. However, owing to the unlimited development of science and technology and the desire for prosperity and wealth, man has forgotten his debt to nature and is taking at a speed that nature cannot endure. The results of such disparity are floods and other natural disasters. We must take this as a warning and return to the embrace of nature. Many countries, including Bosnia and Herzegovina, have enacted legal regulations on environmental preservation and protection, but the adopted laws are not respected in many organizations. It is necessary to have an education plan in all organizations and a continuous appeal to the awareness of producers and consumers regarding environmental protection.*

*Man must be responsible and leave to future generations, clean rivers and seas, natural resources, green forests, and the treasure of the plant and animal world, which provide us purity and joy throughout life. On the other hand, as a result of man's greed, we face fires, floods, polluted air, endangered species, war conflicts, hunger, poverty, and waste, which cause a series of incidents that shake the foundations of the earth. The Law on Environmental Protection establishes preservation, protection, restoration and improvement of the ecological quality and capacity of the environment, as well as the quality of life of people. Every person has the right to a*

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*healthy and environmentally friendly environment, as a basic constitutional right.*

**Type of presentation:** Oral





**THE IMPACT OF TRAFFIC NOISE IN THE UNA-SANA CANTON**

Medina Mešić

University of Bihać, Technical Faculty, Bihać, Bosnia and Herzegovina

medina.mesic@unbi.ba

**Key words: noise, protection, laws, traffic, Una-Sana Canton**

**ABSTRACT:**

*Noise is defined as any unwanted sound, which at higher volume can have harmful and even pathological effects. In the urban environment, where most of the human population is located, whose health may be at risk, the main source of noise is traffic. Although people differ in their sensitivity to noise, prolonged exposure is sure to have consequences for everyone. Any noise above 85 decibels is considered to damage hearing. In addition to hearing damage, prolonged exposure can also lead to health problems such as high blood pressure, nervous breakdown, accelerated heart rate and even heart attack. The Law of Bosnia and Herzegovina prescribes noise protection measures that also apply to the Una-Sana Canton. The aim of this work is to find out whether and to what extent these protection measures are respected and implemented in the Una-Sana Canton, because traffic is an indispensable sphere of life, and then to propose measures to reduce it.*

**Type of presentation: Oral**



**UNDERSTANDING SOUVENIRS IN TOURIST CONSUMPTION OF  
EU TOURISTS IN BOSNIA AND HERZEGOVINA**

Berina Ćatić<sup>1</sup>, Denis Berberović<sup>1</sup>, Ikbala Makić<sup>2</sup>

<sup>1</sup>University of Sarajevo, School of Economics and Business in Sarajevo, Sarajevo, Bosnia  
and Herzegovina

<sup>2</sup>Ministry of Economy USC, Bihać, Bosnia and Herzegovina

berina.c.catic@gmail.com

**Key words:** role of souvenirs, factors influencing tourists to purchase souvenirs, souvenir shopping, tourist experience, Bosnia and Herzegovina souvenirs'

**ABSTRACT:**

*Souvenirs are an integral and intangible part of the tourist experience, acting as a guiding element for tourists. Purchasing souvenirs is considered the most universal of all tourist activities, and souvenir sales are often seen as an effective way for communities to leverage the economic advantages of tourism. Besides economic factors, the role of souvenirs in tourism is considered a significant component of the tourist experience.*

*The importance of souvenirs can be viewed as an efficient promotional tool for tourist attractions. Therefore, it is essential to explore the role of souvenirs in consumer behavior, triggers, motivations, and the meaning of souvenirs for consumers to contribute to better tourism offerings. This study researched a focus group of EU tourists who visited Bosnia and Herzegovina during the period of August 2022. The research focused on the role of souvenirs in consumer behavior, exploring the role of souvenirs in tourism, souvenirs as memory triggers, souvenirs as holiday experiences, souvenirs as gifts, and collectible items. Additionally, factors influencing souvenir purchases by tourists such as motives, motivation, perception, perceived quality, and value were investigated. Thus, the impact of emotional factors and souvenirs in Bosnia and Herzegovina was explored.*

*The results of the research on the target group indicate that EU tourists recognized the souvenirs as something valuable, something that should be*

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---

*unique, handmade, or art craft, i.e., the object that has value. The main function of souvenirs is to be reminded of the visited place, as well as a gift to the close people. Understanding favorable souvenirs and comprehending the factors influencing souvenir purchases are crucial in tourism research. This research will contribute to souvenir traders and tourism as a whole to tailor their offerings to tourists, thereby contributing to the strengthening of tourism in Bosnia and Herzegovina.*

**Type of presentation:** Oral



**COMPARATIVE ANALYSIS OF ENVIRONMENTAL  
LEGISLATION IN BOSNIA AND HERZEGOVINA**

Anita Ramulić-Mujkić<sup>1</sup>, Fatima Muhamedagić<sup>2</sup>

<sup>1</sup>University of Bihać, Islamic Pedagogy faculty, Bihać, Bosnia and Herzegovina

<sup>2</sup>University of Bihać, Biotechnical faculty, Bihać, Bosnia and Herzegovina

anita\_ramulic@yahoo.com

**Key words: environment, legislation, Bosnia and Herzegovina, comparative analysis, legal terminology**

**ABSTRACT:**

*Bosnia and Herzegovina (B&H) is a country in transition with a complex legal system facing numerous challenges in environmental protection. This paper conducts a comparative analysis of environmental legislation in B&H, utilizing legal terminology. The aim of the paper is to identify key elements of the legislative framework and analyze its strengths and weaknesses in the context of environmental protection.*

*The research is based on the analysis of relevant laws, regulations, and other legal documents related to environmental protection in B&H. A comparative method is employed, and the legislative framework in B&H is compared to that of other countries in the region and the European Union.*

*The legislative framework for environmental protection in B&H consists of the Constitution, laws, regulations, and other legal documents at the entity and state levels. There are a number of institutions responsible for implementing environmental protection laws, including the Ministry of Environment and Spatial Planning at the entity and state levels, and the B&H Environmental Protection Agency.*

*The legislative framework for environmental protection in B&H has a number of positive elements, but it also faces several challenges. It is important to strengthen the implementation and enforcement of laws and to ensure resources for environmental protection enforcement. It is also necessary to improve coordination between different levels of government and raise public awareness of environmental protection issues.*

**Type of presentation:** Poster

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