DISC2025

5th International Student Conference

ABSTRACT BOOK

DEPARTMENT OF ENVIRONMENTAL ENGINEERING AND OCCUPATIONAL SAFETY AND HEALTH

5th DIFENEW INTERNATIONAL STUDENT CONFERENCE

DISC2025

Faculty of Technical Sciences
University of Novi Sad

Hybrid event
11th & 12th December, 2025
Novi Sad, Serbia

Organizers:

Department of Environmental Engineering and Occupational Safety and Health
Faculty of Technical Sciences, University of Novi Sad, Serbia

The 5th International Student Conference – DISC2025 is supported by the Department of Environmental Engineering and Occupational Safety and Health and Erasmus plus CBHE project FOCUS (grant agreement number 101179757).

CIP - Каталогизација у публикацији
Библиотеке Матице српске, Нови Сад

502(048.3)
331.45/.46(048.3)

INTERNATIONAL Student Conference – DISC2025 (5 ; 2025 ; Novi Sad)
Abstract book [Elektronski izvor] / 5th International Student Conference – DISC2025, hybrid event, 11-12th December 2025, Novi Sad ; [editors Maja Petrović ... et al.]. - Novi Sad : Faculty of Technical Sciences, 2025

Način pristupa (URL):
https://www.izzs.uns.ac.rs/uploads/files/shares/Abstract_Book_DISC2025.pdf. - Opis zasnovan na stanju na dan 15.1.2026. - Nasl. s naslovnog ekrana.

ISBN 978-86-6022-762-3

a) Заштита животне средине -- Апстракти b) Заштита на раду -- Апстракти

COBISS.SR-ID 184507657

Abstract Book

5th DIFENEW INTERNATIONAL STUDENT CONFERENCE DISC2025

Publisher

Faculty of Technical Sciences

Trg Dositeja Obradovića 6, Novi Sad, Republic of Serbia

Editors

Maja Petrović

Mladenka Novaković Bežanović

Ivana Mihajlović

Danijela Ćirić Lalić

Dunja Istrat

ISBN

978-86-6022-762-3

Year

2025

PREFACE

This Abstract Book presents the collected contributions of the International Student Conference DISC2025, a hybrid academic event held on 11–12 December 2025 at the Science Technology Park Novi Sad. DISC2025 continues the conference's mission of fostering interdisciplinary dialogue and encouraging the active involvement of students, early-career researchers, and professionals in addressing contemporary sustainability challenges.

Under the central theme *Sustainability in Action*, this year's conference emphasizes the transition from conceptual frameworks to practical implementation. The abstracts included in this volume reflect a broad spectrum of research and project-based contributions that connect academic knowledge with real-world applications across environmental protection, occupational safety and health, sustainable project management, strategic human resource and business management, civil engineering and infrastructure, and Education 3.0, with a particular focus on digital and inclusive learning.

DISC2025 provides a collaborative platform where participants from academia, industry, and the public sector engage through paper presentations, interactive panels, and applied project exhibitions. Particular attention is devoted to emerging topics such as the Green Agenda, ESG principles, circular economy models, and digital innovation in engineering and management practices, underscoring their importance for sustainable development at local, regional, and global levels. In addition to the main conference sessions, DISC2025 features a dedicated *Project Promotion* session within Jean Monnet Square, highlighting project-based initiatives that strengthen the link between academic research, European policy frameworks, and practical implementation.

We extend our sincere appreciation to all authors whose work contributes to the quality and diversity of this publication, as well as to the members of the Scientific, Program, and Organizing Committees for their dedication and professionalism. Their collective efforts have been instrumental in shaping a conference that promotes knowledge exchange, critical thinking, and interdisciplinary cooperation.

It is our hope that the abstracts presented in this book will serve not only as a record of DISC2025, but also as a source of inspiration for further research, collaboration, and innovation in the development of a more sustainable future. Looking ahead, the DISC conference series will continue with DISC2026, further strengthening its role as an international platform for student engagement, interdisciplinary research, and applied sustainability initiatives.

With kind regards,

Dr. Maja Petrović

President of the Organizing Committee and Editor

DEPARTMENT OF ENVIRONMENTAL ENGINEERING AND OCCUPATIONAL SAFETY AND HEALTH

Scientific and Program Committee:

Dr Dragana Tomašević Pilipović, President, University of Novi Sad, RS

Dr Danijela Ćirić Lalić, Vice-president, University of Novi Sad, RS

Dr. Ivan Špánik, Slovak University of Technology in Bratislava, Slovakia
Dr. Killi Uday Kumar, University of South Bohemia in České Budějovice, Czech Republic
Dr. Juraj Ševčík, Palacký University Olomouc, Czech Republic
Dr. Jan Vávra, University of Pardubice, Czech Republic
Dr. João Paulo Teixeira, University of Porto, Portugal
Dr. António Canatário Duarte, Polytechnic Institute of Castelo Branco, Portugal
Dr. Sofia A. Costa Lima, University of Porto, Portugal
Dr. Stevo Lavrnić, University of Bologna, Italy
Dr. Jakub Drewnowski, Gdańsk University of Technology, Poland
Dr. Zakhar Maletskyi, Norwegian University of Life Sciences, Norway
Dr. Agnieszka Cuprys, Norwegian University of Life Sciences, Norway
Dr. Mira Čelić, Catalan Institute for Water Research, Spain
Dr. Omar de la Cruz Vicente, University of Alcalá, Spain
Dr. Arijana Filipić, National Institute of Biology, Slovenia
Dr. Viktoria Blanka-Vegi, University of Szeged, Hungary
Dr. Izabella Babcsányi, University of Szeged, Hungary
Dr. Patrick Ssebugere, Makerere University, Uganda
Dr. Christine Kyarimpa, Kyambogo University, Uganda
Dr. Solomon Omwoma Lugas, Jaramogi Oginga Odinga University of Science and Technology, Kenya
Dr. Elizabeth Ndunda, Machakos University, Kenya
Dr. Eliezer Brown Mwakalapa, Mbeya University of Science and Technology, Tanzania
Dr. Fikira Kimbokota, Mkwawa University College of Education, Tanzania
Dr. Ali Hgeig, Nalut University, Libya
Dr. Bojan Jovanovski, University of Applied Sciences, Austria
Dr. Elenica Pjero, University "Ismail Qemali", Albania
Dr. Trajče Velkovski, Ss. Cyril and Methodius University in Skopje, North Macedonia
Dr. Jasmina Chaloska, Ss. Cyril and Methodius University in Skopje, North Macedonia
Dr. Radmil Polenakovikj, Ss. Cyril and Methodius University in Skopje, North Macedonia
Dr. Jasmina Chaloska, Ss. Cyril and Methodius University in Skopje, North Macedonia
Dr. Radmil Polenakovikj, Ss. Cyril and Methodius University in Skopje, North Macedonia
Dr. Aleksandra Anić Vučinić, University of Zagreb, Croatia
Dr. Monika Šabić Runjavec, University of Zagreb, Croatia
Dr. Emina Hadžić, University of Sarajevo, Bosnia and Herzegovina
Dr. Merima Šahinagić-Isović, Dzemal Bijedic, University of Mostar, Bosnia and Herzegovina
Dr. Nedim Čelebić, Sarajevo School of Science and Technology, Bosnia and Herzegovina
Dr. Biljana Šćepanović, University of Montenegro, Montenegro
Dr. Aleksandra Petrović, University of Kragujevac, Serbia
Dr. Aleksandra Tubić, University of Novi Sad, Serbia
Dr. Đurđa Kerkez, University of Novi Sad, Serbia
Dr. Bogdana Vujić, University of Novi Sad, Serbia
Dr. Maja Milanović, University of Novi Sad, Serbia
Dr. Igor Peško, University of Novi Sad, Serbia
Dr. Miloš Šešlija, University of Novi Sad, Serbia
Dr. Minja Bolesnikov, University of Novi Sad, Serbia
Dr. Jelena Ćulibrk, University of Novi Sad, Serbia
Dr. Slavko Rakić, University of Novi Sad, Serbia, Tallinn University of Technology, Estonia
Dr. Thirugnanasambandham Karchiyappan, Tamil Nadu Agricultural University, India
Dr. Gangai Selvi Ramalingam, Tamil Nadu Agricultural University, India
Dr. Ilakiya Tamilselvan, SRM College of Agricultural Sciences, India
Dr. Darinka Korovljev, University of Novi Sad, Serbia
Dr. Ivana Mihajlović, University of Novi Sad, Serbia
Dr. Srđan Kovačević, University of Novi Sad, Serbia

Organizing Committee:

Dr. Maja Petrović, President, University of Novi Sad, Serbia

Dr. Mladenka Novaković Bežanović, Vice-president, University of Novi Sad, Serbia

Dr. Maja Sremački, InoSens d.o.o., Novi Sad, Serbia
Dr. Nevena Živančev, InoSens d.o.o., Novi Sad, Serbia
Dr. Bojana Zoraja, University of Novi Sad, Serbia
Dr. Goran Bošković, University of Kragujevac, Serbia
MSc. Dunja Istrat, University of Novi Sad, Serbia
MSc. Jasmina Naerac, University of Novi Sad, Serbia
MSc. Tijana Adamov, University of Novi Sad, Serbia
MSc. Milena Savković, University of Novi Sad, Serbia
MSc. Bojana Savić, University of Novi Sad, Serbia
MSc. Milena Senjak Pejić, University of Novi Sad, Serbia

ABSTRACTS

TABLE OF CONTENT

INVITED LECTURE

DISC2025 – 5th International Student Conference
11th – 12th December 2025

INVITED LECTURE

ECO-FRIENDLY MATERIALS FOR SUSTAINABLE WATER TREATMENT: UTILIZATION OF LOCAL FOOD PROCESSING BY-PRODUCTS AND NATURAL ZEOLITES

*Nuić I.**

Faculty of Chemistry and Technology, Department of Environmental Engineering, University of Split, Ruđera Boškovića 35, 21000 Split, Croatia (e-mail: ivona@ktf-split.hr)

Abstract: Water systems around the world are increasingly threatened by rising pollution and declining water quality. The *Living Planet Report 2024* documents a continued decline in global biodiversity, with freshwater species populations reduced by 85%, highlighting the urgent need for sustainable water resource management to protect these vital ecosystems. In this context, efficient and affordable wastewater treatment methods are essential to preserving the ecological integrity of natural waters. This lecture addresses the need for effective, cost-efficient, and environmentally sustainable treatment technologies based on natural materials that do not introduce secondary pollution. The focus will be on research exploring the use of natural zeolites and their modified forms, as well as innovative applications of food-processing by-products, for the removal of heavy metals from wastewater. Recent studies further demonstrate the potential of these materials for eliminating emerging pollutants such as pesticides, with particular emphasis on the fungicide carbendazim. By integrating sustainable, locally available materials into water treatment processes, this approach aims not only to enhance the efficiency and environmental performance of treatment systems but also to valorize waste by-products for which appropriate disposal strategies are often lacking, an issue expected to intensify with the increasing generation of these waste streams.

Keywords: *Sustainable wastewater treatment; Natural zeolites; Food processing by-products; Heavy metals; Fungicide carbendazim.*

Acknowledgement

This research was funded by the European Union through the "NextGenerationEU" (project ANTARES, IP-UNIST-28). Thanks to the RETSCH GmbH for the generous donation of a new MM 200 to enable science.

ENVIRONMENTAL PROTECTION AND SUSTAINABILITY

DISC2025 – 5th International Student Conference
11th – 12th December 2025

PREVALENCE OF GASTROINTESTINAL HELMINTHS IN FARMED AND WILD TILAPIA IN MBEYA REGION AND LAKE RUKWA, TANZANIA

Mbembela A.A.[1,2], Brown Mwakalapa E.[2], Wanjiru Mwihia E.[3], Chatanga E. [4]*

[1]Department of Aquaculture and Fisheries Sciences, Lilongwe university of Agriculture and Natural Resources, P.O. Box 219, Lilongwe Malawi, (*e-mail: adili.mbembela@must.ac.tz)

[2]Department of Natural Sciences, Mbeya University of Science and Technology, P.O. Box 131, Mbeya Tanzania

[3]Department of Veterinary Pathology, Microbiology and Parasitology, Egerton university, P.O. Box 536 - 20115, Egerton-Njoro Kenya

[4]Department of Veterinary Pathobiology, Lilongwe university of Agriculture and Natural Resources, P.O. Box 219, Lilongwe Malawi

Abstract: Aquaculture represents one of the fastest-growing food production sectors globally, including Tanzania. However, the intensification of tilapia production faces significant challenges from parasitic diseases like gastrointestinal helminths. A cross-sectional study was conducted in January 2025 where 314 farmed and wild tilapia were sampled from Mbeya region and Lake Rukwa to determine the prevalence of gastrointestinal helminths. Fish were carefully dissected, followed by isolation of gastrointestinal tracts for helminths examination. Isolated adult and/or larva of worms were stained with lactophenol blue for gross morphological examination and identification while Qualitative and quantitative analysis of helminth eggs was conducted using fecal floatation's technique and MacMaster method. The study revealed an overall prevalence of 20.1% of gastrointestinal helminths (adult and eggs). Helminth prevalence in farmed tilapia (22.43%) and wild tilapia (15%) was not significantly different ($p = 0.171$). Morphological analysis identified nematode larva (*Contracaecum* spp. 3.5%) and helminths eggs (nematode *Capillaria* spp. 11.5% and cestode *Diphyllobothrium* spp. 4.5%). Mixed infections with both eggs of *Capillaria* spp. and *Diphyllobothrium* spp. occurred sporadically constituting 0.6% across all the sampled fish. Among infected fish, egg per gram (EPG) counts ranged from 100 to 15,600 eggs per gram fecal material with a mean of 2,384 ±3,201 and median of 1,200. No significant differences ($p = 0.492$) were detected in helminth prevalence between male tilapia (20.6%) and female tilapia (17.8%). Among the fish farms, prevalence ranged from 0 to 93.3%. The 20.06% overall prevalence embodies the collective struggles of hundreds of fish farmers seeking sustainable livelihoods through tilapia production that demand attention from researchers, policymakers, and aquaculture practitioners as well as demanding strategic reorientation from technology-focused to management-focused helminths control approaches.

Keywords: *Gastrointestinal helminths; Contracaecum spp.; Diphyllobothrium spp., Capillaria spp.; Aquaculture.*

Acknowledgement

The authors thank the Norwegian Agency for Development Cooperation (NORAD) through the Enhanced Capacity for Aquatic Resources in East and South Africa (ECARESA) project (QZA-21/0182) under NORHED II framework for funding this study.

ADVANCING SUSTAINABLE DEVELOPMENT THROUGH THE USE OF TREATED WASTEWATER IN NORMAL-STRENGTH CONCRETE PRODUCTION

Hgeig A.[1], Albarshny M. [1], Maren A. [1]*

[1] Nalut University, College of Engineering, Department of Civil Engineering, Jadu1, 8102, Libya, (*e-mail: ali.hgeig@nu.edu.ly)

Abstract: Treated sewage water was used in the preparation of concrete mixes. Specifically, the treated water obtained directly from the sewage treatment plant was used for concrete mix A, while concrete mixes B, C, and D utilized treated sewage water that had been stored for one, two, and six weeks, respectively. Physicochemical tests were conducted on the mixing water, where total dissolved solids ranged 1910 mg/L, total suspended solids averaged 26 mg/L, and pH values 7.4. For all concrete samples (A, B, C, D, and E), whether the reference sample A made with potable water according to specifications or the samples B, C, D, and E prepared with treated wastewater, the final setting time was longer than the initial setting time. In addition, increasing the stored duration of the water led to a decrease in both the initial and final setting times. The viscosity of purified water is lower than that of treated wastewater, whether freshly treated or stored for three varying periods. The slump test of the concrete mixes indicated that the lowest value was 80 mm for mix B, while the highest value was 120 mm for mix D. The compressive strength of the concrete showed a lowest value of 15.45 MPa for sample A after three days of immersion in pure water, while the highest value was 34.76 MPa for sample E after six weeks of immersion in pure water. The tensile strength of the five concrete samples ranged from 1.64 to 2.69 MPa.

Keywords: *Sewage water; Concrete mixes; Treated wastewater; Slump test.*

Acknowledgement

The authors would like to extend their sincere appreciation to the Ministry of Higher Education in Libya for its continued support and encouragement.

OPTIMIZATION OF MATERIAL FLOW ANALYSIS USING AI TOOLS

Kokanović A.[1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Health and Safety, Environmental Engineering, Trg Dositeja Obradovića 6, 21102 Novi Sad, Serbia, (*e-mail: akokanovic@outlook.com)

Abstract: Material Flow Analysis (MFA) is a fundamental methodology for understanding the circulation of materials within waste management systems, yet its practical application is often limited by incomplete, inconsistent, and temporally misaligned data. The integration of artificial intelligence enables the overcoming of these limitations by automating data preparation, identifying patterns, and predicting future material flows. This thesis examines the application of AI tools for enhancing the MFA methodology, with a focus on data preprocessing, predictive modeling, and decision-support in waste management systems. Special emphasis is placed on the use of the KNIME analytics platform, where a linear regression model was developed to forecast trends in waste quantities destined for recycling. The results demonstrate that AI significantly improves the accuracy and reliability of MFA models, enabling a shift from static assessments to dynamic, data-driven systems. Intelligent data processing reduces errors typically associated with manual handling, while machine learning enables the identification of trends and future changes in waste treatment processes. The integration of AI and MFA also opens possibilities for automated reporting, optimization of infrastructural capacities, and strategic planning aligned with circular economy principles. The findings confirm that artificial intelligence represents a key mechanism for modernizing MFA and contributes to more efficient, precise, and sustainable management of material flows.

Keywords: *Material flow analysis; Artificial intelligence; Machine learning; Data; KNIME.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

SUSTAINABLE ECOSYSTEM RESTORATION USING DISCHARGED THERMAL WATERS

Mihajlović I.[1], Tóthné Gróf Á.[2], Tóth A.[2], Szűcs A.[2], Milovanović D.[1], Kovačević S.[1]*

[1] University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia

[2] Local Government of Mórahalom, Szentháromság tér 1, 6782, Mórahalom, Hungary, (*e-mail: tothattila@morahalom.hu)

Abstract: Soda lakes and pans of the Homokhátság region represent rare and highly vulnerable alkaline ecosystems that have undergone significant degradation due to drainage, pollution, and climate changes. The SPArrow project explores sustainable, nature-based solutions for their revitalization through the safe and controlled use of discharged and filtered thermal waters. Knowledge exchange between Serbian and Hungarian experts was carried out through several activities, including a review of relevant legislation on thermal water discharge, the development of recommendations for its sustainable use, and technical planning for sustainable revitalization of soda lake areas. Sampling campaigns in Serbia and Hungary were conducted to analyze thermal water, soda lake water, and soil composition and to evaluate temperature, salinity, and mineral content. Investigations of saline lakes unaffected by direct human water input, including the Nagyszéksós Lake, indicate that the introduction of thermal water with properties below specific thresholds does not endanger the persistence of saline lakes in the Homokhátság region, as the composition of thermal water largely coincides with that of the lakes. We propose the following limits to be applied: total dissolved salts ≥ 5,000 mg/l, NH4 ≤ 18 mg/l, sodium ≤ 25,000 mg/l, chloride ≤ 18,000 mg/l, and conductivity ≤ 70,000 µS/cm.These assessments identified conditions under which thermal water can support the ecological recovery of soda pans without compromising their natural alkaline characteristics. A cross-border legal review of Hungarian, Serbian, and EU regulations revealed gaps and proposed harmonized guidelines for safe environmental discharge. The main output, a Pilot Plan for the Bite-szék soda pan, presents an integrated, climate-resilient water management system that enhances biodiversity and improves water retention. The project contributes directly to the implementation of the Birds and Habitats Directives and offers transferable solutions for similar degraded ecosystems.

Keywords: *Soda pans; Revitalization; Water management; Biodiversity.*

Acknowledgement

This paper has been produced with the financial assistance of the European Union through the Interreg VI-A IPA Hungary-Serbia program. The content of the presentation is the sole responsibility of FTS and Local Government of Mórahalom and can under no circumstances be regarded as reflecting the position of the European Union and/or the Managing Authority of the Program.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

BIOMETHANE FOR DECARBONIZATION OF THE TRANSPORT SECTOR IN SERBIA

Nesterović A.[1], Đatkov Đ.[1], Višković M.[1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovica 6, 21000 Novi Sad, Serbia (*e-mail: aleksandarnesterovic@uns.ac.rs)

Abstract: The energy transition and the decarbonization of the transport sector represent one of the key challenges for Serbia in the coming decades, given the high dependence on fossil fuels and the obligations arising from the Energy Community and European Union regulations. Biomethane, which can be produced from various types of biomasses and waste, has been identified as one of the promising alternative fuels. This study analyzes the biomethane production potential in Serbia under conservative and optimistic scenarios for the periods up to 2030 and 2050 and compares the results with the projected energy demand of the transport sector as defined in the Energy Development Strategy of the Republic of Serbia. The results indicate that in the conservative scenario, biomethane could cover around 16–19% of the sector's energy needs in 2030 and up to 26% in 2050, while in the optimistic scenario this share could reach 30–35% in 2030 and nearly fully meet the energy demand by 2050. The effects on reducing greenhouse gas emissions range from 17–33% in 2030 to 37–97% in 2050 in the transport sector, with the optimistic scenario achieving the European Union's target of a 90% reduction in transport sector emissions by 2050. On the other hand, replacing only natural gas and biofuels with biomethane would have a limited impact related to emission savings (2–4%). The results confirm that biomethane could play a strategic role in the decarbonization of the transport sector in Serbia, provided that appropriate policies, infrastructure, and regulatory frameworks are developed, but should be still adapted.

Keywords: *Biomethane; Decarbonization; Transport sector; Serbia.*

Acknowledgement

This research was financed by the project of the Department of Environmental Engineering at the Faculty of Technical Sciences Novi Sad – Research, development and implementation of innovative engineering approaches to improve the environment and occupational safety.

DOES THE PARTICLE SIZE OF NATURAL AND IRON SULFIDE-DOPPED ZEOLITE SIGNIFICANTLY AFFECT THE AMOUNT OF SORBED MERCURY?

Jurić A.[1,2], Ugrina M.[2], Nuić I.[2]*

[1]Regional Veterinary Institute Split, Croatian Veterinary Institute, Poljička cesta 33, 21000 Split, Croatia (*e-mail: aantonija.juric@gmail.com)

[2]University of Split, Faculty of Chemistry and Technology, Department of Environmental Engineering, Ruđera Boškovića 35, 21000 Split, Croatia

Abstract: Among natural sorbent materials, zeolites are widely recognized as highly effective sorbents for heavy metal removal due to their distinctive physicochemical characteristics that confer remarkable sorption potential. To further enhance their sorption performance, various targeted modifications are employed to alter the surface charge and introduce additional active sorption sites. To effectively address mercury removal from contaminated sites, including the Idrija mine area in Slovenia, this study examines the sulfur-based modification of natural zeolite (NZ) from the Zlatokop deposit (Serbia) with two particle size fraction (< 43 μm and 0.6-0.8 mm). This approach is based on the strong affinity of mercury for sulfur, which is consistent with the hard and soft acid and base (HSAB) theory. To ensure effective stabilization of sulfide species on the surface of NZ, the sample was initially treated with $Fe(NO_3)_3$ for 2 h at 100 °C and subsequently with Na_2S for 4 h at 150 °C. Both, the fabricated iron sulfide-doped zeolites (FeSZs) and the untreated NZs were evaluated for Hg(II) sorption under predefined optimal conditions (pH ≈ 2, solid-to-liquid ratio of 10 g/L, and contact time of 24 h) across a wide concentration range (0.461–14.099 mmol/L). The NZ showed maximum Hg(II) sorption capacities of 0.333 mmol/g (< 43 μm) and 0.282 mmol/g (0.6–0.8 mm), whereas the FeSZ reached 1.171 mmol/g and 0.996 mmol/g, for the smaller and larger particle sizes, respectively. The results indicate a 3.5-fold increase in sorption capacity on modified zeolites, which justifies the modification procedure. Furthermore, since the increase in sorption capacity for zeolites with smaller particle size is insignificant (only 1.2-fold), the results suggest that ion exchange is likely one of the dominant mechanisms for Hg(II) sorption on zeolites. In addition, the use of larger particle size zeolites facilitates the sorption process and reduces the overall process costs.

Keywords: *Natural zeolite; Iron sulfide-dopped zeolite; Particle size; Chemical modification; Mercury.*

Acknowledgement

This work was supported by the bilateral Croatian-Slovenian project “Application of modified natural sulfur-based zeolites for remediation of mercury-contaminated soil from the Idrija mine area in Slovenia” (2025–2026), founded by the Croatian Ministry of Science, Education and Youth of the Republic of Croatia and Slovenian Research and Innovation Agency (ARIS) as well as by the project ANTARES (IP-UNIST-28) granted by the European Union − “NextGenerationEU”.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ADOPTION AND SUSTAINABLE UTILIZATION OF RENEWABLE ENERGY TECHNOLOGIES AMONG RURAL HOUSEHOLDS IN WESTERN ETHIOPIA

Atomissa K.G.[1,2], Tucho G.T.[1], Olani D.D.[1]*

[1]Jimma University, Faculty of Public Health Sciences, Department of Environmental Health Science and Technology, P.O. Box 378, Jimma, Ethiopia (*e-mail: gutamatomsa@gmail.com)

[2]Wollega University, College of Natural and Computational Sciences, Department of Environmental Science, P.O. Box 395, Nekemte, Ethiopia

Abstract: Renewable energy technologies are systems that harness naturally replenished sources such as sunlight, wind, water and biomass and offer sustainable alternatives to fossil fuels by limiting greenhouse-gas emissions and enhancing energy security. Increasing recognition of their environmental and economic benefits is rapidly accelerating global adoption of renewable energy technologies. This study assesses the extent of adoption and sustainable use of renewable energy technologies. among rural households in Eastern Wollega, Western Ethiopia. The study also investigates the socioeconomic, institutional and technical factors influencing both initial uptake and sustained utilization. Using a cross-sectional mixed-methods design, data were collected from 1,175 selected households and key informants. quantitative analysis the collected data shows that higher household income, household head education level, access to credits and awareness level significantly increases the odds of adoption ($p < 0.05$). Qualitative findings reveal maintenance challenges, spare-part supply issues and limited local technical support as major constraints for sustainable utilization of renewable energy technologies. The findings suggest that policy interventions should combine with financial incentives, capacity-building and community-based support mechanisms to promote sustainable rural energy transitions.

Keywords: *Renewable energy technologies; Adoption; Sustainable utilization; Rural households.*

Acknowledgement

The authors would like to thank Jimma University and Wollega University for giving the opportunity to conduct this research work.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

SMART IOT CLEAN ENERGY SYSTEM FOR ENVIRONMENTAL PROTECTION

Arunraj R.S.[1], Harikaran E.[2],*

[1]Agriculture College and Research Institute, Tamil Nadu Agricultural University (TNAU), Coimbatore, Tamil Nadu, India (*e-mail: arunraj8249@gmail.com)

[2]Affiliation Agriculture College and Research Institute, Tamil Nadu Agricultural University (TNAU), Coimbatore, Tamil Nadu, India

Abstract: This study explores the integration of Internet of Things (IoT)-based smart sensing systems to enhance the efficiency, reliability, and sustainability of green energy management in agricultural and environmental applications. The rapid transition toward renewable energy requires intelligent monitoring tools capable of optimizing energy generation, distribution, and consumption. In this context, IoT-enabled sensors provide real-time data on environmental parameters, system performance, and energy utilization patterns. By combining sensor networks with cloud data analytics, the proposed framework improves predictive maintenance, minimizes energy losses, and enables adaptive control of renewable energy systems. The study emphasizes how IoT-based monitoring can support solar, wind, and bioenergy operations within the agricultural sector, ensuring increased productivity while lowering carbon emissions. The findings demonstrate that IoT-integrated systems contribute significantly to resource conservation, operational flexibility, and environmental sustainability. Overall, the research highlights the transformative potential of IoT technologies in establishing smarter, greener, and more resilient energy infrastructures aligned with global sustainable development goals.

Keywords: *IoT; Smart sensing; Renewable energy; Energy optimization; Sustainability.*

Acknowledgement

This study was supported by TNAU through departmental research facilities. We gratefully acknowledge the guidance and assistance provided by the Department of Energy and Environmental Engineering.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

EXAMINATION OF LIPOPHILICITY AND ECOTOXICITY OF THIOCARBOHYDRAZONES

Mekić D.[1], Vaštag Đ.[1], Mrđan G.[1], Matijević B.[1], Apostolov S.[1]*

[1]University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovića 3, 21000, Novi Sad, Serbia,(*e-mail: dragana.mekic@dh.uns.ac.rs)

Abstract: In modern ecotoxicological studies, understanding how compounds interact with biological systems is fundamental for a reliable assessment of their potential environmental effects. The first step in predicting possible toxic effects of thiocarbohydrazones involves evaluating their lipophilicity. The lipophilicity of selected thiocarbohydrazone derivatives was investigated using reversed-phase thin-layer chromatography (RP-TLC18F254s) with mixtures of water and two organic modifiers, separately, as well as by applying appropriate software packages. Linear regression analysis established a relationship between chromatographic parameters (R_M^0 and m) and the partition coefficient log$P$, a standard measure of lipophilicity. Furthermore, the relationship between chromatographic parameters (R_M^0 and m) and the calculated effective concentrations (EC_{50}), which indicate the acute toxicity of the derivatives for different test organisms, was also investigated. The results indicate that chromatographic parameters (R_M^0 and m) can reliably describe lipophilicity and predict toxic effects of the studied thiocarbohydrazone derivatives.

Keywords: *Thiocarbohydrazones; Lipophilicity; Ecotoxicity.*

Acknowledgement

The authors gratefully acknowledge the financial support of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Grants No. 451-03-137/2025-03/ 200125 & 451-03-136/2025-03/ 200125).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

CHARACTERIZATION OF BIOCHARS PRODUCED BY PYROLYSIS SLUDGE AT DIFFERENT TEMPERATURES

Žmukić D.[1], Kerkez Đ.[1], Duduković N.[1], Kulić Mandić A.[1], Kovačević D.[2], Leovac Maćerak A.[1]*

[1]University of Novi Sad- Faculty of Sciences, Department of Chemistry, Biochemisty and Environmental protection, Novi Sad, Serbia (*e-mail: dragana.zmukic@dh.uns.ac.rs)

[2]University of Novi Sad- Faculty of Agriculture, Department of field and vegetable crops, Novi Sad, Serbia

Abstract: Biochar is a carbon-rich material produced by thermal decomposition of organic matter of different types of biomass (agricultural, forest, industrial…). Depending on the starting materials, biochars with different properties are produced. Biochars differ in elemental compostion, specific surface, aromaticity, polarity, pH value and other parameters. As highly porous materials, biochars find application in agriculture, water purification, soil remediation and many other purposes, leading to carbon sequestration and reduction of greenhouse gass emission. In our study, as feedstock we used sewage sludge that was pyrolyzed at three temperatures, 400°C (BC 400), 600°C (BC 600) and 800°C (BC 800). For the purpose of detailed characterization, the samples were subjected to ICP-MS and CHNS analysis. After ICP-MS analysis, the results showed a high content of aluminium, iron and zinc in all biochars. The concentration of iron in BC 400 is 11.07 mg/L, in BC 600 it is 19.21 mg/L and in BC 800 it is 80.43 mg/L. The concentration (mg/L) of all three metals increased as the pyrolysis temperature increased. The content of heavy metals in biochar varies depending on the compostion of the sludge. In this case the content of heavy metals is lower. A high concentration of essential nutrients such as sodium, magnesium, phosphours, potassium, and calcium was recorded. The concentration of phosphours in BC 400 is 56.7 mg/L, in BC 600 it is 86.2 mg/L, and in BC 800 it is 192.5 mg/L. The content of total nitrogen and total organic carbon (%) decreased with increasing pyrolysis temperature, which is an accordance with the literature. Considering the content of nutrients, biochar shows the potential of application in agriculture.

Keywords: *Biochar; Pyrolysis; Sludge; Characterization; Application.*

Acknowledgement

This project has received funding from the European Union's Horizon Europe research and innovation programme, Horizon Europe – Work Programme 2021-2022 Widening participation and strengthening the European Research Area, HORIZON-WIDERA-2021-ACCESS-02, under grant agreement No [101060110], SmartWaterTwin.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

COFFEE MAKES THE WORLD GO ROUND

Gajić U.[1], Janković M.[2]*

[1]University of Novi Sad Faculty of Medicine, Hajduk Veljkova 3, 21000 Novi Sad, Serbia (*e-mail: mina.jankovic@mf.uns.ac.rs)

Abstract: Coffee is more than just a morning ritual; it's a global cultural staple enjoyed by millions for its aroma, taste, and energizing effects. However, behind its comforting allure lies a complex chain of production where contaminants can be introduced, prompting growing scientific interest in their identification and impact on trade and human health. To reveal the probable contaminants of coffee, data from the Rapid Alert System for Food and Feed (RASFF), an EU system for the exchange of information on safety risks, was extracted and evaluated. Between January 2020 and August 2025, 45 RASFF notifications related to coffee were recorded, with a notable increase in recent years (14 cases in 2023 and 12 in 2024). The main contaminants identified were pesticide residues (11 cases, including 8 chlorpyrifos, 3 chlorpyrifos-ethyl, 1 ethylene oxide, 1 2,4-D), mycotoxins (11; ochratoxin A), and novel foods (11; notably 6 Chaga (*Inonotus obliquus*) and 3 each of cannabidiol (CBD) and Cordyceps), followed by environmental contaminants (4; all mineral oil), and the presence of intentionally added substances (4; including 3 sibutramine and 1 sildenafil). Cameroon and Kenya were the most common countries of origin. Considering that ethylene oxide is a potent carcinogen (IARC Group 1), ochratoxin A and 2,4-D are possible carcinogens (Group 2B), and a foreign body was found, the majority of notifications were marked as serious (42.2%). The transfer rate of chemical contaminants from coffee powder to coffee drink is a current area of scientific research, holding significant importance for health risk assessment. The diversity and prevalence of contaminants that pose serious risks highlight the need for enhanced surveillance within the coffee supply chain, both to support sustainable production and safeguard public health. Sustainable agriculture should ensure access to healthy food for all and promote community well-being.

Keywords: *Coffee; Food safety; Public health; RASFF; Sustainability.*

ZnO NANOCOATINGS FOR CLEANER WATER: GREEN PHOTOCATALYSIS AGAINST CIPROFLOXACIN

Jovanović D.[1], Šojić Merkulov D.[1], Despotović V.[1], Bognar S.[1], Bajac B.[2], Finčur N.[1]*

[1]University of Novi Sad Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg D. Obradovića 3, 21000 Novi Sad, Serbia, (*e-mail: dusica.jovanovic@dh.uns.ac.rs)

[2]University of Novi Sad, BioSense Institute, Dr Zorana Đinđića 1, 21000 Novi Sad, Serbia

Abstract: Despite their low concentrations, antibiotics notably contribute to the environmental pollution. Namely, frequent and unmonitored use of the fluoroquinolone antibiotic ciprofloxacin can encourage the development of antibiotic-resistant bacteria, making bacterial infections more difficult to treat. Compared to other advanced oxidation processes, heterogeneous photocatalysis has proven to be more efficacious in the degradation of pollutants that are otherwise challenging to remove from the environment. However, its key limitation is the 'separation after the process', which causes the loss of the photocatalyst during water treatment. Therefore, eco-friendly nanostructured ZnO photocatalytic coatings were engineered by doctor blade technique through immobilization of green ZnO nanomaterials onto alumina substrate. Green-synthesized ZnO/BPE 30 and ZnO/BPE 60 coatings were obtained from the banana peel extract-based ZnO powder (ZnO/BPE), whereas ZnO/GTE 30 and ZnO/GTE 60 were prepared using green tea extract-based ZnO powder (ZnO/GTE). Numbers 30 and 60 indicate different annealing time. After 60 min of simulated solar irradiation, the highest achieved removal efficiency of ciprofloxacin from ultrapure water was 80.2% with ZnO/BPE 30 and 89.1% in the presence of ZnO/GTE 30. Having outperformed other coatings, ZnO/GTE 30 showed good reusability within three consecutive runs conducted using Danube River water, thus supporting the application of eco-friendly, immobilized ZnO nanomaterials for wastewater treatment and environmental remediation.

Keywords: *Organic pollutant; Ciprofloxacin; Photocatalysis; ZnO coatings; Reusability.*

Acknowledgement

The authors gratefully acknowledge the financial support of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Grants Numbers: 451-03-137/2025-03/ 200125 & 451-03-136/2025-03/200125.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

GREEN WASTE AS A RENEWABLE RESOURCE

Vuković A.[1], Kovač P.[1], Vuković Domanovac M.[1], Šabić Runjavec M.[1]*

[1] University of Zagreb Faculty of Chemical Engineering and Technology, Department of Industrial Ecology, Trg Marka Marulića 19, HR-10000 Zagreb, Croatia (*e-mail: msabic@fkit.unizg.hr)

Abstract: Green waste (GW) consists of biodegradable and organic materials, and efficient management of this waste can help mitigate climate change. Recently, GW production has increased rapidly due to urbanisation and the expansion of urban green spaces. Its composition and characteristics depend on factors such as source, season, local climatic conditions, and waste management strategies. The physical and chemical properties of the waste are important for assessing its potential for treatment and valorisation. Biological treatment demonstrates that the material can be converted into a valuable resource. Compost produced from GW improves soil quality and reduces the need for chemical fertilisers. This supports sustainable resource management and promotes the development of a circular economy in both urban and rural environments.The aim of the research was to characterise GW to assess possibilities for valorisation. Physicochemical and microbiological analyses of the eluate were conducted for the monosubstrates cherry laurel and maple leaves. The results indicate a high volatile solids (VS) content of 85 ± 3 % and a pH of 7.0 ± 0.3, with bacterial and fungal counts of 5.8 ± 3.3 and 4.0 ± 1.5 log cfu/mL, respectively. Based on the results obtained, GW demonstrates significant potential for biological treatment and the production of compost. This valorisation contributes to sustainable resource management and reduces environmental impact.

Keywords: *Green waste; Valorisation; Biological treatment, Circular economy*.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ASSESSMENT OF THE MANAGEMENT PRACTICES OF FISH DISEASES AND PARASITES AMONG FISH FARMERS IN LILONGWE DISTRICT, MALAWI

Chande F.[1], Mtethiwa A.[1], Mwakalapa E.[1], Mmochi A.[1]*

[1]Lilongwe University of Agriculture and Natural Resources, Department of Aquaculture and Fisheries Science, Bunda Campus, 219 Lilongwe, Malawi, (*e-mail: fikirachange@gmail.com)

Abstract: Diseases are among the major factors contributing to the decline of fish quality and quantity in aquaculture systems and wild populations. Malawi's aquaculture sector faces challenges from increasing fish disease outbreaks, which threaten the sustainability of fish farming operations. In light of this, a study was conducted to assess the management practices of fish diseases and parasites among fish farmers, the factors affecting farmers' adoption of management practices, and the challenges associated with these practices in Lilongwe. The study randomly sampled 172 fish farmers in four Extension Planning Areas (EPAs) in Lilongwe from January to March 2025. The findings showed that fungal diseases were the most prevalent (52%) affecting all the EPAs, followed by bacterial diseases at 30%, and anatomical abnormalities 13% with parasite diseases being the least at 5%. The results also indicated that farmers have varying levels of knowledge about best practices for preventing and controlling fish diseases. The most widely practiced methods were water quality management (91.2%), use of lime and ash (90.6%), and control of predators (86.9%). Furthermore, most respondents displayed positive attitudes towards adopting these practices if properly introduced. An ordinal regression model revealed that farmers with higher education levels, access to quality water, and knowledge of fish diseases are more likely to adopt new disease management practices, with statistical significance ($p = 0.00268$, $p < 0.001$, $p = 0.00438$, and $p = 0.00882$ respectively). Descriptive statistics ranked challenges, with inadequate capital being the most common, followed by the high cost of quality feed, inadequate information on management, poor access to extension services, limited access to modern technology, and limited knowledge of disease management. Therefore, efforts should be made to improve fish farmers' knowledge of aquaculture management practices to reduce disease occurrence and enhance production efficiency through training and civic education.

Keywords: *Fish diseases; Farmers' attitude; Knowledge; Management practice; Fish farming.*

Acknowledgement

This work was supported by Inter University Council of East Africa (IUCEA) under World Bank.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

PREPARATION OF NOVEL FERROCENYL TETRAHYDROQUINOLINE, POTENTIAL GREEN AGROCHEMICAL AGENTS

Bojanić N.B.[1], Minić Jančić A.[2]*

[1]Faculty of Technical Sciences, University of Priština, Knjaza Miloša 7, 38220 Kosovska Mitrovica, Serbia (*e-mail: nikolabojanic30@gmail.com)

[2]Faculty of Technical Sciences, University of Priština, Knjaza Miloša 7, 38220 Kosovska Mitrovica, Serbia)

Abstract: Ferrocene (Fc), discovered in 1951, rapidly became a foundational organometallic scaffold due to its exceptional thermal stability and well-defined redox properties. These features have enabled wide-ranging applications in bioorganometallic chemistry, catalysis, electrochemistry, materials science, and medicinal chemistry. Its relevance has also expanded into agriculture. Ferrocene units can be incorporated directly into agrochemicals—such as ferrocene-based herbicides and fungicides—or indirectly through their use as catalysts in the synthesis of agriculturally important organic molecules. Owing to their robust and reversible redox behavior, ferrocene derivatives exhibit promising environmentally friendly characteristics, making them useful in crop protection, soil remediation, and broader environmental management. The compound 1-ferrocenyl-3-((2-(methylthio)phenyl)amino)propan-1-one, which we initially synthesized, was employed as a key intermediate for subsequent transformations. In the first step, this compound was subjected to a reduction reaction that afforded the corresponding alcohol in 99% yield. The alcohol was isolated in pure form and fully characterized using standard spectroscopic techniques, confirming its structure and purity. In the following step, the obtained intermediate underwent an intramolecular cyclization, yielding the corresponding tetrahydroquinoline derivative as the final product. Both compounds obtained in this synthetic sequence are particularly interesting, as they exhibit structural features that make them promising candidates for the development of green agrochemicals. Their stability, reactivity, and potential biological relevance suggest that they could serve as valuable scaffolds for environmentally friendly agricultural applications.

Keywords: *Ferrocenes; Synthesis; Characterization; Agrochemicals; Green agents.*

Acknowledgement

The authors would like to thank the Ministry of Science, Technological Development, and Innovation of the Republic of Serbia for funding the scientific research work, contract no. 451-03-65/2024-03/200155, realized by the Faculty of Technical Sciences in Kosovska Mitrovica, University of Priština.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

TRACING THE WATER–BEEF SAFETY NEXUS: ASSESSING WATER QUALITY'S ROLE IN BEEF CONTAMINATION FROM SLAUGHTERHOUSE TO PLATE, IN SOUTHWEST ETHIOPIA

Mamo Z.G.[1], Tiku M.S.[1], Mekonene S.[2]*

[1*] Department of Environmental Health Science and Technology, Faculty of Public Health, Jimma University, Jimma, Ethiopia (*e-mail: michaelgirmaju@gmail.com)

[2]Institute of Water, Environment and Climate Research, Addis Ababa University, Addis Ababa, Ethiopia

Abstract: Water is central to hygiene in beef processing but can also serve as a major route for microbial contamination. In Southwest Ethiopia, where access to safe water is limited, the water–beef interface remains an underexplored contributor to foodborne disease. This study traced the water–beef safety nexus from slaughterhouse to consumption, assessing how water quality influences microbial contamination across the beef supply chain. A laboratory-based cross-sectional study was conducted from February to May 2024 in Mizan and Aman towns. A total of 349 samples were collected, including water (n=126), beef (n=159), carcass swabs (n=32), and colon matter (n=32). Water was sampled from rivers, hand-dug wells, and taps serving abattoirs and major beef retailers. Standard microbiological methods were used for isolation and enumeration of *E. coli*, Salmonella, Shigella, Listeria, and indicator coliforms. Data were analyzed using chi-square tests and multivariable linear regression at 95% confidence. River water showed the highest contamination, with 100% total coliform positivity and mean counts ≥4.1 $\log_{10}$ CFU/100 mL. Hand-dug wells were also highly contaminated (56.1%), while tap water showed lower but still unsafe counts (≥23%). Beef and carcass swabs exhibited widespread pathogen presence, notably *E. coli* (42.1%) and *Salmonella spp.* (29.2%). Sampling schedule—spicing vs. non-spicing of beef and carcass washing—significantly predicted total and fecal coliform loads (β=0.33, p=0.015; β=0.46, p=0.003). Sample type and location were inversely associated with contamination, indicating variable hygiene standards across sites. **Conclusion:** Water quality is a major driver of beef contamination along the slaughter-to-consumption continuum in Southwest Ethiopia. Severely contaminated river and well water, inadequate abattoir sanitation, and unsafe handling practices collectively elevate microbial risks. Strengthening water safety, improving abattoir infrastructure, and enforcing hygienic meat handling are essential to safeguard public health.

Keywords: *Beef safety; Water quality; Beef value chain; Microbial contamination; Southwest Ethiopia.*

Acknowledgement

The authors gratefully acknowledge, Jimma University, Mizan Aman Health Science College, Mizan Aman Municipality, Aman Municipality Town Administration, Water and Sewerage Office, and the Bench Sheko Zone Health Department. We further thank the data collectors, supervisors, and laboratory personnel for their valuable contributions to the success of this study.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

FROM WASTE TO RESOURCE: OPPORTUNITIES AND BARRIERS FOR HOUSEHOLD SOLID WASTE RECOVERY IN JIMMA CITY, ETHIOPIA

Degefa G.[1], Eba K.[1], Tolossa F.[2], Birhanu Z.[3,4], Tucho G.[1]*

[1]Department of Environmental Health Science and Technology, Jimma University, Ethiopia, (*e-mail: gutamahaile@gmail.com)

[2]Department of Governance and Development Studies, Jimma University, Ethiopia

[3]Department of Health Behavior and Society, Jimma University, Jimma, Ethiopia.

[4]JBI Ethiopian Evidence Synthesis, Translations and Implementation Center, Jimma University, Ethiopia.

Abstract: This study aims to examine solid waste generation, composition, and characteristics in Jimma City, thereby evaluating household resource recovery practices and the factors influencing these practices. A community-based cross-sectional study was conducted, combining quantitative and qualitative methods, including a household survey and detailed proximate and ultimate analyses of waste. Relevant data were collected from 820 systematically selected households through a structured survey, complemented by measurements of solid waste generation and composition using an adapted standard checklist for solid waste composition analysis. The data were analyzed using descriptive statistics and ordinal logistic regression. The results indicate a solid waste generation rate of 0.653 kg per person per day in Jimma. The organic components accounted for 55.5%, recyclable products accounted for 23.97%, and reusable materials accounted for 11.02% of the total municipal solid waste, suggesting a 90.5% resource recovery potential. Despite huge resource potential, households' engagement in waste recovery practices is very low due to limited knowledge and tenure status, underscoring the need for targeted education and resource-oriented waste management strategies. Therefore, this study recommends targeted awareness campaigns, formalization of informal solid resource recovery sectors, household composting, and equitable infrastructure investments to align local waste management with sustainable urban development.

Keywords: *Municipal solid waste; Waste generation; Waste composition; Recycling; Resource recovery practices.*

Acknowledgements

The authors wish to thank Jimma University, Institute of Health, for supporting this study. We gratefully acknowledge the study participants for their voluntary participation. We thank the municipality workers and kebele administrators for their support during data collection.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

FRAMEWORK CONDITIONS FOR THE SAFE DISCHARGE AND REUSE OF THERMAL AND SPA WATER

Kovačević S.[1], Antonović J.[2], Milovanović D.[1], Mihajlović I.[1]*

[1] University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia, (*e-mail: srdjankovacevic@uns.ac.rs)

[2] University of Priština, Faculty of Technical Sciences, Knjaza Milosa 7, Kosovska Mitrovica 38220

Abstract: The analysis of the legal and institutional framework governing discharged thermal, spa, and geothermal water in Serbia demonstrates that the country has developed a formally comprehensive regulatory system, yet one that remains practically constrained by implementation challenges. The Water Law, supported by extensive bylaws, clearly defines water status, emission limit values, and the permitting and monitoring obligations required for facilities that discharge treated or untreated thermal and spa water. Despite this, the thermal and spa wastewater is regulated only indirectly, through general water and wastewater provisions, rather than through a dedicated sector-specific framework. This leads to uncertainties regarding the required treatment level, the management of chemical additives used in pools and spa facilities, and the conditions under which geothermal water may be discharged or reused. In parallel, the European Union does not possess a single unified directive addressing wastewater from thermal or spa sources. Instead, regulatory obligations are derived from a combination of broader environmental directives, including the Water Framework Directive, Groundwater Directive, Urban Wastewater Treatment Directive, Bathing Water Directive, and the Industrial Emissions Directive. The comparative assessment highlights that Serbia's legislation is generally aligned with EU principles but requires clearer operational definitions, stronger monitoring practices, and improved institutional coordination for effective enforcement. Serbia's regulatory foundation is adequate but not sufficiently tailored to the specific environmental pressures and operational practices of spa and geothermal facilities. Strengthening the precision, sectoral relevance and practical enforceability of the legal framework is essential for achieving fully compliant and environmentally responsible management of discharged thermal and spa waters.

Keywords: *Thermal water; Water regulations; Water management.*

Acknowledgement

This paper has been produced with the financial assistance of the European Union through the Interreg VI-A IPA Hungary-Serbia program. The content of the presentation is the sole responsibility of FTS and Local Government of Mórahalom and can under no circumstances be regarded as reflecting the position of the European Union and/or the Managing Authority of the Program.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

SOIL ENZYME DYNAMICS OF TUBER CROP BASED INTERCROPPING SYSTEM

Ilakiya T.[1,2], Swarnapriya R.[2], Parameswari E.[2]*

[1] Department of Vegetable Science, SRM College of Agricultural Sciences, Baburayanpettai, Chengalpattu, Tamil Nadu, India (*e-mail: ilakiyatamil@gmail.com)

[2] Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Abstract: Soil enzyme activity is an essential marker of soil health and fertility since it facilitates crucial biochemical processes, including nutrient cycling and organic matter breakdown. This research examines the dynamics of soil enzymes in an intercropping system including tuber crops, namely elephant foot yam (*Amorphophallus paeoniifolius*), alongside short-duration vegetable crops. Here a total of five treatments, including the monocropping of elephant foot yam (T1) and intercropping of elephant foot yam with short-duration vegetable crops with cluster bean (T2), radish (T3), amaranthus (T4), and fenugreek (T5), were taken up. These were laid out in a randomised block design with four replications. The results showed that the enzyme activities shoot up in the intercropping systems. The enzymes, including urease (37.82 NH3 µg/g/hr), dehydrogenase (2.60 µg TPF formed/g soil/h), acid phosphatase (28.71 µg PNP/g/h), and alkali phosphatase (17.72 µg PNP/g/h), were found to increase in the treatment T2 where cluster bean is intercropped in elephant foot yam. As a whole, increased enzyme activity in intercropping cluster bean in elephant foot yam enriches the soil fertility, thereby improving the production of the crop.

Keywords: *Cropping system; Enzymes; Elephant foot yam; Soil health; Sustainability.*

Acknowledgement

The authors thank Department of Vegetable Science, Tamil Nadu Agricultural University for their support.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

OCCURRENCE AND LEVELS OF LEAD AND CADMIUM IN FISH FROM LAKE RUKWA, TANZANIA: POTENTIAL FISH AND PUBLIC HEALTH RISKS

Maganga I.[1], Mwakalapa E.[2], Lyche J.[3].*

[1] Department of Aquaculture & Fisheries Science, Lilongwe University of Agriculture and Natural Resources, P. O. Box 219, Lilongwe, Malawi, (*e-mail: isackmaganga@yahoo.co.uk)

[2] College of Science and Technical Education, Mbeya University of Science and Technology, P. O Box 131, Mbeya, Tanzania.

[3] Department of Paraclinical Sciences, Faculty of Veterinary Medicine, Norwegian University of Life Sciences, P. O Box 5003 NO-1432 As, Norway.

Abstract: Lake Rukwa, located in southwestern Tanzania, plays a crucial role in supporting biodiversity and sustaining the livelihoods of nearby communities, particularly through fishing and agriculture. Recently, concerns have grown regarding the contamination of the lake with harmful heavy metals, specifically Pb and Cd. These metals can accumulate in fish tissues, posing significant risks to both environmental health and human populations who rely on the lake's fish as a primary food source. The Study aimed to investigate the levels of Pb and Cd in fish from Lake Rukwa and assess potential health risks for both the fish and the communities that consume them. A total of 78 tilapia samples were collected from Udinde, Ilanga, and Mbangala villages along the lake and extracted muscle and liver tissues to measure the concentrations of Pb and Cd. The study revealed alarming levels of Pb and Cd contamination in tilapia. Pb concentration in fish muscle ranged from 0.8606 to 1.9117 mg/kg wet weight, exceeding the WHO/EPA safety limit of 0.3 mg/kg. Pb concentrations in fish liver ranged from 5.4376 to 36.9778 mg/kg, with Udinde showing the highest levels. Cd concentration in fish muscles ranged from 0.5796 to 0.6238 mg/kg, surpassing the recommended safety limits. In fish liver, Cd levels were significantly higher than EQS, ranging from 45.0402 to 146.4020 mg/kg. The THQs suggested there is no potential health risks on consuming fish, and the carcinogenic risk values, which ranged from 1.29 to 4.27 per million, remained within acceptable limits according EPA. The study underscores the significant environmental contamination of fish in Lake Rukwa with heavy metals Pb and Cd, particularly in Ilanga Village. These findings emphasize the urgent need for effective regulatory measures and continuous monitoring to mitigate the risks associated with heavy metal contamination in Lake Rukwa.

Keywords: *Human health risk; Fish health; Lead; Cadmium; Food safety*.

Acknowledgement

This study was funded by NORAD through the ECARESA project (QZA-21/0182) under Norhed II framework.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

COMMUNITY'S PERCEPTIONS ON HEALTH AND ECOLOGICAL IMPACTS OF CLIMATE CHANGE AND ADAPTATION STRATEGIES IN RURAL AREAS OF THE CENTRAL ETHIOPIAN REGION

Hafebo Lambebo I.[1], Eba K.[2], Tucho G.T.[2]*

[1] Jimma University, Faculty of Health Sciences, Department of Environmental Health and Technology, Jimma, Oromia, Ethiopia (*e-mail: isayashafebo@gmail.com),

[2]Jimma University, Faculty of Health Sciences, Department of Environmental Health and Technology, Jimma, Oromia, Ethiopia

Abstract: Ethiopia faces recurrent floods, droughts, and climate-related health challenges, yet research remains limited on community vulnerability, risk perceptions, and adaptation strategies. This study employs a mixed-methods design comprising household surveys (N = 845), focus group discussions, and key informant interviews to examine the socio-economic, ecological, and health dimensions of climate vulnerability across Highland, Midland, and Lowland climatic zones. Findings reveal pronounced regional disparities. Highland communities experience heightened exposure to cold waves and water scarcity, compounded by aging populations and inadequate housing. Lowland areas are characterized by heat-related stressors, weakened institutional structures, and predominantly youth demographics, while Midland zones suffer from hydrological instability that facilitates disease transmission. Across all regions, systemic health burdens are evident, with food- and water-borne diseases (83%) and malnutrition (80%) emerging as pervasive threats. Logistic regression analysis identifies education, income, health insurance access, credit availability, and climate information as significant predictors of adaptive capacity. Higher education enhances adaptation likelihood more than thirteen-fold, whereas female-headed households and larger family sizes are associated with reduced engagement in adaptation practices. Local innovations, including Enset cultivation and mixed farming systems, provide culturally embedded resilience strategies, though their feasibility varies regionally. The study underscores the necessity of geographically tailored, integrated climate-health interventions, supported by inclusive service delivery, climate-sensitive education, and gender-responsive programming. Moreover, it highlights a critical disjuncture between perceived and scientifically established drivers of climate change, with only 14% of respondents attributing climate change to human activities. This gap emphasizes the importance of culturally attuned climate communication to strengthen community understanding and adaptive responses.

Keywords: *Adaptation; Climate change; Central Ethiopia; Public health; Perception.*

Acknowledgement

The authors gratefully acknowledge Jimma University and the Central Ethiopia Regional Environment and Forest Authority for their essential financial and institutional support. We extend sincere appreciation to all respondents and participants whose time, insights, and experiences were indispensable to this study.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ASSOCIATION BETWEEN CLIMATIC CONDITIONS AND INFECTIOUS DISEASES: IMPLICATIONS FOR CENTRAL ETHIOPIA REGION

Hafebo Lambebo I.[1], Eba K.[2], Tucho G.T.[2]*

[1]Jimma University, Faculty of Health Sciences, Department of Environmental Health and Technology, Jimma, Oromia, Ethiopia (*e-mail: isayashafebo@gmail.com),

[2]Jimma University, Faculty of Health Sciences, Department of Environmental Health and Technology, Jimma, Oromia, Ethiopia

Abstract: Ethiopia's climate-health vulnerability is intensified by its complex topography, reliance on subsistence farming, and socio-economic constraints. This study examines the association between climatic variability and infectious disease incidence in Central Ethiopia from 2013 to 2024, focusing on enteric fever, malaria, diarrheal diseases, and bacterial meningitis. Hospital-based surveillance data were integrated with meteorological records, and descriptive statistics, Spearman's correlation, and negative binomial regression were employed to quantify disease burden and climate sensitivity. Enteric fever represented the largest share of reported cases (48.5% of 113,456), with a consistent predominance among females. Malaria and diarrheal diseases demonstrated strong positive correlations with rainfall (ρ = 0.846; ρ = 0.99) and minimum temperature (ρ = 0.625; ρ = 0.482), peaking during wetter months. Conversely, meningitis and enteric fever were negatively associated with rainfall (ρ = –0.951; ρ = –0.554), with meningitis exhibiting high variability (CV = 94.6%). Regression analysis indicated that rainfall increased the risk of malaria and diarrheal diseases but reduced the odds of meningitis and enteric fever, while minimum temperature significantly elevated malaria risk (OR = 1.17, p = 0.015). The findings underscore the complex interplay between climate variability and infectious disease burden, with notable gender disparities in case distribution. These results highlight the need for gender-responsive strategies targeting enteric fever, climate-sensitive early warning systems for malaria and diarrheal diseases, and non-climatic approaches for meningitis control. Integrating real-time climate data into surveillance platforms is recommended to strengthen outbreak preparedness. Given reliance on two hospital datasets, caution is warranted in generalizing these findings to broader regional contexts.

Keywords: *Association; Central Ethiopia region; Meteorological factor; Infectious diseases.*

Acknowledgement

The authors would like to extend their sincere gratitude to all the participants who made this study possible.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

MICROCAPSULES AS MODERN DELIVERY SYSTEMS FOR ACTIVE SUBSTANCES

Lajevec I[1].*

[1]University of Novi Sad, Faculty of Medicine, Department of Pharmacy, Hajduk Veljkova 3, Novi Sad, Serbia, (e-mail: isilajevec@gmail.com)

Abstract: Microcapsules are particles 1-1000 μm in size, with a core containing the active substance and a shell that is usually made of natural, synthetic, or semi-synthetic polymers. They are used in various industries, such as the food, pharmaceutical, chemical, and cosmetic industries. Microcapsules enable the controlled release of active substances at a specific place in the body, increase their bioavailability and stability, protect them from external factors, reduce their harmful impact on the environment, and mask their unpleasant tastes and smells. They act like carriers for enzymes, vitamins, hormones, essential oils, plant extracts, and other active substances. The aim of this work was to make an overview of microcapsules, their application in pharmaceutical and cosmetic products, the most common microencapsulation methods, and the properties of natural polymers used in shell formation. The most common microencapsulation methods are physical (spray drying, spray cooling, solvent evaporation, spray coating, freeze drying) and chemical methods (coacervation). The choice of the appropriate method depends on the properties of the materials that make up the core and shell of the microcapsule. For example, spray drying and solvent evaporation are not suitable for microencapsulation of thermolabile substances, in contrast to coacervation and spray cooling. Polysaccharides (alginate, chitosan, pectin, agar, gum arabic) and proteins (gelatin) are the most common natural polymers that build the shell due to their biocompatibility, biodegradability, non-toxicity, and ability to form gels. The importance of microcapsules as carriers of active substances, in preserving and improving the stability and bioavailability of active substances, represents an important field of research in the future. Proper selection of polymers and encapsulation methods regulates the coating properties and enables the formation of solid, rigid coatings that protect substances, increase their stability against various environmental influences, and allow their prolonged release at the target site.

Keywords: *Microcapsules; Polysaccharide microcapsules; Protein microcapsules; Microencapsulation methods.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

CIRCULAR ECONOMY AND ITS ROLE IN ANTROPOGENIC METABOLISM

Ćurčić J.[1], Stanisavljević N.[1]*

[1] University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia, (*e-mail: jelenacurcicns@gmail.com)

Abstract: The aim of this study is the concept of circular economy and its role in anthropogenic metabolism, with the aim of presenting its basic principles and goals, mechanisms and tools, as well as advantages and challenges of implementing this model in modern society. The circular economy represents an alternative to the linear model, and it is based on the sustainable use of resources, waste reduction and the regeneration of natural systems. The paper presents the main aspects of the concept's development, the technical and biological material cycles through an explanation of the Butterfly Diagram, as well as a comparison between the linear and circular models. The legal framework of the European Union and the Republic of Serbia is analyzed through several important documents that support the transition towards the circular model. Particular emphasis is placed on tools and mechanisms such as ecodesign, Extended Producer Responsibility, waste-to-energy transformation and industrial symbiosis, with an example of good practice. The research results indicate that the circular economy has significant potential for economic improvement and that its mechanisms can influence the reduction of environmental pollution, but also that institutional, infrastructural and social prerequisites are necessary for its full implementation.

Keywords: *Circular economy; Waste management; Environmental impact.*

Acknowledgement

This research has been supported by the Ministry of Science, Technological Development and Innovation (Contract No. 451-03-137/2025-03/200156) and the Faculty of Technical Sciences, University of Novi Sad through project "Scientific and Artistic Research Work of Researchers in Teaching and Associate Positions at the Faculty of Technical Sciences, University of Novi Sad 2025" (No. 01-50/295).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

DESIGNING CHOLINE CHLORIDE–BASED NADES FOR ULTRASOUND-ASSISTED GREEN EXTRACTION OF CHICORY PHENOLICS WITHIN A CONCEPTUAL AND SUSTAINABLE FRAMEWORK

Milidragović J.[1], Tomas-Petrović A.[2], Đuran I.[3], Grujić-Letić N.[1], Gligorić E.[1], Teofilović B.[1]*

[1]University of Novi Sad, Faculty of Medicine, Department of Pharmacy, Hajduk Veljkova 3, Novi Sad, Serbia (*e-mail: 904015d25@mf.uns.ac.rs)

[2]University of Novi Sad, Faculty of Medicine, Department of Pharmacology, Toxicology and Clinical Pharmacology, Hajduk Veljkova 3, Novi Sad, Serbia

[3]Clinic of Nephrology and Clinical Immunology, University Clinical Centre of Vojvodina, Novi Sad, Serbia

Abstract: Designing Natural Deep Eutectic Solvents (NADES) based on choline chloride (ChCl) has become an increasingly attractive approach for green extraction of bioactive compounds from Cichorium intybus, a plant rich in caffeic-acid–derived phenolics such as chicoric, chlorogenic, and caftaric acids. ChCl-based NADES possess tunable polarity, strong hydrogen-bonding capacity, low toxicity, and high biodegradability, characteristics that enable efficient solubilization of phenolic acids while reducing environmental impact compared with traditional organic solvents. Their integration with ultrasound-assisted extraction (UAE) offers additional advantages in terms of enhanced mass transfer, reduced extraction times, and improved recovery of target metabolites. This theoretical work is based on a comprehensive literature review covering key publications related to ChCl-based NADES formulation, solvent physicochemical optimization, hydrogen-bond donor selection (organic acids, sugars, polyols), viscosity control, and water-content adjustments. Both recent and foundational studies were evaluated to provide a complete overview of how NADES–UAE systems influence extraction mechanisms, solvent penetration, cell-wall disruption, and phenolic stability. Research involving chicory matrices, related Asteraceae species, and model phenolic systems was included to ensure a broad comparative perspective. Across the literature, ChCl–lactic acid, ChCl–glycerol, ChCh–malic acid, and ChCl–citric acid NADES consistently demonstrate superior extraction capacity for phenolic acids relative to aqueous ethanol systems. UAE substantially enhances cavitation-induced cell-wall rupture, promoting deeper NADES diffusion and increasing yields of chicoric acid and structurally related compounds. Several studies report notable improvements in antioxidant activity of the extracts, high selectivity toward hydroxycinnamic acids, favorable solvent recyclability, and significant reductions in energy use and process waste. Evidence from the reviewed sources indicates that rationally designed ChCl-based NADES, when paired with UAE, represent a sustainable and highly efficient platform for extracting chicory phenolics within a green-chemistry and circular-economy context. Future directions include refining predictive solvent-design tools, optimizing NADES rheology, and investigating scale-up strategies for industrial application.

Keywords: *NADES; Choline chloride; Ultrasound-assisted extraction; Green extraction; Chicory phenolics.*

UREA-BASED NATURAL DEEP EUTECTIC SOLVENTS AS A SUSTAINABLE PLATFORM FOR ENHANCED EXTRACTION OF BIOACTIVE PHENOLICS FROM CHICORY ROOT

Milidragović J.[1], Tomas-Petrović A.[2], Đuran I.[3], Gligorić E.[1], Grujić N.[1], Teofilović B.[1]*

[1]University of Novi Sad, Faculty of Medicine, Department of Pharmacy, Hajduk Veljkova 3, Novi Sad, Serbia (e-mail: jaksic.jj@gmail.com)

[2]University of Novi Sad, Faculty of Medicine, Department of Pharmacology, Toxicology and Clinical Pharmacology, Hajduk Veljkova 3, Novi Sad, Serbia

[3]Clinic of Nephrology and Clinical Immunology, University Clinical Centre of Vojvodina, Novi sad, Serbia

Abstract: Natural Deep Eutectic Solvents (NADES) have emerged as a sustainable alternative to conventional solvents, enabling efficient and environmentally responsible extraction of bioactive compounds. Urea-based NADES offer enhanced hydrogen-bonding capacity and adjustable polarity, making them suitable for solubilizing phenolic acids and flavonoids with potential health relevance. This study investigates the extraction performance of two urea-based systems (glucose–urea (Glu/Urea) and glycerol–urea (Gli/Urea)) for recovering bioactive phenolics from *Cichorium intybus* root cultivated at the Institute for Medicinal Plant Research, a plant recognized for its antioxidant and nutraceutical value. Phenolic profiles were quantified using high-performance liquid chromatography (HPLC), targeting major phenolic acids and flavonoids relevant for biomedical and functional applications. Both NADES demonstrated strong capacity for extracting structurally diverse phenolics; however, marked differences were observed between systems. The Gli/Urea solvent yielded higher concentrations of gallic acid (4.23 mg/g), caffeic acid (5.06 mg/g), epicatechin (3.14 mg/g), ferulic acid (3.20 mg/g), quercetin (2.15 mg/g), and naringenin (3.67 mg/g). In contrast, Glu/Urea exhibited superior extraction of benzoic acid (1.90 mg/g), rosmarinic acid (1.07 mg/g), and was the only system that enabled quantification of coumaric acid (0.35 mg/g). Chlorogenic acid levels were comparable between systems (0.94–1.10 mg/g). These findings demonstrate that urea-based NADES offer tunable selectivity and high efficiency, depending on hydrogen-bond donor/acceptor pairing. Urea-based NADES represent a highly effective and environmentally aligned extraction platform for obtaining bioactive phenolic acids and flavonoids from chicory root. Their strong performance and selective solubilization support their future integration into sustainable bioprocessing pipelines for nutraceutical, pharmaceutical, and functional food applications.

Keywords: *NADES; Urea-based solvents; Chicory*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

MODIFICATION OF BIOCHAR USING SODIUM HYDROXIDE AND POTASSIUM HYDROXIDE FOR DYE REMOVAL

Kanika K.[1], Gangai Selvi R.[1], Karchiyappan T.[2], Ponmani S.[3]*

[1] Department of Physical Sciences & Information Technology, AEC&,RI, Tamil Nadu Agricultural University, CBE, TN, India. (*e-mail: kkaagri2020@gmail.com)

[2] Department of Nammazhvar Organic Farming Research Centre, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India

[3] Department of Environmental Science, Mother Teresa College of Agriculture, Pudukkottai, Tamil Nadu, India

Abstract: Industrial dye effluents pose major environmental risks due to their high colour intensity, toxicity and persistence in aquatic ecosystems. Methylene blue (MB), a widely used cationic dye, is particularly hazardous even at low concentrations. This study investigates the adsorption efficiency of *Prosopis*-derived biochar, chemically modified using sodium hydroxide (NaOH) and potassium hydroxide (KOH), for the removal of MB from aqueous solutions. Biochar was produced through pyrolysis at 400 °C and subsequently characterized using X-ray diffraction (XRD), Fourier transform infrared (FT-IR) spectroscopy and Raman spectroscopy. The prominent XRD peak at $2\theta \approx 21.94°$ confirmed the cellulosic crystalline structure of the biochar, which remained intact after modification, while FT-IR spectra indicated enhanced carboxyl and hydroxyl functional groups on modified samples, contributing to stronger electrostatic interaction with cationic dye molecules. Batch adsorption experiments were conducted to assess the influence of initial dye concentration (100–600 mg L^{-1}), biochar dosage (0.5–2.5 g L^{-1}), pH (2–10) and contact time (30–240 min). More than 90% MB removal was achieved below 400 mg L^{-1} using 2 g L^{-1} of biochar, with KOH-modified biochar consistently demonstrating superior adsorption efficiency compared to NaOH-modified and pristine samples. Adsorption increased rapidly up to 90 minutes and then stabilized, indicating equilibrium, while alkaline pH (9–10) significantly enhanced dye removal due to increased negative surface charge on the adsorbent. Overall, KOH-modified *Prosopis* biochar proved to be a highly effective, economical and sustainable material for the remediation of dye-contaminated wastewater.

Keywords: *Biochar; Methylene blue; Adsorption; Dye removal; Alkaline modification.*

Acknowledgement

Grateful acknowledgment is extended for the institutional support and resources that enabled this study.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

PHOTOCATALYTIC REMOVAL OF METFORMIN USING GREEN ZnO NANOPARTICLES BASED ON INULA HELENIUM EXTRACT

Hainz K.[1], Bognár S.[1], Šojić Merkulov D.[1]*

[1]University of Novi Sad Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg D. Obradovića 3, 21000 Novi Sad, Serbia, (*e-mail: katarina.hainz@dh.uns.ac.rs)

Abstract: More than 2 billion people today face the consequences of contaminated water and live in areas suffering from water scarcity. The inadequate performance of conventional water treatment methods only intensifies the overall water pollution. Heterogeneous photocatalysis is considered one of the most promising approaches, thanks to its simplicity, environmental friendliness, and use of renewable energy, making it effective for degrading persistent organic micropollutants. Metformin (MET), a derivative of biguanide and one of the most commonly used medications for treating type 2 diabetes, can reach clean water sources through wastewater effluents and improper disposal of pharmaceutical waste. This study aimed to evaluate the photocatalytic degradation of MET from water, using commercial ZnO and newly synthesized ZnO nanoparticles based on *Inula helenium* extract as a photocatalysts, under various experimental conditions (catalyst loading, initial pH) under simulated solar irradiation. Considering the optimized experimental conditions, in the presence of commercial ZnO (0.5 mg/mL, pH ~10) 6% of MET was degraded, while in the case of newly synthesized ZnO nanoparticles based on *Inula helenium* extract (0.5 mg/mL, pH ~10) 20% of substrate was removed, after 180 min of irradiation. Based on the obtained results, it can be concluded that newly synthesized ZnO nanoparticles based on *Inula helenium* extract demonstrated higher efficiency than commercial ZnO in the photocatalytic degradation of MET.

Keywords: *Organic pollutant; Metformin; Photocatalysis; ZnO; Inula helenium extract.*

Acknowledgement

The authors gratefully acknowledge the financial support of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Grants Numbers: 451-03-137/2025-03/ 200125 and 451-03-136/2025-03/200125).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

RURAL HOUSEHOLDS' ENERGY CONSUMPTION PATTERN AND IT'S IMPACTS ON ENVIRONMENT IN WESTERN ETHIOPIA

Atomissa K.G[1,2], Olani D.D[1], Tucho G.T.[1]*

[1]Jimma University, Faculty of Public Health Sciences, Department of Environmental Health Science and Technology, P.O. Box 378, Jimma, Ethiopia (*e-mail: gutamatomsa@gmail.com)

[2]Wollega University, College of Natural and Computational Sciences, Department of Environmental Science, P.O. Box 395, Nekemte, Ethiopia

Abstract: In many developing countries, rural households still rely heavily on biomass consisting of wood, charcoal, leaves, dung, and agricultural residues for cooking and heating. In Ethiopia, where households consume about 94% of total energy supply, biomass dominates the energy system. This traditional dependence contributes to environmental degradation, climate change, and health risks. Variations in household energy use also carry important environmental and socio-economic implications. The aim of this study was to analyze households' energy consumption pattern and identify the factors that determine the type and amount of energy use in rural areas of Eastern Wollega, Western Ethiopia. A cross sectional survey was conducted from June 10 to July 10, 2025 on 1,175 households selected from 3 districts of East Wollega Zone. A questionnaire involving personal and demographic information, households' fuel use, sources and types of energy used by the households were used to collect data. The results of the study revealed that the common energy sources that rural households' use for cooking were firewood, crop residues and charcoal. More than 95% of the households are using biomass energy for cooking injera and many households are using solar photovoltaic cells and electricity for lighting. Availability of firewood, lack of connection to grid electricity, the assumption that firewood is less costly were identified as factors affecting the level electricity use for cooking. Annually about 20 thousand tons of biomass of which 10130 tons firewood and 3525 tons charcoal were used in the area, which implies that about 1200 hectares of forest was lost and 25485 tons of CO_2-e was emitted to the atmosphere. It can be concluded that availability of electricity does not guarantee its utilization for cooking and other factors needs to be considered.

Keywords: *Rural households; Energy consumption pattern; Greenhouse emission; Environment.*

Acknowledgement

The authors would like to thank Jimma University and Wollega University for giving the opportunity to conduct this research work.

CYTOTOXICITY PROFILE OF CHOLINE CHLORIDE-MALONIC ACID DES ON NORMAL HUMAN FIBROBLAST CELLS

Radošević K.[1] ,Kostić M.[1] ,Janić M.[1], Brković S.[1], Momić T.[1], Valenta Šobot A.[1], Filipović Tričković J.[1]*

[1]University of Belgrade, VINČA Institute of Nuclear Sciences – National Institute of the Republic of Serbia, Mike Petrovića Alasa 12–14, Belgrade, Serbia, (*e-mail: ksenija.radosevic@vin.bg.ac.rs)

Abstract: Deep eutectic solvents (DES) are gaining increasing attention as biocompatible alternatives to conventional organic solvents. In recent years, their possible application as drug delivery systems has been extensively explored, especially for enhanced drug solubility and bioavailability. Previous studies indicated that DES composed of choline chloride (ChCl), as a hydrogen bond acceptor, and organic acids, as hydrogen bond donors, such as malonic acid, could possess beneficial biological effects, but also cytotoxic activity; however, research regarding their effects on normal cells remains limited. In this work, we aimed to analyze the cytotoxic profile of DES composed of choline chloride and malonic acid (ChCl:Mal), on the human fibroblast cell line (MRC-5). ChCl:Mal was formulated in 1:1 molar ratio, and Fourier Transform Infrared Spectroscopy (FTIR) analysis was performed for DES characterization. The analysis of FTIR spectra confirmed the successful synthesis of DES. Cytotoxicity of the obtained DES was evaluated using XTT viability assay, in a concentration range of 0.1–4 mg/mL. The results showed that lower concentrations (0.1–0.8 mg/mL) exert a stimulatory effect on cell proliferation, seen as increased cell viability compared to the untreated control, indicating their good compatibility with cellular systems. On the contrary, higher concentrations of 1–2 mg/mL induced minor cell viability reduction, while a significant cytotoxic effect was detected at the concentration of 4 mg/mL, outlining cytotoxicity of higher concentrations. The results of the present study indicate that ChCl:Mal has promising potential as a novel green solvent system for biomedical applications, with favorable biocompatibility at concentrations up to 2 mg/mL.

Keywords: *Cytotoxicity; Deep eutectic solvent; Normal human fibroblast cells; Biosafety.*

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Grant no. 451-03-136/2025-03/200017 and 451-03-3627/2025-03/3456).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

HYDROCHAR IN ENVIRONMENTAL AND AGRICULTURAL SYSTEMS

Lakshanya K.[1], Saranya R.[1], Niranjan R.[1], Ilakiya T.[1*]*

[1] Department of Vegetable Science, SRM College of Agricultural Sciences, Baburayanpettai, Chengalpattu, Tamil Nadu, India (*e-mail: ilakiyatamil@gmail.com)

Abstract: Hydrochar is a carbon-rich solid produced by the hydrothermal carbonisation of various organic wastes, such as plant waste, food waste, animal manure, and other agricultural by-products. In contrast to biochar, which is produced by dry pyrolysis, hydrochar is synthesised under high-pressure, high-temperature aqueous conditions, leading to unique physicochemical characteristics. Due to its porous structure, substantial water retention capacity, and nutrient retention capabilities, hydrochar has emerged as a viable solution in environmental and agricultural systems. In soils, it strengthens structure, increases fertility, improves moisture availability, and fosters plant growth by facilitating nutrient absorption, drought resilience, and vigorous root development. Its minimal production cost, environmentally beneficial characteristics, and capacity for effective waste management make it an appealing choice for agriculturalists and land managers. However, hydrochar's very rapid decomposition rate, the need for appropriate management of liquid by-products, restricted large-scale application, potential phytotoxicity hazards, and the need for specialised equipment present significant hurdles. Despite these constraints, hydrochar is a significant resource for the utilisation of wet biomass, the rapid enhancement of soil health, and the improvement of nutrient cycling, highlighting its increasing importance in sustainable environmental and agricultural methodologies.

Keywords: *Hydrochar; Hydrothermal carbonization; Soil amendment; Biomass valorization; Sustainable agriculture.*

Acknowledgement

The authors thank SRM College of Agricultural Sciences for their support.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ENDOCRINE DISRUPTIVE PROFILE OF BISPHENOL S - *IN SILICO* ANALYSIS

Đurić L.[1], Milanović M.[1], Milošević N.[1], Milić N.[1]*

[1]University of Novi Sad, Faculty of Medicine, Department of Pharmacy, Hajduk Veljkova 3, Novi Sad, Serbia, (*e-mail: larisa.djuric@mf.uns.ac.rs)

Abstract: Bisphenol A (BPA) is increasingly being replaced by structurally and functionally similar analogues, which are introduced into production and marketed as "BPA-free". Bisphenol S (BPS), the primary BPA substitute, is widely used in thermal paper, coatings, dyes, and food-contact plastics, including infant bottles. Its environmental and biological concentrations are increasing, despite its presumed greater stability and lower migration potential than BPA. Given its structural similarity to BPA, BPS may share comparable toxicological properties. However, scientific evidence on its biological effects remains insufficient and inconsistent to draw definitive conclusions. Hence, the aim of this study was to assess *in silico* the endocrine-disrupting potential of BPS relative to BPA. Binding affinities of BPS and BPA to the estrogen receptors α and β (PDB ID 7UJO and 5TOA), androgen receptor (PDB ID 4K7A), mineralocorticoid receptor (PDB ID 5MWY), glucocorticoid (PDB ID 3BQD) as well as thyroid receptors α and β (PDB entry codes1NAV, and 1NAX) were predicted with the GOLD molecular docking software and reported as ChemPLP fitness scores. Visualizations of two-dimensional protein-ligand interactions were generated with the academic version of the MAESTRO Schrödinger software. Binding affinities of BPS for the respective analyzed receptors were slightly lower than those of BPA, with the highest ChemPLP scores observed for thyroid receptor α (ChemPLP 63.03). Protein-ligand interaction visualizations, however, showed largely comparable binding patterns between the two compounds. BPS like BPA formed multiple hydrogen bonds and π–π interactions within the ligand-binding domains of the studied receptors. It is worth noting that BPS formed one additional hydrogen bond with estrogen receptor α relevant amino acid residues, implying the better stabilization of the protein-ligand complex in compared to BPA. The obtained results indicate that BPS exhibits binding affinities and interaction patterns comparable to BPA, suggesting a potential for similar endocrine-disrupting activity.

Keywords: *Bisphenol S; Endocrine disruptors; Molecular docking; Nuclear receptors.*

Acknowledgement

This work was supported by Provincial Secretariat for Higher Education and Scientific Research, AP Vojvodina, Republic of Serbia [Grant number 003794555 2025 09418 003 000 000 001 01 001].

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ELECTROCHEMICAL REMOVAL OF TRICHLOROETHYLENE

Plavšin L.[1], Duduković N.[1], Apostolović T.[1], Zrnić Tenodi K.[1], Watson M.[1], Agbaba J.[1]*

[1]University of Novi Sad Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, (*e-mail: lea.plavsin@dh.uns.ac.rs)

Abstract: Trichlorethylene (TCE) belongs to the group of chlorinated volatile organic compounds and is most often used as a solvent in industry. TCE is a highly toxic and persistent compound, prone to long-term persistence in the environment and migration into groundwater. Due to frequent industrial leaks and degradation of other chlorinated organic compounds, TCE is a significant contaminant of aquatic ecosystems. The International Agency for Research on Cancer has classified TCE as a probable carcinogen (group 2A), with well-documented adverse effects on the nervous, immune, and other organ systems. Therefore, the development of efficient, environmentally friendly methods for removing TCE from aquatic ecosystems is of great importance. This paper examines the effectiveness of the electrochemical decomposition of TCE in a synthetic water matrix that was prepared to simulate the conditions of the groundwater of the Strand water source. The experiments were performed in a batch electrochemical reactor consisting of four anodes made of Ti coated with Ir and Ru oxides and six cathodes made of Ti. The experiments were conducted using a constant current of 60 mA for 60 minutes. The treatment showed a very high efficiency, with more than 95% TCE removal achieved after only 20 minutes. The obtained results indicate the possibility of applying electrochemical processes in the removal of TCE from contaminated waters.

Keywords: *Water treatment; Electrochemical treatment; Trichloroethylene.*

Acknowledgement

This research was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia under the Eureka program (SafeWat, 17243) and through Grants No. 451-03-137/2025-03/200125 and 451-03-136/2025-03/200125, as well as Contract No. 451-03-1193/2024-03/2/3381.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

AI-DRIVEN SMART WASTE MANAGEMENT SYSTEM FOR SUSTAINABLE CITIES

Linalraj V.[1], Kishore S.[2]*

[1]Department of Energy and Environmental Engineering, Agriculture college and research institute, TNAU, Coimbatore, India (*e-mail: linalraj507@gmail.com)

[2]Department of Energy and Environmental Engineering, Agriculture college and research institute, TNAU, Coimbatore, India

Abstract: Rapid urbanization has intensified challenges in municipal solid waste handling, leading to increased landfill loads, rising greenhouse gas emissions, and reduced environmental quality in cities. This study proposes an AI-driven smart waste management system aimed at improving waste segregation efficiency, optimizing logistics, and supporting sustainable urban planning. The system integrates computer vision for real-time automatic waste identification, IoT-enabled smart bins for monitoring fill levels, and a machine-learning route optimization model for waste collection vehicles. Real-time data streams allow dynamic scheduling, reducing redundant trips and fuel consumption. Simulation results indicate that the model can enhance segregation accuracy by 25–40%, lower operational costs, and significantly reduce CO_2 emissions through optimized routing. The proposed approach directly supports circular-economy principles and aligns with sustainability goals by promoting efficient recycling, minimizing landfill dependency, and improving overall urban environmental health. The findings demonstrate that incorporating artificial intelligence into municipal waste systems can transform traditional waste management processes into cleaner, smarter, and more sustainable city solutions.

Keywords: *Artificial intelligence; Smart waste management; Sustainability; Circular economy; Urban environment.*

Acknowledgement

The authors would like to acknowledge the support provided by the Institution .We thank the faculty mentors and resources offered by the department are gratefully acknowledged.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ANALYTICAL CHALLENGES AND VALIDATION OF METHODS FOR THE DETERMINATION OF BISPHENOL A AND S IN WATER

Kuč M.[1], Marjanović Srebro T.[1], Simetić T.[1], Molnar Jazić J.,[1] Tubić A.[1], Agbaba J[1].*

[1] University of Novi Sad - Faculty of Sciences, Departmant of Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovića 3, Novi Sad, Serbia, (*e-mail: marija.kuc@dh.uns.ac.rs)

Abstract: Bisphenol A (BPA) and bisphenol S (BPS) represent an emerging class of environmentally relevant micropollutants whose occurrence in surface and groundwater requires reliable and highly sensitive analytical methods. While BPA has long been recognized as a priority contaminant, the growing use of BPS as its replacement necessitates parallel monitoring, further increasing analytical complexity. In this work, an internally validated GC/MS method is presented for the simultaneous determination of BPA and BPS in water following liquid–liquid extraction and derivatization with acetic anhydride. Special emphasis was placed on optimizing sample preparation and derivatization conditions. The optimal procedure-100 mL sample volume, two-step extraction, and 15-min derivatization yielded the highest efficiency and substantially improved GC/MS sensitivity. The method was subsequently validated for both compounds in the mixture. Method performance was assessed through linearity, limits of detection and quantification, repeatability and analytical method bias. The developed method exhibited good linearity across the relevant concentration range (R^2 0.9837 for BPA and R^2 0.9686 for BPS). Detection and quantification limits were in the low µg/L range, enabling reliable determination at relevant concentrations in water. Method and instrument repeatability were below 5% for both analytes, while method bias was 14% for BPA and 13% for BPS.

Keywords: *Method validation; Bisphenol A; Bisphenol S; GC/MS.*

Acknowledgement

The authors gratefully acknowledge the financial support of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia Grants No. 451-03-137/2025-03/ 200125 & 451-03-136/2025-03/200125, as well as Contract No. 451-03-813/2024-03/3353.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ISOTOPIC EVIDENCE OF NITROGEN DYNAMICS IN OXIC AND ANOXIC GROUNDWATER

Perović M.[1], Mitrović T.[2]*

[1] Jaroslav Černi Water Institute, Jaroslava Černog 80, 11226 Belgrade, Serbia (*e-mail: marija.perovic@jcerni.rs)

[2] Institute of Physics Belgrade, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia

Abstract: Groundwater is a very important resource, providing nearly half of the world's drinking water and supporting around 70% of agricultural needs. Sustainable management requires understanding groundwater origin, age, flow paths, and recharge dynamics. Environmental isotopes, particularly stable isotopes, offer powerful tools for tracing these processes, identifying pollution sources, and evaluating contaminant transport. Nitrate is one of the most widespread groundwater pollutants, originating from untreated sewage, fertilizers, manure application, and the oxidation of soil organic matter. Due to a wide range of sources and the prevalence of different transformation processes under specific conditions, accurate interpretation requires a comprehensive analysis of hydrogeological, physicochemical, microbiological, and isotopic data. During nitrification, ammonia is oxidized to nitrate via nitrite, preferentially incorporating lighter isotopes. Denitrification reduces nitrate to nitrogen gas and enriches the residual nitrate in heavier isotopes. Dissimilatory nitrate reduction to ammonium may compete with denitrification under high carbon-to-nitrate ratios, while anaerobic ammonium oxidation and ammonium oxidation coupled to Fe(III) reduction further influence nitrogen cycling in oxygen-depleted environments. This study highlights contrasting nitrogen isotopic signatures in the oxic Ključ spring and the anoxic Kovin–Dubovac drainage system, revealing differences in nitrogen origin and transformation processes in shallow, agriculture-influenced groundwater. At the oxic site, $\delta^{15}N–NO_3^-$ values ranged from +6.70 to +12.90‰ and $\delta^{18}O–NO_3^-$ from +0.28 to +9.70‰, revealing three distinct influence zones: sewage and manure impact, mixed sewage–fertilizer inputs, and riparian denitrification. At the anoxic site, $\delta^{15}N–NH_4^+$ values were lower from −0.84 to +6.93‰, indicating contributions from soil organic matter mineralization, fertilizer application, and autotrophic denitrification. The research assesses the impact of agricultural practices and the aquifer's potential for nitrogen compound attenuation and self-purification.

Keywords: *Groundwater; Nitrogen isotopes; Nitrogen transformation processes.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

MONITORING AND EVALUATION OF LEAD AND NICKEL CONTAMINATION IN SURFACE WATERS IN SERBIA

Perović M.[1], Mitrović T.[2]*

[1] Jaroslav Černi Water Institute, Jaroslava Černog 80, 11226 Belgrade, Serbia (*e-mail: marija.perovic@jcerni.rs)

[2] Institute of Physics Belgrade, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia

Abstract: The quality of surface waters in Serbia is systematically monitored by competent authorities such as the Environmental Protection Agency. For the purposes of this publication, data on lead (Pb) and nickel (Ni) concentrations of the 79 water bodies (2016-2022) were selected as indicators of the trends in surface water quality (Environmental Protection Agency, 2016–2022). Evaluation of the water quality was based on the limit values for priority and priority hazardous substances in surface waters (Environmental Quality Standards - EQS) which are established by the "Official Gazette of RS", No. 24/2014. EQS is concentration which cannot be exceeded to protect the environment and human health. The EQS is linked to the maximum allowed concentration (MDK) and to the values of average annual concentration (PGK) of priority substances. Descriptive statistics showed a median value of 1.0 µg/L for Pb and 3.9 µg/L for Ni. Considering both metals, only a few percent of the values exceeded the MDK values, while over 50 % of the results indicate low pollution. The most polluted water bodies were detected on the rivers Ibar (profiles Raška and Kraljevo), Velika Morava (profile Ljubičevo bridge), and Tisa (profile Titel). In summary, the continuous monitoring of surface water quality in Serbia ensures compliance with regulatory standards aimed safeguarding environmental and human health. While elevated Pb and Ni concentrations do exist, overall trends suggest relatively low pollution levels in the majority of monitored water bodies.

Keywords: *Surface water quality; Lead (Pb); Nickel (Ni); Environmental quality standards (EQS); Monitoring.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

IN VITRO HEMOCOMPATIBILITY AND ANTIOXIDATIVE ACTIVITY OF QUERCETIN

Janić M.[1], Filipović Tričković J.[1], Valenta Šobot A.[1], Radošević K.[1], Kostić M.[1], Momić T.[1]*

[1]University of Belgrade, VINČA Institute of Nuclear Sciences – National Institute of the Republic of Serbia, Mike Petrovića Alasa 12–14, Belgrade, Serbia, (*e-mail: marijana.janic@vin.bg.ac.rs)

Abstract: Consumption of plant polyphenols has been reported to confer a variety of health benefits, including reduced cancer risk and coronary heart disease mortality. Oxidative damage is associated with the pathological development in the cardiovascular system, and flavonoids, a class of polyphenolics, are known to have antioxidant activity against a range of free radicals. Quercetin (Q) is a flavonoid that is commonly found in vegetables and plants. It can be used in co-treatment and as a supplement in many diseases, such as ischemic heart disease, atherosclerosis, liver fibrosis, and kidney failure. Erythrocytes are frequently used as a biological model to assess the hemolytic, anti-hemolytic, and antioxidant potential of various compounds because their membranes are rich in polyunsaturated fatty acids, making them highly sensitive to oxidative stress. Furthermore, erythrocytes are the first targets of free radical attack due to their potential to generate reactive oxygen species (ROS) and the redox reactions of hemoglobin associated with oxygen transfer. In the present case, the *in vitro* hemolytic activity of quercetin was evaluated on human red blood cells (RBC). Antioxidant activity of quercetin was measured by neutralizing DPPH and ABTS radicals. Quercetin showed hemocompatibility at concentrations below 80 μg/mL, whereas acceptable hemolysis limits are less than 3.9%. The highest concentration (500 μg/mL) treatment caused 8.3% hemolysis. In both antioxidant DPPH and ABTS assays, IC_{50} values were 0.598 μg/mL and 0.415 μg/mL, respectively. The results of this study indicated that hemocompatibility was attributed to quercetin's antioxidant status, which protected erythrocytes from oxidative damage and hemolysis.

Keywords: *Quercetin; Hemolysis; Radical scavenging; Erythrocytes.*

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Grant no. 451-03-136/2025-03/200017 and 451-03-3627/2025-03/3456).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

NOVEL NATURAL DEEP EUTECTIC SOLVENT FOR *SALVIA OFFICINALIS* EXTRACTION AND ANTIOXIDATIVE ACTIVITY

Janić M.[1], Radošević K.[1], Kostić M.[1], Zdolšek N.[1], Brković S.[1], Momić T.[1], Valenta Šobot A.[1], Filipović Tričković J.[1]*

[1]University of Belgrade, VINČA Institute of Nuclear Sciences – National Institute of the Republic of Serbia, Mike Petrovića Alasa 12–14, Belgrade, Serbia, (*e-mail: marijana.janic@vin.bg.ac.rs)

Abstract: Traditional extraction of plant material with alcohols and other organic solvents can yield extracts with varying degrees of toxicity to human cells, tissues, and the environment. In that light, natural deep eutectic solvents (NADES) are considered powerful and sustainable green solvents. NADES consist mainly of two compounds: an ionic bond acceptor and an ionic bond donor. One of the first and well-known ionic bond acceptors is choline chloride (ChCl). To the best of our knowledge, the use of ascorbic acid as an ionic bond donor has not been widely reported. Numerous studies have investigated polyphenols derived from various plant materials using NADES, which exhibit better extractability and lower cytotoxicity than those extracts obtained with conventional solvents. Leaves of sage (*Salvia officinalis* L., family Lamiaceae) are often used in traditional medicine to treat a range of health conditions, from oral and dental pathologies to rheumatic and cognitive disorders. In this study, we used sage extracts obtained with choline chloride mixed with ascorbic acid (ChCl:AA (2:1)), whose structure was confirmed with FTIR and UV-Vis spectra. Extraction was obtained under different extraction times (60 and 90 min) at a constant temperature, and NADES was diluted with 10% water for better solubility and viscosity. The total flavonoid content (TFC) of the extracts was measured, and their antioxidant activity was determined using DPPH and ABTS assays. Based on our results, a shorter extraction time yielded a higher TFC. In both DPPH and ABTS assays, lower IC_{50} values and higher antioxidant potential were observed with the extract obtained at shorter extraction time. The results of this study suggest that prolonged extraction time may lead to extract degradation.

Keywords: *Natural deep eutectic solvent; Sage; Sustainable extraction; Flavonoids; Antioxidants.*

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Grant no. 451-03-136/2025-03/200017 and 451-03-3627/2025-03/3456).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

COMPARATIVE EVALUATION OF THE CeF_3 AND GD-DOPED CeF_3 NANOPARTICLES INDUCED CYTOTOXICITY IN HeLa CELLS

Kostić M.[1], Filipović Tričković J.[1], Janić M.[1], Radošević K.[1], Momić T.[1], Tošić M.[1], Valenta Šobot A.[1]*

[1]„VINČA" Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Republic of Serbia (*e-mail: kostic.mila@vin.bg.ac.rs)

Abstract: Nanomaterials based on rare-earth fluorides, such as cerium(III) fluoride (CeF_3) and gadolinium-doped (Gd-doped) fluoride nanoparticles, exhibit the ability to modulate oxidative stress, mitochondrial function, and cellular damage, thereby selectively enhancing the radiosensitivity of tumor cells. Previous studies have demonstrated that Gd-based fluoride nanomaterials could possess pronounced radiosensitizing potential accompanied by increased production of reactive oxygen species and radiation-induced apoptosis in cancer cells. In line with these findings, the aim of this study was to evaluate the cytotoxic effects of CeF_3 and CeF_3:Gd (15%) nanoparticles using the XTT viability assay on the human HeLa cell line. The nanoparticles were applied at concentrations of 0.5, 1, 2, 4, and 8 mg/mL, and cell viability assessed following 24 hours of treatment. The results show that CeF_3 induces a mild, dose-dependent reduction in viability (76–87%), indicating low cytotoxicity. In contrast, CeF_3:Gd (15%) nanoparticles exhibit a markedly stronger cytotoxic effect (56–72%), with a linear decline in viability and a substantially lower IC_{50} value. These findings indicate that gadolinium doping significantly enhances the cytotoxic potential of CeF_3 nanoparticles toward HeLa cells, suggesting that Gd-modified fluoride nanomaterials may represent a more effective platform for the development of antitumor and radiosensitizing agents. The results provide a basis for future studies focusing on the underlying mechanisms of action and the evaluation of combined therapeutic approaches.

Keywords: *Cerium (III) fluoride (CeF_3); Gadolinium-doped CeF_3 Nanoparticles; Cytotoxicity.*

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Grant no. 451-03-136/2025-03/200017 and 451-03-3627/2025-03/3456).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

IMPLEMENTING CIRCULAR ECONOMY PRINCIPLES IN SERBIAN INDUSTRY: A REVIEW OF LEADING BEST-PRACTICE CASES

Jovanov M.[1]*

[1]University of Novi Sad, Technical Faculty "Mihajlo Pupin", Đure Đakovića bb, 23000 Zrenjanin, Serbia, (*e-mail: milica.jovanov@tfzr.rs)

Abstract: Circular economy (CE) is considered one of the most promising approaches for achieving Sustainable Development Goals, particularly SDG 9 (industry, innovation, infrastructure) and SDG 12 (responsible consumption and production), thanks to closed-loop systems, resource optimization, and waste valorization. While Serbia remains in early stages of systematic CE implementation, individual companies demonstrate readiness for applying sustainable business models across different sectors. This study aimed to analyze successful examples of circular economy application in Serbian industry, identifying key advantages and challenges. Considering practical implementation, "Brzan plast" d.o.o. (Brzan) processes waste from PET packaging and plastic film through collection, cutting, washing, drying, and regranulate production, manufacturing construction film and bags with up to 50% cost savings compared to new granulate production while preventing over 5% of plastic waste landfill deposition. "Strauss Adriatic" d.o.o. (Šimanovci) implemented heating system using coffee husk briquettes as by-product from coffee processing, replacing fossil fuels with biomass and reducing CO_2 emissions. "Newpen" d.o.o. (Smederevska Palanka) produces graphite pencils and crayons from recycled or unsold newspapers, reducing wood consumption and creating innovative product design with educational social value. "Belinda animals" d.o.o. (Belgrade) developed biological plastic recycling method using specific larvae species, offering potential biotechnological alternative to traditional recycling and addressing microplastic waste reduction. Based on obtained results, it can be concluded that Serbian industry possesses capacity for applying circular principles, with analyzed examples showing ecological benefits (pollution reduction, CO_2 emission decrease, natural resource conservation), economic advantages (up to 50% production cost savings, reduced dependency on primary raw materials, new revenue streams), and social value (green job creation, educational programs, sustainable product promotion), yet broader implementation requires systemic support through regulatory incentives, access to financing, strengthening science-industry collaboration, and creation of regional recycling center networks enabling model replication in agriculture, construction, food processing sectors, and local communities throughout Serbia.

Keywords: *Circular economy; Best practices; Serbian industry; Recycling innovation; Sustainable production.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

CIRCULAR ECONOMY AS AN INSTRUMENT FOR ENVIRONMENTAL PROTECTION: IMPLEMENTATION ANALYSIS IN SERBIA

Jovanov M.[1]*

[1]University of Novi Sad, Technical Faculty "Mihajlo Pupin", Đure Đakovića bb, 23000 Zrenjanin, Serbia, (*e-mail: milica.jovanov@tfzr.rs)

Abstract: Contemporary global economic trends face growing challenges related to excessive consumption of natural resources, environmental degradation, and consequences of climate change. Circular economy (CE) is considered one of the most promising approaches within the EU's "European Green Deal" and "Action Plan for Circular Economy," making it the main instrument for achieving climate neutrality by 2050. This study aimed to analyze the current state of circular economy in Serbia, with particular focus on production processes and identification of advantages and barriers under various aspects (legislative framework, infrastructure, institutional capacity, statistical indicators). Analysis was conducted through review of strategic documents, relevant legislation, and statistical data examination from 2015-2025 period with comparative assessment against EU policies. Considering current situation, Serbia made progress through adoption of the Roadmap for Circular Economy (2020, first country in Western Balkans), introduction of concepts "by-product" and "end-of-waste status" into Law on Waste Management, and Program for Waste Management 2022-2031, yet municipal waste recycling rate declined to 15.5% in 2023 (from nearly 18% in 2022) compared to EU average of 45-50%, CO_2 emissions from fuel combustion stabilized around 45 million tons annually (2015-2020) after peak of 56 million tons (2004), and hazardous waste generation reached 4,493 kg per capita in 2022 showing alarming upward trend. Based on obtained results, it can be concluded that Serbia possesses strategic framework and initial initiatives, but accelerated development requires strengthening regulatory harmonization with EU directives (Waste Framework Directive 2008/98/EC, Packaging Directive 94/62/EC), developing recycling infrastructure and collection systems, improving institutional coordination between government levels, enhancing inspection capacity, raising public awareness through educational campaigns, and mobilizing European funding mechanisms (IPA, Horizon Europe, Green Deal) to achieve EU targets of 55% recycling by 2025, 65% by 2030, and maximum 10% landfilling by 2035 for ensuring long-term sustainability and competitiveness aligned with European standards.

Keywords: *Circular economy; European integration; Waste management; Recycling; Legislative harmonization.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

GREEN EXTRACTION OF *SATUREJA HORVATII* (LAMIACEAE): PRELIMINARY CHEMICAL AND ANTIOXIDANT ANALYSIS

Vidić M.[1], Grujić-Letić N.[1], Teofilović B.[1], Gligorić E.[1]*

[1]University of Novi Sad, Faculty of Medicine, Department of Pharmacy, Hajduk Veljkova 3, Novi Sad, Serbia (*e-mail: milica.vidic@mf.uns.ac.rs)

Abstract: *Satureja horvatii* Šilić (Lamiaceae) is an underexplored endemic species of the Balkan Peninsula, with potential medicinal applications due to the presence of phenolic acids and flavonoids. Increasing environmental awareness has impelled the development and application of green extraction methods in combination with eco-friendly solvents. Natural deep eutectic solvents (NADES) are non-toxic, sustainable, reusable, biodegradable, and economically accessible solvents that are effective in extracting phenolic compounds. The present study investigated the effect of lactic acid-based NADES ($NADES_{LA}$), combined with the green ultrasound-assisted extraction (UAE), on the preliminary chemical composition and antioxidant potential of *S. horvatii* aerial parts. The efficacy of NADES was further compared with ethanol and water. Two $NADES_{LA}$, lactic acid: glucose (5:1) and lactic acid: glycerol (1:1) systems were synthesized through the heating and stirring method, with a water content of 20%. A 30-minute UAE employing $NADES_{LA}$, ethanol, and water as extraction solvents resulted in four extracts of *S. horvatii*. The preliminary chemical composition and antioxidant activity of the extracts were determined using spectrophotometric methods. The highest total phenolic content was obtained using the lactic acid: glycerol NADES, whereas the lactic acid: glucose NADES exhibited the strongest antioxidant activity in the cupric reducing antioxidant capacity (CUPRAC) assay. The highest total flavonoid content and the greatest 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity were achieved through UAE with ethanol. Furthermore, $NADES_{LA}$ enabled efficient flavonoid extraction, accompanied by pronounced DPPH radical scavenging activity. Aligning with the principles of green chemistry, NADES represent an effective and sustainable alternative to conventional solvents.

Keywords: *Satureja; Green extraction; NADES; Antioxidant potential.*

Acknowledgement

This work was supported by the Provincial Secretariat for Higher Education and Scientific Research, Province of Vojvodina (Grant No. 142-451-3474/2023).

HOW DO YOU WANT YOUR CUP OF TEA - WITH PESTICIDE RESIDUES?

Gajić U.[1], Janković M.[1]*

[1]University of Novi Sad Faculty of Medicine, Hajduk Veljkova 3, 21000 Novi Sad, Serbia (*e-mail: mina.jankovic@mf.uns.ac.rs)

Abstract: Tea is among the most widely consumed beverages globally, appreciated for its sensory attributes and bioactive compounds. Due to its extensive international trade, tea is subject to rigorous safety monitoring. Pesticide residues in tea are a potential human health concern due to the direct manufacturing of tea leaves after harvest without thorough washing, leading to the concentration of residues on the leaves, which can transfer to the tea infusion during brewing. This study evaluates pesticide residue contamination patterns in tea using data from the Rapid Alert System for Food and Feed (RASFF), an EU system for exchanging information on food safety risks. Between January 2020 and August 2025, 293 RASFF notifications related to tea were recorded. Of these, 161 (55%) concerned pesticide residues. Over 1000 pesticides are in use around the world. During this study period, the most frequently detected compounds in tea were chlorpyrifos and tolfenpyrad (44 cases), followed by anthraquinone (38), dinotefuran, and lambda-cyhalothrin (37 each). The majority of the notified teas originated from China, with 82 cases, which constituted 51% of all reported cases concerning pesticide residues. Other commonly represented countries of origin were India and Sri Lanka, with 10 cases each (6.2%), and Taiwan with 9 (5.6%). Although the health risk of 28% of the findings could not be decided, an important number of cases have been marked as serious and potentially serious (23.6% and 21.7%, respectively). Subsequently, a significant number of cases, 63.4%, resulted in border rejection. These findings underscore the need for enhanced monitoring of pesticide residues, especially in certain tea-exporting countries, to mitigate health risks and ensure food safety in international trade. The right approach must concern the development of sustainable systems that minimize the use of synthetic pesticides and fertilizers, relying on natural pest control and integrated nutrient management.

Keywords: *Food safety; Public health; RASFF; Sustainability; Tea.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

GRANITE POWDER AS CEMENT ALTERNATIVE

*Alendar M.1**

[1]Džemal Bijedić University of Mostar, Sjeverni logor b.b. Mostar, Bosnia and Herzegovina, (*e-mail: mirza.alendar@outlook.com)

Abstract: In a world that is still adjusting to climate change and average global temperature rise, civil engineering and construction industry are playing a significant part – but not one of a good guy. Its negative effect, displayed with alarming 8% CO_2 emission in Europe by cement industry, cannot be neglected. Like all other industries operating worldwide, the construction industry also inevitably generates certain amounts of waste. Estimates indicate that waste from this industry accounts for approximately 40% of total global waste. More than 100 million tonnes of concrete structures are demolished annually around the world, clearly demonstrating the importance of seeking alternative materials. In our faculty's laboratory, we conducted research and testing of granite powder as eco-friendly alternative for cement in concrete mixtures. Granite powder is a residue from cutting stone. As such, it's classified as waste at stonemason's, to be collected in specially designed pits in a mud form- this is a result of water that's being used during stone cutting process. Granite powder, as potential substitute for cement, is of natural origin and its extraction does not have negative effect on environment. For the sake of testing, we designed six mixtures with different quantities of granite powder. Our research indicated that, if added at a certain percent, granite powder can shorten the time needed for mixture to bind. When it comes to stress and tension testing, there was no significant drop in performances of hardened samples with lower percentage of granite powder compared to the conventional concrete. It is our conclusion that granite powder, along with other natural residues from stones, definitely deserves our attention, further research and possible application.

Keywords: *Eco-friendly; Cement; Granite powder.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ROLE OF BIM (BUILDING INFORMATION MODELING) IN CIRCULAR GREEN ECONOMY

*Alendar M.1**

[1]Džemal Bijedić University of Mostar, Sjeverni logor b.b. Mostar, Bosnia and Herzegovina, (*e-mail: mirza.alendar@outlook.com)

Abstract: The construction industry is one of the biggest factors in every country's economy, but it's also the one that has great negative impact on environment. It creates a lot of waste during project creation phase where a lot paper is used even in this modern digital time of mighty software programs. A significant drop in information sharing occurs during transition from one phase of the project to another. First big information gap always takes place during crossing from project to building phase. We could aid this by implementing modern software programs that are using models with important information. Another benefit would be optimized building maintenance, which is the longest and most expensive phase of every object (60% of costs contributed to the grand total). Of course, it's not expected that BIM solves all of these problems, but it can help reduce them in the initial stages of the project. BIM (Building Information Modelling) is in its core – an information. Therefore, it is vital for our world's sake that the information (BIM) is formed, treated and shared in a right way so that we can be on the sustainability side of things and leading a correct approach to this form of digitalization in green economy.

Keywords: *Project; BIM; Information; Model, Software.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ORGANOCHLORINE PESTICIDE RESIDUES IN HONEY FROM SOUTHWESTERN ETHIOPIA

Jebel A.M. [1*], *Ambelu A.*[1], *Malu A.*[1], *Mokenen S.*[1] *and Gure A.*[1]

[1]Jimma University, Institute of Health, Department of Environmental Health Sciences and Technology, Ethiopia, (*e-mail: mohammedabbajabal@gmail.com)

Abstract: Pesticide application in agricultural practices can contaminate soil, air, water, and flowering plants from which honeybees collect nectar. This contamination may introduce toxic chemicals into honey, posing risks to the food chain and human health through secondary exposure. In Ethiopia, information on pesticide residues in honey under local conditions is limited and incomplete. Therefore, this study aimed to determine the presence and levels of organochlorine pesticide residues in honey collected from selected sites in the honey belt of southwest Ethiopia. An experimental study design was employed. A total of 22 honey samples were collected from 11 sites across four zones of southwest Ethiopia during major and minor harvesting seasons. The samples were transported to Jimma University for laboratory analysis. Dispersive Liquid–Liquid Microextraction (DLLME) was used for residue extraction, and analysis was performed using Gas Chromatography equipped with an Electron Capture Detector (GC-ECD) at the Laboratory of Environmental Science and Technology. Nine organochlorine pesticides were investigated. Organochlorine pesticide residues were detected in samples from seven of the sampling sites. Seven different organochlorine pesticide residues were identified in samples collected from Channa during the major harvesting season, with DDT and heptachlor epoxide showing the highest concentrations. In Channa, 69.29% of samples collected during the major harvesting season were contaminated with DDT. Similarly, samples collected during the minor harvesting season from Limmu showed DDT residues in 17.81% of the samples. Overall, 54.35% of the analyzed honey samples exceeded the maximum residue limits (MRLs), 9.09% were below the MRLs, and 36.36% showed no detectable residues. This study highlights the need for comprehensive research and regulatory attention to pesticide use and its effects on honeybees and honey quality in Ethiopia.

Keywords: *Beekeeping site apiary; Organized cooperative; Api millfera honeybee; Honey flora; Pesticide residue.*

Acknowledgements

First of all I would like to thank my lord Allah who helped me throughout my life. I am very thankful to my advisors: Dr. Argew Ambelu Asgdom Malu, Dr. Seblework Mokenen and Dr. Abera Gure for their help in designing this thesis report by guiding me thoroughly and giving me unreserved advice and also for their moral as well as technical supports and encouragement from start of this work up to end.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ASSESSING ENVIRONMENTAL DEGRADATION AND HEALTH RISKS LINKED TO SOLID WASTE PRACTICES IN SOKOTO METROPOLIS

Musa Y.F.[1], Job J.[1], Aliyu I.[1]*

[1]Department of Geography, Usmanu Danfodiyo University, Sokoto, Nigeria, (*e-mail: musa.yakubu@udusok.edu.ng)

Abstract: Solid waste mismanagement remains a critical environmental and public health challenge in rapidly growing urban areas of Nigeria, including Sokoto Metropolis. This study assessed the extent to which solid waste practices contribute to pollution and disease burden in the metropolis. A descriptive survey was conducted using 120 questionnaires, of which 110 were valid, representing a 91.7% response rate. Households were found to generate an estimated 3 - 4 kg of solid waste per day, yet only about one-third (≈34%) of respondents reported regular waste collection. More than 70% confirmed open dumping as the dominant disposal method, while over 60% indicated a lack of functional waste bins, reflecting major infrastructural deficits. Environmental results show that approximately 75% of respondents experienced drainage blockage and flooding linked to waste accumulation, 78% reported persistent foul odours and air pollution, and 73% noted open burning as a common practice. Water contamination was reported by 69% of participants, while over 80% observed increased rodent and insect infestation around waste sites. Health-related findings indicate that residents living near dumpsites experience significantly higher cases of malaria, cholera, typhoid fever, respiratory problems, and skin infections, with vector-borne and sanitation-related diseases accounting for more than 70% of reported illnesses. Children and scavengers were identified as the most vulnerable groups. Institutional responses were weak, with only about 30% of respondents acknowledging effective enforcement of waste regulations or regular sensitization campaigns. The study concludes that waste management in Sokoto Metropolis is ineffective and significantly degrades the urban environment, poses substantial risks to environmental integrity and public health. It recommends improving waste infrastructure, strengthening institutional capacity, enhancing public awareness, promoting private sector engagement, and adopting modern waste management technologies to mitigate escalating environmental and health hazards.

Keywords: *Solid waste management; Environmental degradation; Public health risks; Urban pollution; Waste disposal practices.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

PROBLEMS AND CHALLENGES OF HAZARDOUS WASTE MANAGEMENT IN SERBIA

Stevanović N.[1], Mihajlović V.[2]*

[1] University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia, (*e-mail: nikolastevanovic726@gmail.com)

[2] Department of Environmental Engineering, Technical Faculty "Mihajlo Pupin", Đure Đakovića bb, 23000 Zrenjanin, University of Novi Sad, Serbia

Abstract: Hazardous Waste Management (HWM) in Serbia represents a critical, multidimensional challenge (ecological, health, economic, and social). Due to its physical and toxic properties, HW requires specialized handling in accordance with the principles of prevention, the waste hierarchy, and the "polluter pays" principle. The aim of this study is to analyze the current situation, identify key obstacles, and propose directions for improving the HWM system in the Republic of Serbia. Although the classification of HW in Serbia is harmonized with EU standards (including the Basel Convention and EWC), practical implementation remains weak and inconsistent. A key deficiency is the absence of a comprehensive national infrastructure for the collection, treatment, and safe disposal of HW. This result in waste being stored in inadequate conditions, mixed with other waste streams, and extremely limited domestic capacity for treatment. Inadequate management carries serious ecological and health risks, including contamination of soil and drinking water. Economically, the lack of a system results in higher long-term costs (remediation, healthcare) and financial dependence on expensive HW export. The problem is exacerbated by insufficient rule enforcement, lack of reliable data, and generally weak institutional capacity, creating a significant gap between legislative ambitions and the reality on the ground. The low level of public awareness and education, coupled with the perception of HW exclusively as an industrial problem, excludes households and smaller enterprises from solving the issue, even though active public participation is crucial for a sustainable system. Serbia must strengthen its legal frameworks, develop modern treatment infrastructure, and improve monitoring systems. Therefore, HWM is not just an ecological obligation but a strategic opportunity for job creation, attracting investment, and reducing dependence, thereby ensuring compliance with international standards and sustainable economic and social development.

Keywords: *Waste hierarchy; Polluter pays principle; Legal framework.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

BIODEGRADABLE BIOPLASTICS FROM PLANT-BASED WASTE: A SUSTAINABLE SOLUTION TO REPLACE SINGLE-USE PLASTICS

Rathna R.[1], Sivasankari B.[2], Gangai Selvi R.[1], Sundar A.[2]*

[1]Department of PS&IT, AEC&RI, Tamil Nadu Agricultural University, CBE, TN, India (*e-mail: rrathna200214@gmail.com)

[2] Community Science College & Research Institute, Madurai, TN, India

[3] Department of Agricultural Economics, AC&RI , Madurai, TN, India

Abstract: The escalating global crisis of plastic pollution necessitates the urgent development of biodegradable alternatives derived from waste biomass valorization, where invasive weeds and agricultural residues traditionally considered environmental burdens can be transformed into functional bioplastics. Cellulose extraction from Parthenium hysterophorus through optimized acid-alkali-chlorination treatment achieves yields of 36.43% by weight, significantly exceeding baseline rates of approximately 21%, demonstrating efficient conversion of problematic plant species into high-value feedstock. Bioplastic films formulated from banana peel fiber exhibit impressive tensile strength of 31.3 MPa while achieving over 90% biodegradation within 30 days under soil-burial conditions, satisfying both mechanical performance and environmental compatibility requirements. Similarly, composite films combining banana-peel starch and sugarcane-bagasse cellulose demonstrate tensile strength of approximately 3.1 N/mm² with 44.8% weight-loss over 15 days in soil, indicating that multi-source agricultural waste blends achieve balanced mechanical-biodegradation properties suitable for short-lifecycle packaging applications. Collectively, these empirical findings establish waste-derived bioplastics as technically viable, economically rational, and ecologically responsible alternatives to petroleum-based polymers, offering dual environmental benefits through waste-stream diversion and reduced persistence pollution. Strategic adoption of these bio-based materials could systematically redirect diverse plant waste categories including invasive botanical species, fruit processing byproducts, and vegetable peel residues into sustainable packaging matrices and material solutions, thereby diminishing environmental burden while advancing circular economy principles through closed-loop biomass utilization and biodegradable product design frameworks.

Keywords: *Bioplastics; Waste valorization; Agricultural residues; Cellulose extraction; Sustainable packaging.*

Acknowledgement

The authors acknowledge the institutional support and resources that enabled the completion of this study.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

BIOCHAR AS A NATURE-BASED SOLUTION FOR SOIL RESTORATION AND ENVIRONMENTAL PROTECTION

Saranya R.[1], Niranjan R.[1], Lakshanya K.[1] and Ilakiya T.[1]*

[1] Department of Vegetable Science, SRM College of Agricultural Sciences, Baburayanpettai, Chengalpattu, Tamil Nadu, India (*e-mail: ilakiyatamil@gmail.com)

Abstract: Rapid waste accumulation, declining soil quality, and rising greenhouse gas emissions have accelerated the worldwide search for environmentally friendly, sustainable solutions. The thermal conversion of organic waste produces biochar, a stable, carbon-rich substance. It has become a promising tool for horticultural resource efficiency, soil restoration, and mitigating the effects of climate change. Its porous structure aids in the recovery of damaged agricultural and horticultural soils by increasing soil aeration, water retention, and nutrient retention. Biochar helps improve soil fertility and crop performance over time by enhancing the physical, chemical, and biological characteristics of soil. Beyond its benefits for agriculture, biochar is crucial for environmental preservation. Its capacity to trap organic pollutants and heavy metals helps clean soil and water, and its centuries-long carbon storage helps offset greenhouse gas emissions. Additionally, making biochar supports principles of the circular economy by turning agricultural and forestry waste into valuable soil additives. This process reduces waste disposal issues and encourages resource conservation. In sustainable horticulture, incorporating biochar offers a practical approach to boost soil resilience, lower environmental impacts, and maintain steady crop yields during changing climate conditions. Overall, biochar serves as a multifunctional and eco-friendly solution that improves soil health, supports climate resilience, and encourages environmentally sustainable horticulture practices.

Keywords: *Biochar; Sustainable horticulture; Soil health;carbon sequestration; Climate resilience.*

Acknowledgement

The authors thank SRM College of Agricultural Sciences for their support.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

PHYTOGENIC SYNTHESIS AND APPLICATIONS OF ZINC OXIDE NANOPARTICLES

Sowbarnika R.[1], Ilakiya T. [1], Thirugnanasambandham K.[2]*

[1] Department of Vegetable Science, SRM College of Agricultural Sciences, Baburayanpettai, Chengalpattu, Tamil Nadu, India (*e-mail: ilakiyatamil@gmail.com)

[2] Nammazhvar Organic Farming Research Centre, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Abstract: The phytogenic synthesis of zinc oxide (ZnO) nanoparticles is a sustainable and environmentally friendly method that employs bioactive chemicals from plant extracts as reducing, capping, and stabilising agents. This green synthesis process provides substantial benefits compared to traditional chemical and physical procedures by removing hazardous chemicals, decreasing energy usage, and improving biocompatibility. Phytochemicals found in leaves, stems, flowers, and fruits—such as flavonoids, phenolics, terpenoids, and alkaloids—promote fast nucleation and regulated development of ZnO nanoparticles, yielding stable and uniform nanostructures. These biosynthesised ZnO nanoparticles have exceptional functional capabilities, including potent antibacterial, antioxidant, photocatalytic, and anticancer activities, attributed to their elevated surface-area-to-volume ratio and distinctive optoelectronic features. Variables like plant species, extract concentration, pH, reaction duration, and temperature significantly affect nanoparticle dimensions, morphology, and stability. Despite their promise, obstacles persist in augmenting yield, sustaining repeatability, and guaranteeing consistent quality. Phytogenic ZnO nanoparticles serve as a potential foundation for many applications in agriculture, biomedicine, environmental remediation, and nanotechnology, facilitating the progress of more sustainable and safer nanomaterial production.

Keywords: *Green synthesis; ZnO nanoparticles; Plant extracts; Antimicrobial activity; Nanotechnology.*

Acknowledgement

The authors thank SRM College of Agricultural Sciences for their support.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

VALORIZATION OF OLIVE PITS AS BIOSORBENT: KINETIC STUDY OF Zn(II) SORPTION AT OPTIMAL pH

Mileta S.[1,2], Nuić I.[2], Ugrina M.[2]*

[1]Ivanal d.o.o., Gorička 19, Industrijska zona Podi, 22000 Šibenik, Croatia (*e-mail: suncica.mileta@gmail.com)

[2]Faculty of Chemistry and Technology, Department of Environmental Engineering, University of Split, Ruđera Boškovića 35, 21000 Split, Croatia

Abstract: Valorizing food industry by-products such as the olive pits, widely available in the Dalmatia region (Croatia) due to the high olive-oil production, enables their conversion from waste into efficient biosorbents for heavy metal removal. The kinetic study of Zn(II) sorption onto olive pits was conducted in a batch mode at a previously determined optimal pH = 5, at initial Zn(II) concentration of 1 mmol/L, sorbent dosage of 1 g/100 mL, particle size 0.56−1.00 mm, at room temperature (23 ± 2 °C) and at 230 rpm for 24 h. The experimental data were fitted to pseudo-first-order and pseudo-second-order kinetic models in both linear and nonlinear forms. The process exhibited a rapid initial sorption phase during the first 60–120 min, followed by equilibrium at approximately 24 h ($q_{e(exp)}$ = 3.31 mg/g). Nonlinear regression yielded more reliable kinetic parameters and indicated that the pseudo-second-order model provided a substantially better fit to the experimental data ($q_{e(cal)}$ = 2.87 mg/g, R^2 = 0.94) than the pseudo-first-order model ($q_{e(cal)}$ = 2.65 mg/g, R^2 = 0.87). Although the pseudo-second-order model provided the most accurate overall description, the discrepancy between experimental and model-fitted capacities indicates that neither kinetic model fully captures all adsorption stages. This behavior is typical for heterogeneous biosorbents such as olive pits, where surface reactions, film diffusion, and intraparticle mass transfer occur simultaneously. The observed deviation therefore suggests the presence of multi-step adsorption processes, likely involving both film and intraparticle diffusion rather than a single chemisorption-controlled mechanism, highlighting the need for more detailed kinetic study.

Keywords: *Olive pits; Zn(II); Biosorption; Sustainable water treatment; Kinetic models.*

Acknowledgement

This research was funded by the European Union through the “NextGenerationEU” (project ANTARES, IP-UNIST-28).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

THERMAL PROPERTIES AND STABILITY PROFILE OF HYDRATED CHOLINE CHLORIDE–GLYCEROL NADES

Grujić T.[1], Papović S.[2], Milidragović J.[1], Đuran I.[3], Grujić-Letić N.[1], Gligorić E.[1], Teofilović B.[1]*

[1]University of Novi Sad, Faculty of Medicine, Department of Pharmacy, Hajduk Veljkova 3, Novi Sad, Serbia, (*e-mail: 202070@mf.uns.ac.rs)

[2]University of Novi Sad, University of Novi Sad Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovća 3, Novi Sad, Serbia

[3]Clinic of Nephrology and Clinical Immunology, University Clinical Centre of Vojvodina, Novi sad, Serbia

Abstract: Natural deep eutectic solvents (NADES) have gained attention as sustainable and biocompatible media for extraction, formulation, and processing of biologically active compounds. Among them, glycerol-based systems offer enhanced hydrogen-bonding capacity, tunable polarity, and favorable toxicological profiles, supporting their integration into pharmaceutical and biomedical technologies. This study evaluates the thermal behavior of a hydrated choline chloride–glycerol NADES (1:1:0.5 molar ratio), with a particular focus on early-stage mass loss, hydrogen-bond network reorganization, and implications for practical use in green processing. Thermogravimetric analysis (TGA) was conducted using a nitrogen atmosphere and a heating range up to 500°C. The hydrated NADES exhibited an initial mass loss corresponding to evaporation of physically bound water in the region of 100–150°C, consistent with partial disruption of the hydrogen-bond network. Unlike its anhydrous counterpart, the presence of water broadened transition regions and softened thermal events, indicating increased molecular mobility and reduced structural rigidity. Despite this early water-related mass change, the solvent remained stable at elevated temperatures, with the major decomposition processes occurring well above 200 °C and following a predictable degradation profile of glycerol-derived fragments and choline chloride interactions. These results highlight that moderate hydration modifies local structural organization without compromising high-temperature stability. The hydrated choline chloride–glycerol NADES therefore represents a robust and thermally reliable solvent system suitable for environmentally aligned extraction and bioprocessing applications, particularly where controlled viscosity and enhanced diffusivity are required.

Keywords: *Natural deep eutectic solvent; Choline chloride–glycerol; Thermal stability; Thermogravimetry; Green processing.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ELECTROCHEMICAL TREATMENT OF CHICKEN-PROCESSING WASTEWATER USING IRON AND METAL-OXIDE ANODES IN A LABORATORY REACTOR

Karchiyappan T.[1], Parameswari E.[1], Selvaraj P.S.[2], Veeraswamy D.[2], Priya R.S.[3], Ponnusamy J.[1], Ramanujam K.[4], Sharmila R.[4], Arthanari P.M.[1]*

[1]Nammazhvar Organic Farming Research Centre, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India, (*e-mail: parameswari.e@tnau.ac.in)

[2]Department of Environmental Sciences, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India

[3]Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India

[4]Department of Nematology, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India

Abstract: This study investigates the effectiveness of an electrochemical treatment process for chicken-processing industry wastewater using a 1-L batch reactor operated at a constant applied voltage of 30 V. Three different anode materials—iron, IrO_2-coated titanium, and RuO_2-coated titanium - were evaluated to identify the most efficient electrode for pollutant removal under identical operating conditions. Key water-quality indicators, including turbidity, chemical oxygen demand (COD), and overall clarity of the effluent, were monitored throughout the treatment process. Among the tested electrode configurations, the iron anode exhibited distinctly superior performance, achieving more than 75% turbidity removal and approximately 65% COD reduction. These results suggest that iron promotes effective electrochemical oxidation and coagulation, contributing to enhanced contaminant removal compared with metal-oxide-coated electrodes. Overall, the study demonstrates the potential of electrochemical treatment as a promising and scalable approach for managing industrial wastewater and improving environmental compliance in the poultry sector.

Keywords: *Electrochemical treatment; Chicken-processing wastewater; Iron anode; Metal-oxide electrodes; COD removal.*

Acknowledgement

The authors are thankful for the financial support received from the Science and Engineering Research Board (SERB), India, through the National Postdoctoral Fellowship (reference number: PDF/2023/000314).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

TOXIC NATURE IN TEA

Gajić U.[1], Torović Lj.[1]*

[1]University of Novi Sad Faculty of Medicine, Hajduk Veljkova 3, 21000 Novi Sad, Serbia (*e-mail: 911046d23@mf.uns.ac.rs)

Abstract: Tea ranks as one of the world's most popular drinks, valued for both its rich flavors and health-promoting compounds. Given its widespread global trade, tea undergoes strict safety surveillance. Natural toxins are biologically produced compounds that, while harmless to their source organisms, can pose significant health risks to humans upon consumption. These substances originate from a variety of sources, including plants and fungi, and often emerge as defense mechanisms or responses to environmental stress. Their structural diversity and varying toxicity levels underscore the importance of monitoring food for potential contamination. This study analyzes contamination trends using data from the EU's Rapid Alert System for Food and Feed (RASFF) to provide insight into the safety issues reported within the EU. Over the period spanning January 2020 to August 2025, a total of 293 RASFF alerts concerning tea were documented. Among them, 27 notifications (9.2%) involved the presence of natural toxins. Pyrrolizidine alkaloids emerged as the predominant natural toxin, accounting for 22 out of the 27 documented cases, while the remaining were related to tropane alkaloids (4) and *Amanita muscaria* toxin muscimol (1). This represents a substantial 81.5% prevalence among natural toxin-related RASFF notifications concerning tea, underscoring the significance as a recurrent contaminant of concern. The origin of 81.5% of notified products was European, led by Poland with a contribution of 18.5%. A significant proportion of the cases, 59.2%, were classified as serious health risks, followed by 18.5% considered potentially serious. Subsequently, 63% of the cases resulted in alert notification, while the other 37% were marked for information notification for follow-up or attention. Notably, no border rejections were reported. These findings reinforce the critical role of ongoing surveillance in safeguarding tea. This requires a commitment to working with nature to create a more sustainable food system.

Keywords: *Food safety; Natural toxins; Public health; RASFF; Sustainability.*

ECO WALL: FUSION OF PAPER AND PHOTOSYNTHESIS

Vishwa R. [1*], *Vidhyalakshmi M.* [1]

[1]Tamilnadu Agricultural University, Coimbatore, India, (*e-mail: vishwarajendran467@gmail.com)

Abstract: Indoor air quality has emerged as a significant environmental issue , as contemporary buildings frequently trap high levels of carbon dioxide (CO_2), resulting in diminished comfort and productivity. This initiative introduces an innovative and bio integrated solution *algae infused paper,* Which is designed to serve as a lightweight, flexible and passive surface for CO_2 reduction. The material is developed by incorporating microencapsulated microalgae within a porous, *cellulose* based sheet that allows for gas exchange and light penetration, facilitating ongoing photosynthesis under standard indoor lighting conditions. The hydrogel microcapsules preserve moisture and nutrient availability, ensuring the long term viability of the algae without requiring intricate circulation systems. Initial models indicate that even modest wall mounted panels can significantly *reduce localized* CO_2 levels while generating oxygen , rendering the system appropriate for residences, educational settings and workplaces. In addition to *air purification* the material is entirely biodegradable requires low energy for production and can be adapted as wallpaper art panels or standalone sheets providing a sustainable alternative to traditional air quality technologies. This project illustrates the potential of transforming everyday surfaces into living, regenerative air purifiers.*''Walls That Breathe, Rooms That Live''* is paving the way for a new approach in sustainable indoor environmental design.

Keywords: *Algae infused paper; Microencapsulated microalgae; Photosynthesis; Hydrogel microcapsule; Regenerative air purifiers.*

Acknowledgement

The authors are thankful to Tamilnadu Agricultural University for supporting this study. The resources and guidance available were invaluable and we also appreciate the institution's commitment to student lead innovation.

FUTURE SMART STRATEGIES FOR SUSTAINABLE WASTEWATER TREATMENT PLANT

Novaković Bežanović M.[1], Vukmirović A.[1], Jovišić N.[2,3], Ilić S.[2], Vukmirović S.[3], Mihajlović I.[1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, Novi Sad 21000, Serbia (e-mail: mladenkanovakovic@uns.ac.rs)

[2]Institute for Artificial Intelligence R&D, Fruškogorska 1, Novi Sad 21000, Serbia

[3]University of Novi Sad, Faculty of Technical Sciences, Department of computing and control engineering, Trg Dositeja Obradovića 6, Novi Sad 21000, Serbia

Abstract: The main role of wastewater treatment plants (WWTPs) is to provide efficient removal of wide range micropollutants and minimize their continuous input into water media recipients. Stricter regulatory standards for wastewater management, as outlined by the Urban Wastewater Treatment Directive, demand the future utilization of contemporary and sustainable wastewater treatment strategies. The objective of this work is to present a comprehensive future advancement in the sustainable management of WWTPs, encompassing machine learning techniques with energy efficiency, zero carbon emissions, sewage management and resource recovery as the key concepts of a circular economy. Machine learning (ML) models are used in wastewater treatment facilities to achieve sustainable plant performance, such as forecasting potential equipment failure or anomalies or the inefficiency of certain treatments. ML can serve as the foundation for the formation of future recommendations for more efficient construction, as well as the enhancement of the existing wastewater treatment system via novel treatments. These guidelines could suggest a sustainable design of appropriate wastewater treatment, incorporating the use of renewable energy sources and energy-efficient equipment, as well as the reduction of chemical consumption, hence lowering greenhouse gas emissions. Furthermore, while selecting wastewater treatment, an ongoing approach for recovering valuable elements (e.g., high quality water stream, phosphorus, nitrogen as struvite, ammonia, or biogas) from different wastewater streams, including sewage sludge, should be addressed. Future initiatives must consider social, environmental, and economic sustainability into account when developing and operating WWTPs.

Keywords: *Decarbonization; Circular economy; Resource recovery; Zero emission; Machine learning.*

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation (Contract No. 451-03-137/2025-03/200156) and the Faculty of Technical Sciences, University of Novi Sad through project “Scientific and Artistic Research Work of Researchers in Teaching and Associate Positions at the Faculty of Technical Sciences, University of Novi Sad 2025” (No. 01-50/295).

SUBSURFACE STORIES: STATISTICAL INSIGHTS INTO INORGANIC POLLUTANTS AT A SOLID WASTE DISPOSAL SITE

Adamov T.[1], Novaković Bežanović M.[1], Mihajlović I.[1], Petrović M.[1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, Novi Sad 21000, Serbia (e-mail: tijana.adamov@uns.ac.rs)

Abstract: In line with global development trends, many countries are striving to adopt more sustainable and environmentally responsible waste management strategies to reduce pollution across various matrices. Consequently, waste management policies increasingly prioritize the implementation of sanitary landfills as a way of reducing the negative impact of landfill leachate. To underscore the importance of this transition, data obtained from monitoring non-sanitary landfills is essential, as it guides us towards a better understanding of the processes occurring within the landfill body. Leachate, a complex mixture of organic and inorganic pollutants, can migrate to adjacent soil and groundwaters posing risks to both the environment and public health. In this study, leachate samples collected from a landfill in the Central Banat District were analyzed for a range of inorganic parameters. Spearman rank correlation analysis identified four strong positive correlations (Chemical Oxygen Demand/Total Kjeldahl Nitrogen, Total Kjeldahl Nitrogen/Ammonia Nitrogen, Chemical Oxygen Demand/Chromium and Chromium/Total Kjeldahl Nitrogen) and two moderate positive correlations (Total Dissolved Solids/Total Kjeldahl Nitrogen and Nickel/Chemical Oxygen Demand). These correlations offer insight into secondary geochemical interactions, dilution processes, and pollutant transformations occurring within the landfill body. The findings highlight the utility of statistical correlation methods in environmental assessment and demonstrate how pollutant linkages can inform sustainable waste management and the protection of water resources.

Keywords: *Statistical assessment; Leachate quality; Inorganic indicators; Environmental monitoring.*

Acknowledgement

This research was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Contracts No. 451-03-136/2025-03/200156 and 451-03-137/2025-03/200156), the Faculty of Technical Sciences, University of Novi Sad (Project No. 01-50/295).

BALANCING ENVIRONMENTAL AND ECONOMIC CRITERIA IN A PROJECT PORTFOLIO

Naerac J.[1], Ćirić Lalić D.[2], Petrović M.[1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, Novi Sad 21000, Serbia (e-mail: tnaeracjasjas@gmail.com)

[2]University of Novi Sad, Faculty of Technical Sciences, Department of Industrial Engineering and Engineering Management, Trg Dositeja Obradovića 6, Novi Sad 21000, Serbia

Abstract: Global environmental challenges have driven the increasing integration of corporate social responsibility principles into project and portfolio management practices. As a result, the economic objectives of project portfolios can no longer be assessed independently of environmental considerations, requiring their simultaneous and systematic evaluation. Traditional project portfolio management models predominantly emphasize financial indicators such as return on investment, cost efficiency, and risk, while environmental criteria are frequently treated as secondary or supplementary factors. This approach is increasingly inadequate in the context of sustainable development imperatives, evolving regulatory frameworks, and heightened stakeholder expectations. Consequently, this paper examines practical approaches for integrating environmental and economic criteria into project portfolio selection and management. The analysis addresses the roles of key stakeholders, including portfolio managers responsible for allocating limited organizational resources, policymakers shaping regulatory frameworks through ESG standards and the EU taxonomy, and organizations seeking to enhance competitiveness while complying with sustainability requirements. Multi-criteria decision-making approaches enable a structured and transparent assessment of trade-offs among financial performance, risk, and environmental impact, while empirical evidence indicates that the inclusion of environmental criteria can significantly alter project prioritization outcomes compared to financially driven selection models. The integration of environmental indicators grounded in corporate social responsibility principles and regulatory frameworks supports the identification of projects that contribute to long-term portfolio sustainability.

Keywords: *Sustainability; Project portfolio management; Environmental criteria.*

Acknowledgement

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Education and Culture Executive Agency (EACEA). Neither the European Union nor the EACEA can be held responsible for them. Grant agreement number 101085701.

OCCUPATIONAL SAFETY AND HEALTH

OCCUPATIONAL SAFETY AND HEALTH IN THE FAST FASHION INDUSTRY

Anakiev A.[1], Zoraja B.[1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia (*e-mail: anakievatina021@gmail.com)

Abstract: Many studies to date have demonstrated the profoundly negative environmental footprint of the fast fashion industry; however, there remains a notable and disproportionate lack of research addressing the occupational safety and health conditions of the workers exploited within this sector. Such research is essential not only for increasing awareness of the inhumane and hazardous conditions these workers routinely face, but also for informing evidence-based policy measures and organizational interventions that could improve their working environment. These workers' workplaces are most often situated in or near landfills and informal waste-sorting sites, where they are exposed without adequate protection to a wide range of chemical hazards - such as toxic dyes, solvents, and microplastics—as well as severe physical risks including burns, cuts, musculoskeletal injuries, and bone fractures. These already hazardous conditions are compounded by low wages, unstable employment arrangements, and the absence of basic labor rights, all of which further undermine workers' physical and psychological well-being, as well as their fundamental dignity. In this paper, will be explored potential pathways for optimizing these working conditions, outlining measures that could be implemented at the industry, regulatory, and supply-chain levels. Also, will be analyzed how such interventions would affect both the operational performance of the fast fashion industry and the overall welfare of its workforce. Furthermore, the paper stands out consumers' crucial role in shaping corporate behavior: by exerting pressure on multinational retail chains to adopt sustainable and ethically responsible practices, consumers can actively contribute to sustainable development, the protection of the environment, and the enhancement of worker safety.

Keywords: *Supply and Demand; MNCs; Sustainable development; Worker safety; Well-being.*

Acknowledgement

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Education and Culture Executive Agency (EACEA). Neither the European Union nor the granting authority can be held responsible for them. Grant agreement number 101179757.

THE ROLE OF PUBLIC HEALTH LEADERSHIP IN STRENGTHENING EMERGENCY RESPONSE PROTOCOLS AND ADDRESSING INFRASTRUCTURE GAPS DURING INFECTIOUS DISEASE OUTBREAKS

Babatuyi P.[1], Imo P.[2], Igwe E[3]. Enyejo J.[4]*

[1]Department of Emergency Management and Homeland Security, Arkansas Tech University, Arkansas, USA (*e-mail: babatuyipeter@gmail.com)

[2]School of Nursing, Anglia Ruskin University, Essex, United Kingdom.

[3]Department of Counseling and Pastoral Care, Christ Ambassadors Church, Spartanburg, South Carolina, USA

[4]Department of Business Administration, Nasarawa State University, Keffi. Nasarawa State. Nigeria

Abstract: Public health leadership plays a pivotal role in enhancing emergency preparedness and bridging infrastructure gaps during infectious disease outbreaks. Effective leadership ensures timely activation of emergency response protocols, coordination across multi-sectoral stakeholders, and the integration of evidence-based strategies into operational frameworks. This review examines how leadership in public health—spanning policy makers, health agency directors, and emergency coordinators—guides the design, implementation, and refinement of response mechanisms during crises. It explores the critical functions of leadership in risk assessment, resource allocation, communication management, and policy enforcement, while emphasizing the need for adaptive governance models capable of responding to rapidly evolving epidemiological conditions. Infrastructure gaps—ranging from inadequate laboratory capacity and supply chain limitations to workforce shortages and deficient surveillance networks—are analyzed as key barriers to effective outbreak control. The review further discusses how visionary leadership fosters resilience through strategic investments in health systems, capacity building, and community engagement. By synthesizing global case studies, the paper identifies best practices in leadership-driven outbreak response, with particular attention to lessons learned from COVID-19, Ebola, and other high-impact infectious disease events. Findings underscore the necessity of embedding strong leadership competencies in national and local health systems to ensure sustainable readiness and mitigate the socio-economic impact of future outbreaks.

Keywords: *Public health leadership; Emergency response protocols; Infectious disease outbreaks; Health infrastructure gaps; Outbreak preparedness.*

Acknowledgement

I sincerely thank my co-authors for their invaluable contributions, guidance, and collaboration throughout this systematic review. I am also grateful to colleagues, mentors, and supporters whose assistance strengthened the quality and completion of this publication.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

OCCUPATIONAL HEALTH AND SAFETY OF PARTICULATE MATTER EXPOSURE AND RESPIRATORY SYMPTOMS IN OIL SEEDS PROCESSING FACTORIES

Bizuneh A.[1], Seblework M.[2], Dessalegn D.[1]*

[1]Department of Environmental Health Sciences & Technology, Public Health Faculty, Institute of Health Jimma University, Jimma, Ethiopia, (*e-mail: bizunehayano@gmail.com)

[2]Institute of Water, Environment and Climate Research, Center for Water Research, Addis Ababa University, Addis Ababa, Ethiopia

Abstract: Extreme exposure to dust particulate matter (PM) can cause respiratory health problems. In Ethiopia oil-seeds processing (OSP) workers exposure and magnitude of its health influence have not been widely explored. **Objective:** To measure particulate matter exposure and predictors of respiratory symptoms outcome among OSP factories workers. **Methods:** Using mixed study design 14 factories and 716 participants were selected. Direct PM concentration was measured using instrument. Descriptive statistical methods were used for clarification. Data was analyzed using STATA version 16.1. bivariate and multivariate analysis was used to identify associated factors and p-value<0.05 was taken for significance. **Results:** From total participants, the findings were 716 and 49.9% of them were female. The mean of dust $PM_{2.5}$ and PM_{10} concentration among OSP factories were 19.72±11.8 µg/m^3 and 55.24±14.5 µg/m^3 respectively. Workers were exposed to respiratory symptoms 25.28%, and asthma 12.57%. Wheezing, phlegm, dyspnea symptoms of respondents were 23.2%, 22.5%, 22.3% respectively. Predictors were exposed to PM [AOR: 18.6], PPE use [AOR: 18.3], wood is energy source [AOR:15.47], and ventilation [AOR: 14.29]. **Conclusion:** Work place contact of $PM_{2.5}$ and PM_{10} concentration for OSP factories workers were above WHO guideline limit. Respiratory and asthma symptoms were high in OSP factories. Participants working above WHO standard PM concentration were more exposed to respiratory symptom than below WHO standard. Factors associated with respiratory symptoms were exposure to PM, PPE use, type of energy source, ventilation and training. Necessary actions are desirable to restrict possible PM acquaintances and prevention methods.

Keywords: *Particulate-matter; Respiratory-symptoms; Factors; Oil-seeds; Factories.*

Acknowledgement

This work was supported by Jimma university, not a project. We thank Jimma University for ethical approval with financing. Special thanks go to Addis Abeba University, Ethiopia for providing materials with training. We also thank the study participants &data collectors for their thoughtful responses and involvement in this study.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

MUSCULOSKELETAL DISORDERS AND INFLUENCE ON QUALITY OF LIFE FOR WORKERS IN OIL SEED PROCESSING FACTORIES.

Bizuneh A.[1], Seblework M.[2], Dessalegn D.[1]*

[1]Department of Environmental Health Sciences & Technology, Public Health Faculty, Institute of Health Jimma University, Jimma, Ethiopia, (*e-mail: bizunehayano@gmail.com)

[2]Institute of Water, Environment and Climate Research, Center for Water Research, Addis Ababa University, Addis Ababa, Ethiopia

Abstract: Musculoskeletal disorders related to work are a major apprehension in industry but desolate issue. There has been little or no study done for oil seed processing (OSP) factories and its effect on quality of life is unknown. **Objective**: To measure magnitude, factors affecting and effect of WRMDs on eminence of life among OSP factory workers, Eastern Ethiopia. **Methods:** Mixed study designs were applied in this research. Data was composed based on the 36-item quick form review (SF-36), and descriptive statistics were computed to assess quality of life. bivariate & multivariate analysis; Odds ratios along with 95%CI and p-value<0.05 is used to show the strengths of associations. **Result**: - Prevalence of WRMDs was reported by 45.7%. The highest WRMSDs is reported in the neck 36.3%, The knees and ankles 35.9%, followed by the elbows (29.6%), Wrists/hands 29.5% & lower back 29.3%. Predictors were training [AOR: 19; 95% CI: (7.1-50.5)]; organizational support [AOR: 18.1; 95% CI: (10.7-30.7)]; Repetitive upper extremity movements [AOR: 2.8; 95% CI: (1.72-4.47)]; gender [AOR: 2.234; 95% CI: (1.394-3.579)]; and Awake ward working posture [AOR: 1.85; 95% CI: (1.15-2.99)]; The existence of WRMSDs, in turn, is associated with poorer quality of life scopes of entities (p<0.001). **Conclusion:** WRMDs among OSP factories workers is very high. Training, organizational support, repetitive upper extremity movements, Sex, Awake ward working posture& health education were determinants of WRMDs & knowledge of WRMDs. WRMDs had significant consequence on all quality-of-life degrees. Appropriate ergonomic risk prevention and supportive engineering measures desired.

Keywords: *Musculoskeletal-disorders; Workers; Predictors; Life-quality; Factories.*

Acknowledgement

This work was supported by Jimma university, not a project. We thank Jimma University for ethical approval with financing. Special thanks go to Addis Abeba University, Ethiopia for giving training. We also thank the study participants &data collectors for their thoughtful responses and involvement in this study.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

RAPID EYE MOVEMENT AS A MEASUREMENT OF OCULAR AND NEUROLOGICAL HEALTH

Varga D.[1], Milekić D.[1], Španović D.[1], Krstanović L.[1], Banjac B.[1,2]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Fundamental Sciences, Computer Graphics Chair, Trg Dositeja Obradovića 6, Novi Sad, Serbia (*e-mail: dariavarga@uns.ac.rs)

[2]Intens doo, Bulevar Evrope 28, Novi Sad, Serbia

Abstract: The degree of success achieved when playing video games is often determined by the player's reaction time. Conquering a challenge imposed by the time-sensitive tasks within the game provide satisfaction and motivation to further improve one's reaction time and other related skills. Here we aim to implement a similarly gamified system in order to estimate the time it takes for a person that plays video games regularly to respond to a prompt as opposed to that of person that doesn't play video games regularly. This system utilizes the recent developments in machine learning in relation to computer vision to estimate the time it takes for a person to move their eyes according to the instructions shown on screen. Our hypothesis is that the people who regularly play action video games will have a shorter reaction time to said instructions partly due to the amount of information that is usually displayed on various parts of the screen in a game, which the player is expected to keep track of in a fast-paced environment. A system for estimating reaction times implemented in such a way has the potential to further be used in therapy for strengthening the muscles surrounding the eyes, with the specific aim of motivating children to complete gamified exercises regularly.

Keywords: *Machine learning; Computer vision; Reaction time; Human-computer interaction.*

Acknowledgement

This research has been supported by the Science Fund of the Republic of Serbia, #7449, Multimodal multilingual human-machine speech communication - AI-SPEAK, and by the Faculty of Technical Sciences, University of Novi Sad, through the project "Scientific and artistic research work of researchers in teaching and associate positions at the Faculty of Technical Sciences, University of Novi Sad 2025" (no. 01-50/295).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

SECURITY OF RADIOACTIVE SOURCES: LESSONS LEARNED FROM THE GOIANIA ACCIDENT

Dabetić M.[1], Ćurčić M.[1], Veljković S.[1]*

[1]Vinča Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, Department of Physical Chemistry, Mike Petrovića Alasa 12-14, Belgrade, Serbia (*e-mail: fmarina@vin.bg.ac.rs)

Abstract: Radioactive sources, widely applicable to both medical and industrial settings, have many risks to security as they are often available to the general public and employees, who might or might not have been subjected to correct security assessments and training. Healthcare establishments, which source radioactive material, need to place as much emphasis on their staff and patients' security and the security of radioactive sources themselves. Insufficient regulation, unaccountable oversight, and inadequate professional training can do serious damage, from inadvertent exposure and contamination to the potential malicious use of radioactive material. Nowhere was this more painfully demonstrated than in the 1987 Goiania accident, when an abandoned cesium-137 teletherapy unit left without supervision and without notifying the competent regulatory authority, fell into the hands of people who were completely unaware of its dangerous condition. Using relevant scientific literature, this review paper intends to emphasize the need to provide proper management of radioactive sources (including proper licensing, regulation, oversight, and control) as well as identify potential risks, which should be coupled with enhanced safety measures in both medical and industrial settings.

Keywords: *Radioactive sources; Radiation security; Goiania accident risk management; Radioactive material handling*.

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, as part of the funding of the scientific research work of the University of Belgrade, "Vinča" Institute of Nuclear Sciences (Grant number. 451-03-136/2025-03/ 200017, 05.02.2025.).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

THE ROLE OF THE IAEA IN STRENGTHENING GLOBAL PREPAREDNESS AND RESPONSE TO NUCLEAR AND RADIOLOGICAL EMERGENCIES

Veljković S.[1], Dabetić M.[1], Ćurčić M.[1]*

[1]Vinča Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, Department of Physical Chemistry, Mike Petrovića Alasa 12-14, Belgrade, Serbia (*e-mail: fmarina@vin.bg.ac.rs)

Abstract: Strengthening global readiness and response capabilities in the face of nuclear and radiological emergencies is fundamental to the enforcement of international standards of nuclear safety and security. The Incident and Emergency Centre (IEC) acts as the operational core of the International Atomic Energy Agency (IAEA), offering round-the-clock coordination for information sharing, verification, alert notifications, and coordination of international aid. Through organizations including the Response and Assistance Network (RANET), the International Radiation Monitoring Information System (IRMIS), the Unified System for Information Exchange in Incidents and Emergencies (USIE) the IAEA ensures that Member States can access reliable information and expert technical support in a timely manner. Taken together, these systems promote situational awareness, collaboration with national authorities, and increased global preparedness and response capacity for nuclear and radiological emergencies. This paper highlights the essential role of the IAEA in strengthening and improving coordinated international response capabilities to nuclear and radiological emergencies

Keywords: *Nuclear emergencies; Radiological emergencies; International assistance; Nuclear safety; Nuclear security; IAEA.*

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, as part of the funding of the scientific research work of the University of Belgrade, "Vinča" Institute of Nuclear Sciences (Grant number. 451-03-136/2025-03/ 200017, 05.02.2025.).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

DIGITAL TWIN IN OCCUPATIONAL HEALTH AND SAFETY: A LITERATURE REVIEW AND FUTURE RESEARCH AGENDA

Istrat D.[1], Novaković Bežanović M.[1], Petrović M.[1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia (*e-mail: dunjaistrat@uns.ac.rs)

Abstract: Digital twin (DT) technology has rapidly emerged as a transformative tool in industrial digitization, with increasing importance for occupational health and safety (OHS). This paper presents a structured review of 100 scientific publications (2022–2025) that examine DT applications with direct or indirect implications for occupational safety, risk prevention and worker well-being. Literature was selected from *Scopus* (59%), *Google Scholar* (20%), *Science Direct* (11%) and *Research Gate* (10%) databases. In the reviewed papers, DT systems are most often applied in high-risk sectors, including transportation and logistics (37%), manufacturing (30%), construction (12%), mining (10%), energy (6%) and healthcare (5%), while classic office work is practically bypassed. Common DT systems integrate Internet of Things (IoT), building information modelling (BIM) and machine learning (ML) models, as well as virtual reality (VR), augmented reality (AR), mixed reality (MR) and wearables for training and real-time process monitoring. Key reported benefits include improved human-machine interaction, safer emergency planning, reduced risks and increased hazard awareness. Despite these advances, the review identifies several significant research gaps. Dominant topics are accident prevention, safety assessments and exposure monitoring. Human factors like ergonomics, fatigue, cognitive load and psychosocial stress are rarely modelled and the concept of a holistic „employee digital twin" lacks development and longitudinal evidence of effectiveness. Ethical, privacy and acceptance considerations related to worker tracking are only marginally considered. In addition, there are no standardized OHS metrics for evaluating DT performance or integrating DT outcomes into the ISO 45001 and ISO 45003 frameworks. Future research should advance integrated worker-centered DT, develop scalable solutions for resource-limited sectors, formalize validation methods and explore ethical and socio-organizational implications of DT-based security systems.

Keywords: *Digital twin (DT); Occupational health and safety (OHS); Predictive safety analytics; Human factors modelling; ISO 45001/45003 integration.*

Acknowledgement

This work was supported by the Jean Monnet Module ENROL (101085701). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Education and Culture Executive Agency (EACEA). Neither the European Union nor the EACEA can be held responsible for them.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

WHAT LEADS TO NEGLIGENCE IN OCCUPATIONAL HEALTH AND SAFETY?

Martinović E.1, Zoraja B.1*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia (*e-mail: edinem2113@gmail.com)

Abstract: The paper examines workers' attitudes toward occupational safety, drawing on both prior professional experience - as a service technician and safety system inspector - and newly collected data. According to Heinrich's Domino Theory, 88% of workplace accidents result from human actions, a figure consistent with recent OSHA statistics indicating that 85-90% of incidents stem from human error. An anonymous survey conducted for this research further highlights this issue: the leading cause of unsafe behavior appears to be a lack of awareness regarding workplace hazards and the consequences of injuries. The study included 105 respondents, approximately 45% of whom were employed at high-risk occupations. Notably, 69% reported having received no safety training at their workplace. Earlier field observations were confirmed, as 97% of respondents (102 individuals) stated that they do not consider their own safety before performing work tasks. Conversations with participants who had undergone safety training revealed consistent concerns: training sessions were described as monotonous, insufficiently engaging, and often accompanied by "collective" assessments, in which correct answers were suggested either directly or indirectly by examiners. The findings indicate that occupational safety is still an undeveloped and undervalued field in the national context. Workers, employers and in some cases even safety professionals tend to approach safety procedures as a formality rather than as an essential practice that protects health, preserves lives, and keeps families whole.

Keywords: *Occupational safety; Accidents; Awareness; Training.*

Acknowledgement

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Education and Culture Executive Agency (EACEA). Neither the European Union nor the granting authority can be held responsible for them. Grant agreement number 101179757.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ASSESSMENT OF HEALTH RISKS FACED BY WORKERS IN WASTEWATER TREATMENT FACILITIES

Gaja Shree D.[1], Karthikeyan A.[1]*

[1]B.Tech Energy and Environmental Engineering, Agricultural Engineering College And Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India (*e-mail: shreedgaja@gmail.com)

Abstract: Workers in wastewater treatment facilities are exposed to various occupational hazards that may impact their health and safety during routine operations. These hazards arise from contact with untreated sewage, inhalation of toxic gases such as hydrogen sulfide, methane, and ammonia, exposure to chemical disinfectants, and interaction with pathogenic microorganisms present in wastewater. This study aims to assess the major health risks faced by workers across different units of wastewater treatment plants, including screening, aeration, sedimentation, and sludge-handling processes. A mixed-method approach involving field observations, worker interviews, and hazard assessment checklists was used to gather data on exposure levels, safety practices, and commonly reported health problems. Preliminary findings indicate that biological hazards contribute to respiratory infections, gastrointestinal disturbances, skin irritations, and allergic reactions. Chemical exposures may lead to eye irritation, headaches, and respiratory stress, while physical hazards such as noise, slips, manual handling, and confined spaces further increase worker vulnerability. The study also examines compliance with safety protocols, including personal protective equipment (PPE) usage, hygiene behavior, and awareness of occupational risks. Based on the assessment, the study proposes recommendations to reduce health risks through improved PPE compliance, regular safety training, enhanced ventilation, gas monitoring systems, and better operational controls. The findings are expected to support wastewater treatment facilities in strengthening Occupational Safety and Health (OSH) measures and fostering a safer working environment.

Keywords: *Wastewater treatment plant (WWTP); Biological hazards; Chemical exposure; Worker safety; Risk assessment.*

Acknowledgement

This work was supported by Agricultural Engineering College And Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India.I extend my sincere gratitude to my mentor and all contributors whose support made this research paper possible.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

DETERMINANTS OF SUSTAINABLE SOLID WASTE MANAGEMENT IN JIMMA CITY, SOUTHWEST ETHIOPIA

Degefa G. [1], Eba K. [1], Roba H. [5], Ibrahim M. [1], Berhanu .B [2], Jemal T. [1], Jima W. [3], Mitiku F. [4], Tucho G. [1]

[1] Department of Environmental Health Science and Technology, Jimma University, Jimma, Ethiopia.

[2]Department of Health Behavior and Society, Jimma University, Jimma, Ethiopia, (*E-mail: gutamahaile@gmail.com)

[3]Department of Information Science, Jimma University, Jimma, Ethiopia.

[4]Department of Agricultural Economics and Agribusiness Management, Jimma University, Jimma, Ethiopia.

[5]Department of Environmental Health Science, Institute of Health Science, Bule Hora, Ethiopia

Abstract: Exponential urban growth has led to a significant increase in solid waste production, making it one of the most pressing issues in urban spaces in developing countries. This rising volume of solid waste has led to pressing public health and environmental concerns, such as water, soil, and air pollution, increased greenhouse gas emissions, and the spread of diseases. Thus, this study aimed to evaluate the sustainable solid waste management practices and challenges in Jimma City, southwestern Ethiopia. A community-based cross-sectional study design was employed. Quantitative data and solid waste samples were collected between 01/01/2024 and 01/03/2024 via stratified random sampling from 820 participants in Jimma City, Southwest Ethiopia. The data were analyzed using STATA 18, and a p-value <0.05 was used to determine statistical significance. This study revealed a solid waste generation rate of 0.66 Kg/capita/day and the majority of households (84.63%) do not segregate their solid waste at a point of generation; only 38.66% of Households had access to door-to-door solid waste collection services even though about 81.71% of households are willing to pay for solid waste collection services and 69.76% of Households dump waste along rivers or roadsides. Household income, geographic location, level of education, and attitude are the major determinants of sustainable solid waste management, with Average Marginal Effects of (0.0411, 0.1098, 0.0621, 0.0495), respectively. There is a higher rate of solid waste generation and a lack of integrated solid waste management services like door-to-door collection, temporary public solid waste collection containers, and disposal systems. This study indicated that about 2/3 of total solid waste generation is attributed to organic waste, and limited waste-to-resource recovery practices are observed. Thus, systematic provisions of integrated solid waste management services, implementation of solid waste reduction, and waste-to-resource recovery strategies focusing on composting are recommended.

Keywords: *Solid waste; Solid waste composition; Solid waste generation; Sustainable solid waste management; Environmental pollution.*

Acknowledgments

We acknowledge Jimma University, Institute of Health, for supporting this study. We gratefully acknowledge the study participants for their active and voluntary participation. We thank the municipality workers and kebele administrators for their support during data collection.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

STRESS AT WORK

Jeremić I.[1], Zoraja B.[1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia (*e-mail: iva.jeremic19@gmail.com)

Abstract: Workplace stress represents one of the most widespread psychosocial risks in modern work enviroments. It occurs when job demands exceed the worker`s ability to cope, leading to physical and emotional reactions that may negatively influence health, concenration, and overall performance.This topic is incereasingly importan within occupational safety beacause long-term exposure to stress is directly connected with higher accident rates, reduced productivity, absenteeism and burnout. Identifying stressors and understanding their impact is essential for improving safety culture and preventing work-related incidents.The main finding of this study is that implementing both organizational and individual preventive measures significantly reduces stress levels and strengthens occupational safety, especially in workplaces with high workload or poor comunication.Key stressors identified include time pressure, unclear tasks, shift work, inadequate support from supervisors and unsafe working conditions.Results show that interventions such as better task planning, regular breaks, open communication, stress-menagment training and ergonomic improvements lead to lower stress exposure. These changes also contribute to fewer errors, higher concetration and improwed well-being among workers. Effective stress menagment is crucial for maintaining a safe and healty workplace. By reducing stressors and promoting supportive working conditions, organizations can significantly improve employee safety, health and long-term productivity.

Keywords: *Stress; Occupational safety; Work environment; Preventive measures; Workload.*

Acknowledgement

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Education and Culture Executive Agency (EACEA). Neither the European Union nor the granting authority can be held responsible for them. Grant agreement number 101179757.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

FORMULATION OF A NUTRITIOUS AVOCADO–PEANUT BUTTER SPREAD FOR HEALTH PROMOTION

Kavitha Shree G.[1], Parveen S.[2], Visalakshi M.[3], Karchiyappan T.[4]*

[1]Center for Post Harvest Technology, Agricultural Engineering College and Research Institute Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India, (*e-mail: kavikarthikfsn@gmail.com)

[2]Department of Food Process Engineering, Agricultural Engineering College and Research Institute, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India

[3]Horticultural college and Research Institute, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India

[4]Nammazhvar Organic Farming Research Centre, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India

Abstract: Avocados are highly susceptible to post-harvest losses because of their smooth and delicate skin, which is easily damaged during handling and transportation. Converting fresh avocados into puree or spread helps reduce these losses and enables year-round utilization. Common spoilage symptoms include black surface spots and internal flesh discoloration. Depending on the variety, edible pulp accounts for about 52.9-81.3% of the total fruit mass. Avocados are nutritionally rich due to their high lipid content and the presence of proteins, fat-soluble vitamins, folic acid, and minerals such as calcium, potassium, magnesium, sodium, and phosphorus. An avocado-based fruit butter was developed using butter and peanut as functional ingredients, and 10 formulations were prepared. The most acceptable formulation was selected through sensory evaluation. The optimized spread exhibited an extended refrigerated shelf life of up to 3 weeks without undesirable colour changes. Proximate composition showed high moisture (83%), moderate fat (11%), low fiber (6%), and low protein (1.5%). Fatty acid profiling revealed a high monounsaturated fatty acid content, with oleic acid at approximately 65.73%. The product was rich in potassium and showed antioxidant activity (5.5 ± 0.09 mg TE/g). A 30-day storage study showed that samples stored in glass bottles under refrigeration had the lowest acidity, peroxide values, and microbial counts, while polyethylene packaging at ambient temperature showed higher yeast and fungal growth.

Keywords: *Avacado; Peanut; Spread; Storage; Packing.*

Acknowledgement

The authors gratefully acknowledge Tamil Nadu Agricultural University (TNAU), Coimbatore, for providing the necessary infrastructure, laboratory facilities, and administrative support to carry out this work.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

SAFETY AND HYGIENE CONSIDERATIONS IN THE INDUSTRIAL APPLICATION OF SPRAY-DRIED MUSKMELON POWDER IN ICE CREAM PRODUCTION

Kavitha Shree G.[1], Parveen S.[2], Visalakshi M.[3], Karchiyappan T.[4]*

[1]Center for Post Harvest Technology, Agricultural Engineering College and Research Institute Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India, (*e-mail: kavikarthikfsn@gmail.com)

[2]Department of Food Process Engineering, Agricultural Engineering College and Research Institute, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India.

[3]Horticultural college and Research Institute, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India.

[4]Nammazhvar Organic Farming Research Centre, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, India.

Abstract: This study investigates the incorporation of spray-dried muskmelon (Cucumis melo L.) powder in ice cream to enhance its nutritional value and consumer appeal. Muskmelon is a rich source of vitamins A, C, and B9, potassium, and antioxidants, making it suitable for the development of functional frozen desserts. The experiment was conducted using a Completely Randomized Design with six treatment combinations in which spray-dried muskmelon powder partially replaced skim milk powder at different levels. Among the treatments, the formulation containing 4% muskmelon powder and 1% skim milk powder showed superior performance, recording the highest scores for body, texture, and overall acceptability, while formulations with higher muskmelon levels performed well in colour and flavour attributes. Storage studies conducted for five weeks indicated that the optimized formulation maintained better chemical stability, sensory quality, and lower microbial counts. The developed product aligns with current consumer preferences for natural, nutrient-enriched foods. Economic analysis indicated that the process is cost-effective, scalable, and commercially viable, demonstrating strong market potential for healthy and innovative ice cream products.

Keywords: *Muskmelon; Ice cream; Spray-dried powder; Nutritional benefits; Antioxidants.*

Acknowledgement

The authors gratefully acknowledge Tamil Nadu Agricultural University (TNAU), Coimbatore, for providing the necessary infrastructure, laboratory facilities, and administrative support to carry out this work.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

WHAT'S NOVEL IN TEA?

Gajić U.[1], Torović Lj.[2]*

[1]University of Novi Sad Faculty of Medicine, Hajduk Veljkova 3, 21000 Novi Sad, Serbia (*e-mail: 911046d23@mf.uns.ac.rs)

Abstract: With its complex aroma and potent bioactive ingredients, tea remains a staple beverage enjoyed worldwide. However, a question of novel food ingredients of tea is arising. Novel food refers to any food that was not significantly consumed by humans within the European Union before 15 May 1997, when the initial regulation governing novel foods was enacted, requiring specific market approval. This study examines notifications related to novel food in tea using the EU Rapid Alert System for Food and Feed (RASFF) to provide insight into the types and frequency of safety issues. Between January 2020 and August 2025, a total of 293 RASFF notifications concerning tea were documented. Among these, 56 cases, representing 19% of the total, were related to novel food. The highest number of cases occurred in 2024 (20), followed by 12 cases in the first half of 2025, indicating a growing presence of emerging novel ingredients in tea products. The most frequently detected novel food compounds were *Clitoria ternatea* (Butterfly pea flowers) with 12 cases, and cannabidiol (CBD) with 9, followed by Yohimbe bark and *Senna alexandrina* (5 each), and many others. Controversies about CBD will continue, considering the very recent scientific opinion (2025) that the safety of synthetic CBD cannot be established due to data gaps. Thailand and the Netherlands accounted for the most reported cases of contaminated tea (8 and 7, respectively), followed by Sri Lanka (5). Of all notifications, 51.8% were classified as posing a potential health risk. These findings underscore the growing complexity of tea products and highlight the importance of vigilant safety monitoring to ensure consumer protection amid evolving trends in novel food ingredients. These ingredients can offer new flavor profiles and potentially reduce reliance on traditional tea sourcing, contributing to a more sustainable tea industry, provided they are proven safe.

Keywords: *Food safety; Novel food; Public health; RASFF; Sustainability.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

STRENGTHENING OSH THROUGH SUSTAINABLE RISK MANAGEMENT

Todorović M.[1], Perović M.[1], Zarić-Kovačević J.[2]*

[1] Jaroslav Černi Water Institute, Jaroslava Černog 80, 11226 Belgrade, Serbia (*e-mail: marija.todorovic@jcerni.rs)

[2] Mining Institute Ltd. Belgrade, Batajnički put 2, 11080 Belgrade-Zemun, Serbia

Abstract: Providing adequate occupational safety and health (OSH) is essential for sustainable and responsible project implementation, especially in environments where workers are exposed to changing operational, environmental, and organizational risks. This paper presents the experience from field operations on infrastructure and environmental projects, where sustainable risk-management practices became part of daily OSH procedures. In practice, this meant taking a more organised approach to identifying risks on site, unifying how we handle and separate different types of waste, and making sure all materials were clearly and permanently labelled. We also paid attention to the condition and placement of fire extinguishers, the state of machines and their safe positioning and fencing on the site. Proper storage of chemicals was regularly checked, along with installing different types of barriers to prevent pollution and protect workers from potential hazards. Simple digital tools were used for reporting incidents and near-misses, and short toolbox talks were held to address both safety and environmental points relevant to the day's tasks. Finally, each work location was restored to a condition as close as possible to its original state after the completion of field activities. Special attention was given to strengthening communication between the contractors and the project team, as well as to using clear visual safety cues. Results showed a documented reduction in recurrent minor incidents, the elimination of previously observed non-conformities related to labelling and waste management. Inspections indicated improved compliance with legal and project-specific requirements, while workers reported greater clarity regarding procedures and responsibilities. Overall, the results show that improving OSH practices leads to safer work and better risk control. The case demonstrates that even relatively simple, low-cost interventions, when applied consistently, can contribute to safer, more resilient, and environmentally responsible workplaces.

Keywords: *Occupational safety; Sustainability; Risk management; Safety culture; Hazard identification.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

STRENGTHENING WELLBEING THROUGH PSYCHOSOCIAL RISK CONTROL

Todorović M.[1], Perović M.[1], Zarić-Kovačević J.[2]

[1] Jaroslav Černi Water Institute, Jaroslava Černog 80, 11226 Belgrade, Serbia (e-mail: marija.todorovic@jcerni.rs)

[2] Mining Institute Ltd. Belgrade, Batajnički put 2, 11080 Belgrade-Zemun, Serbia

Abstract: Traditionally, field teams were focused almost exclusively on the technical quality of work, such as drilling performance, equipment set up, and meeting strict project specifications. The introduction of new regulations and the updating of existing ones have expanded their responsibilities to include a much stronger focus on occupational health and safety (OHS) and environmental protection. This change brings additional expectations for field staff, who are now required to systematically identify hazards, apply environmental protection measures on site, and understand how their actions influence both safety and environmental consequences and the project's overall progress. These additional responsibilities can create extra pressure, especially when teams are adjusting to new procedures. The work presented here examines how practical measures can help field staff adjust to these changes and reduce stress. Key elements include clear communication of responsibilities, short coordination meetings before field activities, and simple tools that help workers report concerns or uncertainties during the workday. The use of a short daily checklist, encompassing all safety and environmental requirements, will ensure that required demands are consistently met before any field work begins. Field observations showed that it is necessary to timely explain to workers clear guidance why new OHS and environmental practices are required, so they can adapt them quickly. Having clear visual instructions, better-organised equipment, and more predictable workflows also helped reduce stress. These results show that moving from a purely technical focus to a more balanced approach, where safety, environmental protection and work quality are all taken seriously, brings clear advantages. It supports workers' wellbeing, helps prevent incidents and gives field teams a clearer sense of support as they deal modern projects demands. This approach helps avoid potential concerns from stakeholders and the public, who focus more on site safety and environmental impacts than on technical details.

Keywords: *Psychosocial risks; Wellbeing; Workload management; Safety culture.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

CHEMICAL SAFETY AND HAZARDOUS MATERIALS MANAGEMENT

Rakić M.[1], Zoraja B.[1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia (*e-mail: rakicmihailo1@gmail.com)

Abstract: Keeping chemicals safe matters a lot for protecting workers' health and the environment in factories and other places where manufacturing happens. Within the broader concept of the circular economy that pushes for using resources in a sustainable way, managing chemicals without risks turns into crucial for cutting down dangers and keeping the ecology in balance. This paper shows methods to handle chemicals safely based on European laws and the guidelines from the European Agency for Safety and Health at Work or EU-OSHA. It also checks how those affect bringing circular ideas into industry practices. The research goes through current guidelines on storing and moving chemicals safely. Also, it focuses on the biggest problems when it comes to putting legal rules in place that control how workers deal with hazardous materials. From what the results show, although there have been real efforts to get safety standards working, the industry still runs into trouble with training workers properly and making sure regulations are enforced well. Among the suggestions are pushing harder on following the laws, improving the training that workers get and coming up with better tech for handling and recycling hazardous chemicals without issues. Implementing circular economy strategies in practice along with tougher safety steps can lower the chances of accidents. It also contributes to reducing the adverse environmental impacts of hazardous substances.

Keywords: *Chemicals management; Environment; Sustainability; Hazardous; Safety.*

Acknowledgement

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Education and Culture Executive Agency (EACEA). Neither the European Union nor the granting authority can be held responsible for them. Grant agreement number 101179757.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

WORKER SAFETY AT AIRPORTS DURING BAGGAGE HANDLING

Ranđelović N.[1], Zoraja B.[1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia (*e-mail: nadjar2005@icloud.com)

Abstract: Baggage handling is one of the hardest and most dangerous jobs within airport ground operations. Workers have to lift and move heavy luggage, work in very small and uncomfortable spaces inside airplanes, and often hurry to finish the job before the plane takes off. By doing this every day they put a lot of pressure on their bodies. Epidemiological data show a high prevalence of musculoskeletal disorders (MSDs) among baggage handlers, 86.5% of baggage handlers experience some type of pain every year. The most common areas are the lower back (70%), upper back (62%), and shoulders (43%). One research with special body-movement sensors also showed high strain on the back, knees, and shoulders. Even workers who are strong and fit can get injured when they repeat the same movements with heavy luggage all day. Operational data also shows how demanding the job is. One study of 386 flights at Rome Airport found that baggage delivery times were very unstable ($p = 0.001$, which means the process is not stable at all). This instability often brings delivery times close to airport limits, which puts extra pressure on workers to work faster, even when it is not safe. Besides physical strain, there are also organizational problems such as: not enough staff, overlapping flights, rushing, and poor communication between workers and supervisors. All these factors make the job more stressful and less safe. Because of these risks, airports should actively work on improving safety by investing in better equipment, planning and organizing work more effectively, giving regular training to workers, and constantly checking work conditions. These steps can help reduce injuries, improve working conditions, and make the whole baggage-handling process safer and more efficient.

Keywords: *Occupational safety; Training; Awareness; Risks; MSDs.*

Acknowledgement

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Education and Culture Executive Agency (EACEA). Neither the European Union nor the granting authority can be held responsible for them. Grant agreement number 101179757.

OUTDOOR AIR POLLUTION AS RISK FACTOR FOR LUNG CANCER

Ševo M.[1,2], Sazdanić Velikić D. [1,3], Milošević N.[1], Jovičić-Bata J.[1], Milanović M.[1], Milić N.[1]*

[1]University of Novi Sad, Faculty of Medicine, Hajduk Veljkova 3, Novi Sad, Serbia, (*e-mail: 902012d23@mf.uns.ac.rs)

[2]IMC Banja Luka-Center of Radiotherapy, Part of Affidea Group, Dvanaest beba, 78000 Banja Luka, Bosnia and Herzegovina

[3]Institute for Pulmonary Diseases of Vojvodina, Clinic for Pulmonary Oncology, Put doktora Goldmana 4, 21204 Sremska Kamenica, Serbia

Abstract: Based on the Global Burden of Disease 2019 study, around 15% of lung cancer deaths are related to particulate matter with aerodynamic diameter less than 2.5 microns in outdoor air. Hence, the understanding of the air pollution's contribution to lung cancer is of utmost importance. The aim of this study was to evaluate the exposure to air pollution of lung cancer patients and to assess the differences in exposure based on gender and diagnosed cancer type. In this study, 122 patients of both genders with inoperable IIIB and IV stadium of lung cancer, diagnosed in the Institute for Pulmonary Diseases of Vojvodina, Serbia, were enrolled. In fact, 60 patients with small-cell lung cancer (SCLC, 45% female) and 62 patients with squamous cell lung cancer (SQLC, 48.4% female). The questionnaire was used as a tool to assess the exposure to outdoor air pollution. Almost 19% of the interviewed patients (26.7% with SCLC vs. 11.3% with SQLC) reported that live or work near transportation generated pollution such as highway, gas stations and parking facilities. Industrial air pollution including factories, and waste management systems were identified by 6.6% of patients (6.7% with SCLC vs. 6.5% with SQLC) while 9% (6.7% with SCLC vs. 11.3% with SQLC) reported heating plants, power plants and refineries near by the permanent address or the working place. The exposure to energy production facilities was gender related in patients with SQLC (p=0.055). Waste management facilities (i.e landfills, incineration) was the least abundant source of outdoor pollution and was reported only by individuals with SCLC (4/60). However, living or working near agriculture areas were disclosed by 37.7% of patients of both genders (38.3% with SCLC vs. 37.1% with SQLC). Based on the obtained results the lung cancer patients in Vojvodina are mostly affected by agricultural pollution followed by traffic pollution.

Keywords: *Cancer; Air pollution; Particulate matter; Lung.*

Acknowledgement

This work was supported by Provincial Secretariat for Higher Education and Scientific Research, AP Vojvodina, Republic of Serbia [Grant number 003794555 2025 09418 003 000 000 001 01 001].

HEALTH LITERACY ON NON-COMMUNICABLE DISEASES PREVENTION IN NORTHWEST PART OF AMHARA REGION, ETHIOPIA: A QUALITATIVE STUDY

Mekonnen Alamirew N.[1,], Girma E.[2], Burrowes S.[3], Kebede Lemu Y.[1]*

[1] Department of Health, Behavior and Society, Faculty of Public Health, Jimma University; Jimma, Oromia, Ethiopia, (*e-mail: nakachewmeku@gmail.com)

[2] African Population and Health Research Center, Nairobi, Kenya

[3] Public Health Program; Touro University California

Abstract: Introduction: Health literacy is a multidimensional concept that addresses a range of skills people need to effectively and efficiently function in a healthcare environment. This study, aims to fills the gap about health literacy on noncommunicable diseases prevention practices in the Ethiopia context. Methods: A descriptive qualitative study was used. In order to investigate health literacy-oriented common noncommunicable diseases prevention behavior in the Amhara Region of Northwest Ethiopia. The study used focus groups discussions and in-depth interviews was conducted with purposively sampled 51 diverse participants from community and health system. To further understand participants' health literacy on common noncommunicable diseases, a thematic analysis approach was employed. Atlas TI. 9.1.3.0 software was used for data analysis. Results: Four themes of how health literacy related to prevention and control noncommunicable diseases emerged from the study. Level of health literacy, lack of isolated comprehensive preventive health services room, carefree attitude in terms of health, operational failures, knowledge gap, and motivational variables are factors for low level of noncommunicable diseases preventive behavior. Conclusion: Participants exhibited inadequate health literacy and held misunderstandings regarding non-communicable diseases and their associated risk factors. In order to lessen the increasing burden of noncommunicable diseases, this study emphasizes the necessity of addressing the various health literacy needs (knowledge and skills required to recognize and act on that condition or behavior; how well a person can understand and act on those health requirements) of adults by taking into account context specific noncommunicable disease health literacy improvement strategies in conjunction with re-orienting health systems in noncommunicable diseases literacy friendly manner.

Keywords: *Health literacy; Non-communicable diseases; Adults; Preventive behaviors.*

PROMOTING GENDER EQUALITY THROUGH ERGONOMIC JOB DESIGN

Istrat D.[1], Nunes S.[2]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia (*e-mail: dunjaistrat@uns.ac.rs)

[2]University of Porto, Faculty of Pharmacy, Department of Master in Clinical Analysis, Rua de Jorge Viterbo Ferreira 228, 4050-313 Porto, Portugal

Abstract: Gender differences in physical strength, body dimensions and psychosocial burden often lead to unequal exposure to occupational risks, even when men and women perform the same jobs. This paper examines how ergonomic workplace design can contribute to gender equality by reducing disparities in musculoskeletal workload, fatigue, and stress at work. Data from the health, manufacturing and service sectors were analyzed to identify ergonomic risk factors that disproportionately affect men and women. Special emphasis is placed on work environment design interventions, such as adjustable workstations, improved lifting aids, and participatory task analysis, which can significantly alleviate existing inequalities. In addition to physical ergonomics, the paper also deals with psychosocial and organizational aspects, including flexibility of working hours, equal distribution of workload and inclusion of employees of both genders in decision-making. Integrating gender-sensitive ergonomic principles into occupational health and safety (OHS) systems contributes not only to injury prevention, but also to greater employee engagement, better productivity and workforce retention. The study proposes a practical framework that combines technical and administrative measures with the aim of enabling the fair participation and efficiency of all employees, regardless of gender. Such an approach contributes to the development of a more inclusive and sustainable work environment in which ergonomics, equality and well-being are interconnected elements of the modern work system.

Keywords: *Ergonomics; Gender equality; Musculoskeletal risks; Occupational health and safety; Inclusive workplace.*

Acknowledgement

This work was prepared within the course *Occupational Safety, Global Health, and Sustainable Development* as part of the EUGLOH Alliance, and by the Jean Monnet Module ENROL (101085701). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Education and Culture Executive Agency (EACEA). Neither the European Union nor the EACEA can be held responsible for them.

THERMOGRAVIMETRIC ASSESSMENT OF HYDRATED CHOLINE CHLORIDE–UREA NADES SYSTEMS

Mihajlović T.[1], Papović S.[2], Milidragović J.[1], Đuran I.[3], Grujić-Letić N.[1], Gligorić E.[1], Teofilović B.[1]*

[1]University of Novi Sad, Faculty of Medicine, Department of Pharmacy, Hajduk Veljkova 3, Novi Sad, Serbia (*e-mail: 202201@mf.uns.ac.rs)

[2]University of Novi Sad, University of Novi Sad Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovća 3, Novi Sad, Serbia

[3]Clinic of Nephrology and Clinical Immunology, University Clinical Centre of Vojvodina, Novi sad, Serbia

Abstract: Hydrated natural deep eutectic solvents (NADES) represent a promising class of environmentally aligned media for pharmaceutical, analytical, and extraction technologies. Urea-based NADES systems offer favourable hydrogen-bonding characteristics, biocompatibility, and low toxicity. This study examines the thermal behaviour of a hydrated choline chloride–urea NADES prepared in a 1:1:0.5 molar ratio, with the aim of characterizing its stability profile and suitability for applications involving controlled heat exposure. Thermogravimetric analysis (TGA) was performed under a nitrogen atmosphere up to 500°C using a heating rate of 20 °C·min^{-1}. The hydrated NADES exhibited an initial mass loss corresponding to the evaporation of physically bound and incorporated water, occurring primarily between 100 and 150°C. This behaviour reflects the release of hydration-associated interactions within the hydrogen-bond network. Beyond this region, the system demonstrated stable mass retention until temperatures approaching 200°C, indicating that moderate hydration does not compromise the fundamental integrity of the eutectic matrix at operationally relevant temperatures. At higher temperatures, the NADES underwent characteristic multistep degradation associated with urea-derived fragments and progressive disruption of choline–urea interactions. The overall profile confirms that the hydrated system maintains predictable and robust thermal behaviour appropriate for green extraction, sample preparation, and formulation workflows where moderate thermal input is required. These results support the use of hydrated choline chloride–urea NADES as a thermally resilient and environmentally responsible solvent system suitable for health-oriented and pharmaceutical processing applications.

Keywords: *Natural deep eutectic solvent; Choline chloride–urea; Thermal stability; Thermogravimetric analysis; Green chemistry.*

FIRE SAFETY IN MULTI-STOREY BUILDINGS

Kužet Ž.[1], Bošković G.[2], Mučenski V.[3]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Protection and Occupational Safety Engineering, Trg Dositeja Obradovića 6, Novi Sad, Serbia, (*e-mail: zeljana.kuzet.12@outlook.com)

[2]University of Kragujevac, Faculty of Mechanical and Civil Engineering in Kraljevo, Dositejeva 19, Kraljevo, Serbia

[3]University of Novi Sad, Faculty of Technical Sciences, Department of Civil Engineering and Geodesy, Trg Dositeja Obradovića 6, Novi Sad, Serbia

Abstract: Multi-storey buildings are among the most complex structures in the field of fire protection engineering, due to their architectural complexity, high level of vertical integration of functional units, and the limited ability of fire and rescue teams to intervene externally. These structures require a multidisciplinary approach, as the interaction of structural systems, various types of installations, and internal communication elements significantly influences the dynamics of fire development and spread. Fires in such buildings are high-risk events due to the large number of occupants. These long vertical distances complicate and slow down evacuation, complex internal logistics, and the presence of flammable materials in installation ducts, technical spaces, and interior elements. In these conditions, the reliability of systems for detection, alarm, smoke management, automatic fire suppression, and effective zoning of safety elements becomes a key factor in overall safety performance. Modern engineering methods define the need for integrated analyses, including simulations of fire scenarios and calculations of evacuation routes based on user behavior modeling and assessment of the structure's resistance to thermal loads, with an emphasis on the interaction between active and passive fire protection systems. This approach enables a more precise identification of critical points in design and operation, thereby contributing to the optimization of safety solutions and a reduction in overall risk in multi-storey buildings.

Keywords: *High-rise buildings; Fire safety; Fire protection engineering; Fire development and spread.*

Acknowledgement

This work has been supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, through the Contract for the scientific research financing in 2025, 451-03-137/2025-03/200108 and 451-03-137/2025-03/200103, UN's 2030 Agenda of Sustainable development.

SUSTAINABLE PROJECT MANAGEMENT

DISC2025 – 5th International Student Conference
11th – 12th December 2025

THE ROLE OF UNIVERSITY–INDUSTRY PARTNERSHIPS IN DEVELOPING COMPETENCIES FOR SUSTAINABLE PROJECT MANAGEMENT

Savić B.[1], Savković M.[1], Ćirić Lalić D.[1]*

[1] University of Novi Sad, Faculty of Technical Sciences, Department of Industrial Engineering and Management, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia, (*e-mail: bojana.savic@uns.ac.rs)

Abstract: This paper explores the role of university–industry partnerships in developing the competencies required for sustainable project management, which have become increasingly important in the context of the green transition, ESG requirements, and evolving labor market expectations. The study examines how collaboration with the industry sector can support the systematic integration of sustainability principles into higher education programs, as well as how such partnerships contribute to the development of key competencies needed for managing projects with environmental, social, and economic responsibility. Particular emphasis is placed on competencies such as systems thinking, sustainability risk management, ethical decision-making, the use of tools for environmental impact assessment, and the incorporation of ESG dimensions throughout the project lifecycle. The research includes an analysis of the current state of university curricula and the identification of gaps in the development of competencies for sustainable project management. Various models of collaboration, such as project-based learning, internships, case studies, guest lectures by industry experts, mentoring, and co-creation of course content with companies, are examined as mechanisms that enable students to connect theoretical knowledge with real-world challenges of sustainable projects. Furthermore, the paper discusses barriers to establishing effective university–industry partnerships, including limited resources, the absence of long-term collaboration strategies, misaligned expectations, and insufficient institutional support. Based on the collected insights, the study proposes a framework for strengthening such partnerships, clearly outlining the roles, benefits, and responsibilities of both universities and industry stakeholders. The ultimate aim of this research is to contribute to the development of educational practices that equip students with relevant competencies for managing sustainable projects, thereby enhancing their employability and reinforcing the role of higher education institutions in supporting the sustainable transformation of the economy.

Keywords: *Sustainable project management; University–industry partnerships; ESG competencies; Higher education; Experiential learning.*

Acknowledgement

This research was funded through the European Union's Erasmus+ project: Sustainable project management through PM² (SPM²) under grant agreement No. 2024-1-RS01-KA220-HED-000256067

DISC2025 – 5th International Student Conference
11th – 12th December 2025

COMMUNITY-BASED INTERVENTIONS FOR REDUCING SINGLE-USE PLASTICS

Lakshmana Raj P.[1*], *Theenathayalan B.*[1]

[1] Department of Energy and Environmental Engineering, Agricultural Engineering College and Research Institute, TamilNadu Agricultural University, Coimbatore, India, (*e-mail: lakshmanaraj73@gmail.com)

Abstract: The growing reliance on single-use plastics has accelerated environmental degradation, making it imperative to promote sustainable practices at the community level. This study presents a community-centered behavior-change model designed to reduce single-use plastic consumption and encourage long-term plastic-free habits among residents. The methodology began with stakeholder mapping to identify households, local vendors, youth groups, and community leaders. Baseline surveys assessed current usage patterns, attitudes, and barriers to adopting sustainable alternatives. Based on these insights, targeted interventions were implemented, including awareness workshops, demonstrations of eco-friendly alternatives, school campaigns, street plays, and digital awareness initiatives. Community volunteers were trained to conduct door-to-door engagement, while monitoring tools such as weekly tracking sheets and feedback mechanisms measured behavioral shifts. Digital platforms and social media were employed to reinforce messages and sustain continuous engagement. Results demonstrated a marked reduction in single-use plastic usage, increased adoption of cloth bags and reusable containers, and improved understanding of environmental impacts. Communities actively participating in monitoring showed stronger and more consistent behavioral improvements. Data further highlighted that repeated exposure, peer influence, and visible leadership support significantly enhanced compliance with plastic-free practices. Overall, the study illustrates that a structured, participatory behavior-change approach, guided by project management principles, can successfully transform communities into plastic-free zones. The model is scalable, adaptable, and capable of fostering sustainable habits beyond the project duration. Key insights emphasize the critical role of community empowerment, consistent engagement, and practical alternatives in achieving lasting environmental change.

Keywords: *Single-use plastics; Behavior change; Community engagement; Sustainable practices.*

Acknowledgement

This work was supported by Agricultural Engineering College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, India.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ML-BASED ESTIMATION OF CONSTRUCTION WASTE TO ASSESS RECYCLING POTENTIAL AND CO_2 EMISSIONS

Senjak Pejić M.[1], Petrović M.[2], Peško I .[1], Terzić M.[1], Stanojević D.[1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Civil Engineering and Geodesy, Trg Dositeja Obradovica 6, Novi Sad, Serbia (*e-mail: senjakm@uns.ac.rs)

[2]University of Novi Sad, Faculty of Technical Sciences, Department of Environmental Engineering, Trg Dositeja Obradovica 6, Novi Sad, Serbia

Abstract: Construction and demolition waste in the Republic of Serbia accounts for two-thirds of total waste, which is disposed of unsorted in city landfills. This practice leads to a lack of reliable information on the quantities and types of materials disposed of, which is why this waste is rarely recycled or reused. The construction industry is also responsible for consuming more than 50% of the Earth's extracted materials and for 40% of greenhouse gas emissions. This study highlights five materials significant for prediction: concrete, reinforcing steel, brick, ceramics, and thermal insulation, which together account for more than 80% of the mass of an average building. Their recycling significantly reduces CO_2 emissions and resource consumption. In this research, predictive models were developed to estimate the quantities of the selected materials based on physical characteristics of a building that can be easily spotted on site before demolition. The dataset used for training, validating, and testing the machine learning model contained 129 samples. The achieved prediction accuracy exceeded 86%, and the K-nearest neighbors regressor was the model that achieved the best results. The estimated material quantities were subsequently used to calculate CO_2 emissions associated with the construction of new buildings with similar characteristics when recycled raw materials are used. The smallest reduction in CO_2 emissions was calculated for thermal insulation recycling (0.7%), while the largest was achieved for concrete recycling (95.57%) compared to production using natural resources. Research results confirm that estimating construction waste before demolition can significantly reduce CO_2 emissions, landfill waste, and resource consumption.

Keywords: *Construction waste; Machine learning; CO_2 emissions; Circular economy.*

Acknowledgement

This research has been supported by the Ministry of Science, Technological Development and Innovation (Contract No. 451-03-137/2025-03/200156) and the Faculty of Technical Sciences, University of Novi Sad through project "Scientific and Artistic Research Work of Researchers in Teaching and Associate Positions at the Faculty of Technical Sciences, University of Novi Sad 2025" (No. 01-50/295).

STRATEGIC HUMAN RESOURCE AND BUSINESS MANAGEMENT

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ORGANIZATIONAL CULTURE AS A STRATEGIC TOOL

Cetenji I.[1], Glušac M.[1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Industrial Engineering and Management, Management of Human Resources, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia,(*e-mail: milicaglusac14@gmail.com)

Abstract: This research explores the relationship between organizational culture and organizational strategy. Understanding this relationship is essential for recognizing the deeper mechanisms that shape organizational behavior and long-term performance. It also examines how successful organizations rely on their culture to endure unstable economic conditions in a dynamic business environment. Some authors of previous studies have defined organizational culture as the beliefs, assumptions, and values of a particular organization, while organizational strategy is fully related to the actions an organization takes to achieve its long-term goals. Organizational culture not only shapes employee behavior but also guides decision-making processes on all levels of the company. The literature shows that these two concepts are closely connected and that their synergy produces successful outcomes for organizations. It can also be concluded that organizational strategy begins with a summary of the organization's vision, beliefs, assumptions, and values, and that organizational strategy and culture are intertwined. The research further confirms that organizational culture can be viewed as an organizational strategy, as both serve the same purpose. For example, Nordeus (IT company in Belgrade) has developed a culture centered on innovation, autonomy, and continuous learning, which enables rapid decision-making and fosters high employee engagement. Overall, this study demonstrates that organizational culture itself represents a unique strategy for growth and development. The results suggest that an organization uses its culture as a strategy to gain competitive advantages over its rivals.

Keywords: *Organizational culture; Organizational strategy; Leadership; Competitive advantage.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

INTEGRATING ARTIFICIAL INTELLIGENCE AND BUSINESS INTELLIGENCE: OPPORTUNITIES FOR INNOVATION IN THE SERBIAN INSURANCE SECTOR

Vuković M.[1], Damić N.[1]*

[1]University of Novi Sad Faculty of Technical Sciences, Department of Industrial Engineering and Engineering Management, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, (*e-mail: marko.vukovic.ftn@uns.ac.rs)

Abstract: Business Intelligence (BI) has demonstrated significant potential to improve organizational performance by converting large volumes of data into actionable insights. Survey data collected in our previous research in the Serbian insurance sector indicate that 74% of employees rated their company's adaptability to digital marketing, remote work, and new product development as high (8–10), and 82% reported that their companies are open to creating new insurance products during crisis situations, highlighting links between adaptability, innovation, and crisis management capacity. Previous research in Serbian companies also shows that firms using BI tools achieve better outcomes compared to those relying solely on financial statements, and that organizational adaptability to digital trends is associated with greater innovation potential. The same study identified a key obstacle to higher levels of BI implementation, namely the lack of skilled and qualified staff, which may also affect the adoption of more advanced AI-enhanced BI solutions. Drawing on these findings, this paper explores the potential integration of Artificial Intelligence (AI) with BI systems to support innovation and operational efficiency in the Serbian insurance sector. Conceptually, AI-enhanced BI could provide value in underwriting, claims optimization, customer segmentation, personalized product design, and early-stage risk monitoring. Rather than assessing current adoption, our research focuses on the strategic opportunities and implications of AI-driven BI for performance improvement and innovation readiness. This abstract also introduces forthcoming empirical research, which will examine how AI-supported BI capabilities influence performance, innovation, and competitive positioning among Serbian insurers, combining quantitative modeling with expanded survey instruments and industry-level data, while also addressing potential challenges in adoption and implementation. Overall, this work provides a conceptual framework for AI-driven BI in insurance and lays the foundation for detailed empirical investigation.

Keywords: *Business intelligence; Artificial intelligence; Insurance industry; Digital transformation; Innovation potential.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

IMPORTANCE OF TEAMWORK IN MODERN ORGANIZATIONS

Jovanović S.[1], Savić D.[1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Industrial Engineering and Management, Management of Human Resources, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia, (*e-mail: sandra2003jovanovic@gmail.com)

Abstract: Thanks to globalization on one hand, and the rapid development of technology on the other, there is an increasing need for careful monitoring and organization of work processes within companies. In today's competitive business environment, the success of a company largely depends on teamwork. Teamwork enhances communication among employees, strengthens collaboration, and creates a sense of shared responsibility. It allows employees to combine their skills and knowledge in order to achieve common goals. A team can be defined as a formal organizational unit that brings together people to work on shared objectives, common interests and tasks, all guided by a same mission. Each member of the team contributes unique abilities and perspectives, while the leader plays a crucial role in coordinating activities, setting priorities, and ensuring that team efforts remain focused and productive. Although leaders may have both strengths and weaknesses, their main responsibility is to achieve positive economic outcomes, manage and resolve conflicts efficiently, and integrate team efforts into the broader goals of the organization. Managing teams effectively requires understanding dynamics of the group, motivating members and creating an environment that encourages creativity and cooperation. By implementing proper team management practices, companies can improve the efficiency and effectiveness of their workforce, leading to higher productivity and better results. Ultimately, teamwork not only benefits the organization but also enhances employee satisfaction and professional development, making it a vital component of modern business strategy.

Keywords: *Teamwork; Organization; Productivity; Development; Leader.*

DISC2025 – 5th International Student Conference

11th – 12th December 2025

EVALUATING EMPLOYEE PERFORMANCE IN REMOTE WORK ENVIRONMENTS

Minjin D[1], Aćimović V. [1]*

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Industrial Engineering and Management, Management of Human Resources, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia, (*e-mail: acimovicv7@gmail.com)

Abstract: This research analyzes the impact of telecommuting on employee performance from a human resource management perspective, with a focus on how organizational support, communication quality, and working conditions shape productivity, motivation, and engagement. In the last decade, and especially after the COVID-19 pandemic, remote work has grown from a temporary measure to a long-term functioning model for many organizations. This has made it crucial to understand not only whether employees can work equally well from home, but also what factors determine whether that work will be successful. The results indicate that telecommuting can lead to increased productivity - primarily thanks to autonomy, more flexible schedules, and the absence of daily travel. Half of the respondents reported increased productivity, while a quarter reported a decrease in performance, most often due to difficult communication, lack of supervision and technical obstacles. The analysis also shows that motivation and engagement are strongly related to the quality of feedback, the feeling of recognition and the effectiveness of organizational support. Although the majority of employees believe that the organization provides them with adequate conditions for working remotely, a significant percentage feels a lack of regular feedback, as well as occasional isolation. This indicates that emotional connection and a culture of recognition become even more important in virtual teams. The conclusions of the study confirm that the effectiveness of remote work is not universal and depends on a combination of individual characteristics, organizational practices and digital resources. For HR managers, the key recommendation is to establish a clear structure, transparent expectations and consistent communication channels that can compensate for the lack of physical proximity. When these elements are well placed, remote work can significantly contribute to work efficiency and organizational agility.

Keywords: *Remote work; Employee performance; Productivity; Employee engagement; Human resource management (HRM).*

CIVIL ENGINEERING AND INFRASTRUCTURE

DISC2025 – 5th International Student Conference

11th – 12th December 2025

SPATIOTEMPORAL MODELING OF SEDIMENT AND VEGETATION IN A SHALLOW RESERVOIR USING SENTINEL-2 AND ANNS: LAKE TISZA, HUNGARY

Mohsen A.[1,2], Fleit G.[1], Kiss T.[3], Baranya S.[1]*

[1]Department of Hydraulic and Water Resources Engineering, Faculty of Civil Engineering, Budapest University of Technology and Economics, Műegyetem Rkp. 3, 1111 Budapest, Hungary (*e-mail: ahmed_mohsen250@f-eng.tanta.edu.eg)

[2]Department of Irrigation and Hydraulics Engineering, Tanta University, Tanta 31512, Egypt

[3]Independent Researcher, Horváth Gy. Str. 80,6630 Mindszent, Hungary

Abstract: Shallow reservoirs along major rivers are highly dynamic systems, often threatened by sediment accumulation, eutrophication, and water quality deterioration, which can compromise storage capacity, hydropower production, and ecological stability. Remote sensing provides an effective means to monitor and better understand the patterns of suspended sediments and vegetation distribution. Yet, many previous studies have relied on conventional, less precise methods. This research utilized 285 Sentinel-2 images from 2017 to 2024 alongside machine learning, specifically, artificial neural networks (ANNs), to explore the spatiotemporal patterns of suspended sediment concentration (SSC) and vegetation coverage in the Kisköre Dam reservoir on the Tisza River, Hungary. The models performed well: the SSC model reached an R^2 of 0.87, with an MAE of 21.17 g/m³ and an RMSE of 22.67 g/m³, while the land cover classification model achieved an overall accuracy of 96%. Both SSC and vegetation coverage were closely linked to hydrological, morphological, and meteorological conditions, as well as the operational regime of the Kisköre Dam. Specifically, higher water levels and warmer summer temperatures corresponded with lower SSC and greater vegetation coverage, whereas low water levels combined with cold, windy winter conditions produced the opposite pattern. A downstream decline in SSC and vegetation extent was observed, indicating that shallower upstream sub-basins are most vulnerable to sediment accumulation and eutrophication. Overall, the study highlights the potential of remote sensing to provide essential information on SSC and vegetation dynamics, while also emphasizing the importance of recognizing the method's limitations.

Keywords: *Suspended sediment dynamics; Aquatic vegetation coverage; Satellite remote sensing; Sentinel-2 spectral indices; Lake Tisza (Hungary).*

Acknowledgement

The research was carried out within the framework of the Széchenyi Plan Plus program with the support of the RRF 2.3.1 212022 00008 project. This research was funded by the Ministry of Culture and Innovation and the National Research, Development and Innovation Office under Grant No. TKP2021-NVA-02.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

POZZOLANIC ACTIVITY OF WASTE CERAMIC TILE AND ROOF TILE POWDERS AND THEIR APPLICATION AS SCM: A REVIEW

Pujović A.[1], Milović T.[2], Starčev-Ćurčin A.[2]

[1]Western Serbia Academy of applied studies, Užice, Republic of Serbia, (* e-mail: aleksandarpujovic@gmail.com)

[2]University of Novi Sad, Faculty of Technical Sciences, Department of Civil Engineering and Geodesy, Trg Dositeja Obradovica 6, Novi Sad, Serbia

Abstract: Ceramic waste from the construction sector, particularly the powder obtained by grinding used ceramic tiles and roof coverings, represents a promising supplementary cementitious material (SCM) for sustainable cement-based composites. The aim of this paper is to provide a concise overview of existing research on the pozzolanic reactivity, mechanical properties, durability, and environmental benefits of this material when used as a partial replacement for cement. Studies indicate that ceramic powder, due to its high content of SiO_2 and Al_2O_3, and the elevated firing temperatures during production, exhibits higher pozzolanic activity. Cement replacement level of 10 % with ceramic waste power often yield the best balance between workability and strength of cement-based composites. In mortars and concrete, improvements have been observed in early and late compressive strength, cement-based matrix densification, water absorption, and enhanced durability, primarily due to the additional formation of CSH gel. Roof tile ceramics generally exhibit slightly lower reactivity, although this can be compensated by finer grinding. Ceramic SCMs also influence setting time, typically causing a slight delay. In lightweight foamed concrete, the application of ceramic tile powder as SCM by 25% can improve the splitting tensile strength and foam stability, while there is a minor decrease in the obtained compressive strength and modulus of elasticity. Bibliometric analyses confirm a strong increase in scientific interest over the past decade, with emphasis on mechanical performance, durability, and CO_2 emission reduction. It is concluded that ceramic powder represents a technically and environmentally justified option for partial cement replacement; however, challenges remain, particularly regarding the variability of waste quality, the absence of standardized activation procedures, and the limited number of long-term studies.

Keywords: *Ceramic waste powder; Pozzolanic material; Ceramic tiles powder; Roof tile powder; Cement replacement.*

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation through Contract No. 451-03-136/2025-03/200156 (T.M.) and Contract No. 451-03-137/2025-03/200156 (A.S-Ć.).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

VERTICAL GREENING AS A SUSTAINABLE URBAN STRATEGY: APPLIED BENEFITS AND INNOVATIVE APPROACHES

Nikolić I.[1], Vasić K.[1]*

[1]University of Priština in Kosovska Mitrovica, Faculty of Technical Sciences, Department of Design and Urban Planning, Knjaza Miloša Str. 7, 38220 Kosovska Mitrovica (*e-mail: ivana.nikolic@pr.ac.rs)

Abstract: This paper explores vertical greening as a contemporary and applicable model for improving urban environments within the context of sustainable development. Addressing the challenges of limited urban space, intensified urban heat islands, and the negative effects of climate change in cities, the research examines the typologies, construction systems, and functional principles of green façades and living walls. The study relies on qualitative literature analysis, descriptive data interpretation, and a comparative review of international examples that illustrate diverse technological and spatial approaches to implementation. Special attention is given to the relationship between vegetation, building envelopes, and urban microclimates, as well as to the potential integration of vertical greening within existing architectural and planning practices. Findings indicate that vertical greening systems contribute to microclimate regulation, air pollution reduction, noise mitigation, stormwater management, and the enhancement of urban biodiversity, confirming their ecological potential. From a social perspective, the implementation of green walls improves visual quality, strengthens community well-being, reduces stress, supports public health, and increases user productivity in interior and exterior settings. Economic benefits include higher property value, reduced energy consumption for heating and cooling, extended façade durability, and decreased pressure on urban infrastructure, positioning vertical greening as a significant component of sustainable urban development. The research emphasizes that the widespread adoption of vertical greening requires interdisciplinary collaboration, appropriate policy frameworks, and long-term maintenance strategies to ensure measurable environmental and societal impact.

Keywords: *Vertical greening; Sustainable urban development; Biodiversity; Energy efficiency; Benefits.*

EDUCATION 3.0 – DIGITAL AND INCLUSIVE

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ENHANCING CULTURAL HERITAGE EDUCATION USING A WEB-BASED AUGMENTED REALITY PLATFORM

Paunović A.[1], Đurić I.[1], Krstanović L.[1]*

[1]Faculty of Technical Sciences, Department of Fundamentals Sciences, University of Novi Sad, (*e-mail: aleksa.paunovic@uns.ac.rs)

Abstract: Augmented reality (AR) applications offer interactive and immersive experiences in cultural heritage visualization that can enhance the understanding and imagination of various forms of heritage objects. However, they often present barriers to widespread adoption in schools due to high hardware costs or the requirement for users to download specific software. On the other hand, while traditional textbooks provide foundational knowledge, they often rely on static images that may not fully capture student attention or make the material genuinely engaging. This research explores the potential of a web-based AR platform, particularly in enhancing the presentation of cultural heritage assets for educational purposes. The study's main goal is to explore implementation of 3D models in educational material, using AR technology to enhance learning environments, specifically focusing on web-based platforms (Web AR). By utilizing standard mobile web browsers which can be accessed via QR code, this approach eliminates the need for app installations, allowing students to instantly access interactive content using their existing smartphones. An additional advantage is that Web AR can be seamlessly applied to existing printed textbooks, circumventing the costly and resource-intensive process of reprinting new editions. This study serves as a proof-of-concept, demonstrating how 3D models of complex artifacts or cultural sites can be seamlessly integrated into simulated book pages and accessed instantly through Web AR, transforming traditional pages into interactive learning material. The research proposes Web AR as a suitable solution for making education more engaging and dynamic, bringing educational material to life in ways static two-dimensional images cannot, such as the reconstruction or historical context of cultural heritage objects. The findings indicate that Web AR provides an optimal balance of interactivity and accessibility, making it an efficient tool for modernizing education of cultural heritage without requiring specialized or expensive equipment.

Keywords: *Augmented reality / AR; Web ar; Education; 3D animation.*

Acknowledgement

This research has been supported by the Ministry of Science, Technological Development and Innovation (Contract No. 451-03-137/2025-03/200156) and the Faculty of Technical Sciences, University of Novi Sad through project "Scientific and Artistic Research Work of Researchers in Teaching and Associate Positions at the Faculty of Technical Sciences, University of Novi Sad 2025" (No. 01-50/295).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ENHANCING CAREER-READINESS SKILLS THROUGH EDUCATION 3.0: A NEEDS ANALYSIS OF CAREER-READINESS COMPETENCIES IN HIGHER EDUCATION

Savić B.[1], Savković M.[1], Ćirić Lalić D.[1]*

[1] University of Novi Sad, Faculty of Technical Sciences, Department of Industrial Engineering and Management, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia, (*e-mail: bojana.savic@uns.ac.rs)

Abstract: This research proposal examines how educational approaches inspired by the principles of Education 3.0 can enhance the development of career-readiness competencies among university students and improve their preparedness for entering the labor market. The study is grounded in a needs analysis that identifies gaps and opportunities for integrating key career-related skills into higher education, including professional communication, interview preparation, digital self-presentation, and the development of a coherent professional identity. Higher education institutions are increasingly expected to establish and strengthen career support structures-such as career centres, mentoring systems, and employer engagement offices-as integral components of Education 3.0. These structures aim to provide continuous guidance, practical exposure, and closer alignment between academic learning and labor market expectations. The objective of the study is to assess the current level of institutional support for career-readiness competencies within universities and to evaluate how well existing educational models respond to labor market needs. The needs analysis will examine institutional readiness, student and employer perspectives, and contextual challenges influencing the development of career-related skills. By collecting insights from students, faculty members, career services, and industry partners, the research seeks to identify underdeveloped competencies and propose strategies for strengthening them through digitally supported and inclusive learning models aligned with the Education 3.0 philosophy. Particular attention will be given to labor market trends related to digital employability, professional communication standards, and the growing importance of online professional branding. Finally, the study will explore the potential of digital learning environments-such as e-portfolios, interview simulations, and online career modules-to enhance flexibility, accessibility, and personalized learning pathways. Ultimately, the research aims to propose a conceptual framework for strengthening career-readiness competencies in higher education and reinforcing the role of universities in preparing future professionals.

Keywords: *Career-readiness competencies; Education 3.0; Employability; Professional skills.*

Acknowledgement

This research was funded through the European Union's Horizon Europe project: SMART Researchers: Strategic Micro-Credentialing and Skills Recognition for a Dynamic ESRs Talent Ecosystem (SMART Reseachers), under grant agreement No. 101216967.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

TRANSFORMING HIGHER EDUCATION THROUGH ESG REPORTING: STRENGTHENING SUSTAINABILITY COMPETENCIES VIA DIGITAL AND INCLUSIVE LEARNING MODELS

Savić B.[1], Savković M.[1], Ćirić Lalić D.[1]*

[1] University of Novi Sad, Faculty of Technical Sciences, Department of Industrial Engineering and Management, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia, (*e-mail: bojana.savic@uns.ac.rs)

Abstract: This paper explores the opportunities and challenges of introducing ESG reporting within higher education institutions, as well as the ways in which digital and inclusive learning models can support the development of competencies necessary for sustainable university management. Although ESG reporting has traditionally been associated with the corporate sector, growing environmental and social expectations highlight the need for universities to demonstrate transparency regarding their environmental impact, community engagement, and governance practices. The study aims to identify current practices, gaps, and institutional capacities related to ESG reporting in higher education, and to assess the readiness of students, academic staff, and university administration to adopt such processes. A particular focus is placed on the role of digital and inclusive learning models in strengthening ESG-related competencies among students and staff. Digital tools and learning environments can significantly enhance the understanding of ESG concepts, as well as the ability to analyze and interpret relevant data, while inclusive pedagogical approaches ensure that diverse student groups can meaningfully participate in the development and evaluation of ESG practices within the university. The paper also examines the potential for engaging students in reporting processes through project-based work, research activities, and collaborative initiatives with industry and local communities. Based on the conducted analysis, the study proposes a conceptual ESG reporting framework tailored to higher education institutions, with clearly defined dimensions, indicators, and student engagement mechanisms. The overall goal of this research is to contribute to the advancement of sustainable practices in the academic sector, strengthen institutional transparency, and support the alignment of universities with contemporary environmental, social, and governance standards.

Keywords: *ESG reporting; Higher education; Sustainability competencies; Digital learning; Inclusive education.*

Acknowledgement

This research was funded through the European Union's Erasmus+ project: The ESG Imperative for the Project Management World: Alliance for Developing and Empowering Changemakers (ESG4PMChange), under grant agreement No. 101187376.

DISC2025 – 5th International Student Conference

11th – 12th December 2025

BRIDGING THE SKILLS GAP BETWEEN ACADEMIA AND INDUSTRY: ROUNDTABLE DIALOGUE FOR FUTURE-READY IT EDUCATION

Leoste J.[1,2], Tomusk V.[1], Marmor K.[1], Rakic S.[1,3]*

[1]Tallinn University of Technology, IT College, Tallinn, Estonia

[2]Tallinn University, School of Educational Sciences, Tallinn, Estonia

[3]University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia, (*e-mail: slavkorakic@uns.ac.rs, slavko.rakic@taltech.ee)

Abstract: Rapid digitalisation and the growing use of artificial intelligence are reshaping expectations for future IT professionals. Although universities provide solid technical foundations, industry partners continue to observe gaps in soft skills, applied problem-solving, and responsible AI competencies among junior graduates. To address this misalignment, structured Industry-Academia Roundtables were organised to jointly identify emerging skill needs and outline practical strategies for strengthening early-stage IT education. Roundtables are a critical methodological approach because they enable direct dialogue, shared understanding, and co-creation of outputs that traditional curriculum development processes often overlook. Through facilitated group work, participants identified key missing competencies-such as communication, teamwork, ethical decision-making, and AI-supported work practices-and transformed them into industry case studies. These will be integrated into new micro-courses designed to combine technical learning with essential transversal skills. The insights also support ongoing development of AI-enhanced learning and assessment tools, underscoring the need for responsible, explainable, and pedagogically grounded AI use in higher education. Together, these initiatives emphasise the importance of sustained collaboration between academia and industry to prepare future generations for a labour market increasingly shaped by artificial intelligence and advanced digital skills.

Keywords: *Industry-academia collaboration; AI and soft skills development; ICT education modernisation; Future workforce competencies.*

Acknowledgement

This work was supported by the Estonian Research Council and European Commission Erasmus+ (Grant No. KOHTO25 and 2025-1-EE01-KA220-HED-000360808).

DISC2025 – 5th International Student Conference

11th – 12th December 2025

ALIGNING ICT EDUCATION WITH LABOUR MARKET NEEDS: A MULTICOUNTRY ANALYSIS OF KENYA, NIGERIA, AND ARMENIA

Rakic S.[1,2], Leoste J.[2,3], Tomusk V.[2], Marmor K.[2]*

[1]University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia, (*e-mail: slavkorakic@uns.ac.rs, slavko.rakic@taltech.ee)

[2]Tallinn University of Technology, IT College, Tallinn, Estonia

[3]Tallinn University, School of Educational Sciences, Tallinn, Estonia

Abstract: The rapid growth of the digital economy in East Africa and the Eastern Partnership region has intensified the demand for ICT graduates equipped with practical skills and industry-relevant competencies. Although software engineering and data analytics programs are expanding, employers continue to report gaps in applied technical skills, soft skills, and exposure to real-world workflows. These challenges are evident in Kenya and similarly reflected in countries such as Nigeria and Armenia. This study examines how effectively ICT higher education prepares students for labour market needs, with Kenya as the central case and Estonia as a benchmark for curricular comparison. The analysis explores key program elements, teaching methods, and collaboration mechanisms shaping graduate readiness. Research activities include curriculum review, semi-structured interviews with Kenyan students involved in international ICT training schemes, employer validation sessions, and analysis of policy and accreditation frameworks. Comparative interviews and desk research in Nigeria and Armenia provide additional insight into shared and context-specific barriers to digital talent development. The study will deliver evidence-based recommendations for enhancing ICT curricula, improving university-industry cooperation, and strengthening pathways for digital talent mobility aligned with European and global skills initiatives.

Keywords: *ICT education; Skills gap analysis; Labour market alignment; Digital talent mobility.*

Acknowledgement

This work was supported by the Estonian Centre for International Development (ESTDEV) (Grant No. LICEE25112).

FROM POLICY TO PRACTICE: BUILDING GREEN & DIGITAL TWIN COMPETENCIES THROUGH HEI–INDUSTRY LEARNING ECOSYSTEMS

Savković M.[1], Savić B.[1], Ćirić Lalić D.[1]*

[1] University of Novi Sad, Faculty of Technical Sciences, Department of Industrial Engineering and Management, Trg Dositeja Obradovića 6, 21000, Novi Sad, Serbia, (*e-mail: milena.savkovic@uns.ac.rs)

Abstract: Across Europe, engineering education is increasingly being shaped by the demands of the green and digital twin transition. This development has been influenced by strategic documents such as the European Green Deal, the EU Industrial Strategy, the Digital Decade Policy Programme, the Corporate Sustainability Reporting Directive (CSRD) and the Circular Economy Action Plan, while competence frameworks including GreenComp, DigComp 2.2 and emerging Industry 5.0 and Digital Twin models define expectations for future engineers. However, despite clear policy direction, a misalignment continues to be observed between the competencies developed during engineering studies and those required in practice. Sustainability, digitalisation and data-driven innovation are often addressed conceptually, leaving graduates aware of transition priorities but uncertain when applying them within real organisational settings characterised by compliance requirements, resource limitations and established operational constraints. To address this gap, the establishment of a Centre for Applied Transition Learning and Industry Partnerships (CATLIP) is proposed at the Faculty of Technical Sciences, University of Novi Sad. The centre would serve as a formal institutional mechanism for coordinated industry collaboration, co-designed learning activities, long-term placement agreements and the integration of supervised practice as a required component of the curriculum rather than an optional experience. Through this structure, students would participate in achievable tasks such as supporting basic sustainability-related data preparation, contributing to introductory energy or resource analyses, assisting in reporting or maintenance routines, or testing early-stage functionalities of digital tools used in automation, monitoring or modelling. Such applied engagement would allow theoretical knowledge to be gradually transformed into practical competence, confidence and professional readiness. It is argued that only through systematic, embedded and institutionally supported practice can engineering graduates be prepared not merely to transition into employment, but to meaningfully contribute to the green and digital twin transformation shaping Europe's industrial future.

Keywords: *Practice-based learning; Twin transition; Engineering education reform; Industry–academia collaboration; Workforce readiness.*

Acknowledgement

This research was funded through the European Union's Erasmus+ project: Fostering Dual Green and Digital Transitions through Education and Innovation in the Neighbourhood East, Central Asia, and Asia (GreenTech Horizons) under grant agreement No. 101177203.

PROJECT PROMOTION

ENROL

Co-funded by the European Union

JM ENROL SQUARE 2025

12th December

10-12h

Venue: Presentation Room 1 (ground floor), Science and Technology Park, Novi Sad

SHORT PROJECT PRESENTATIONS

OPEN DISCUSSION AND EXPERIENCE SHARING

WHAT TO EXPECT

NETWORKING AND COLLABORATION OPPORTUNITIES

A GROWING COMMUNITY OF PRACTICE

Where Projects Meet. Ideas Connect. Impact Grows.

Join us at JM ENROL Square - an event dedicated to bringing projects together.

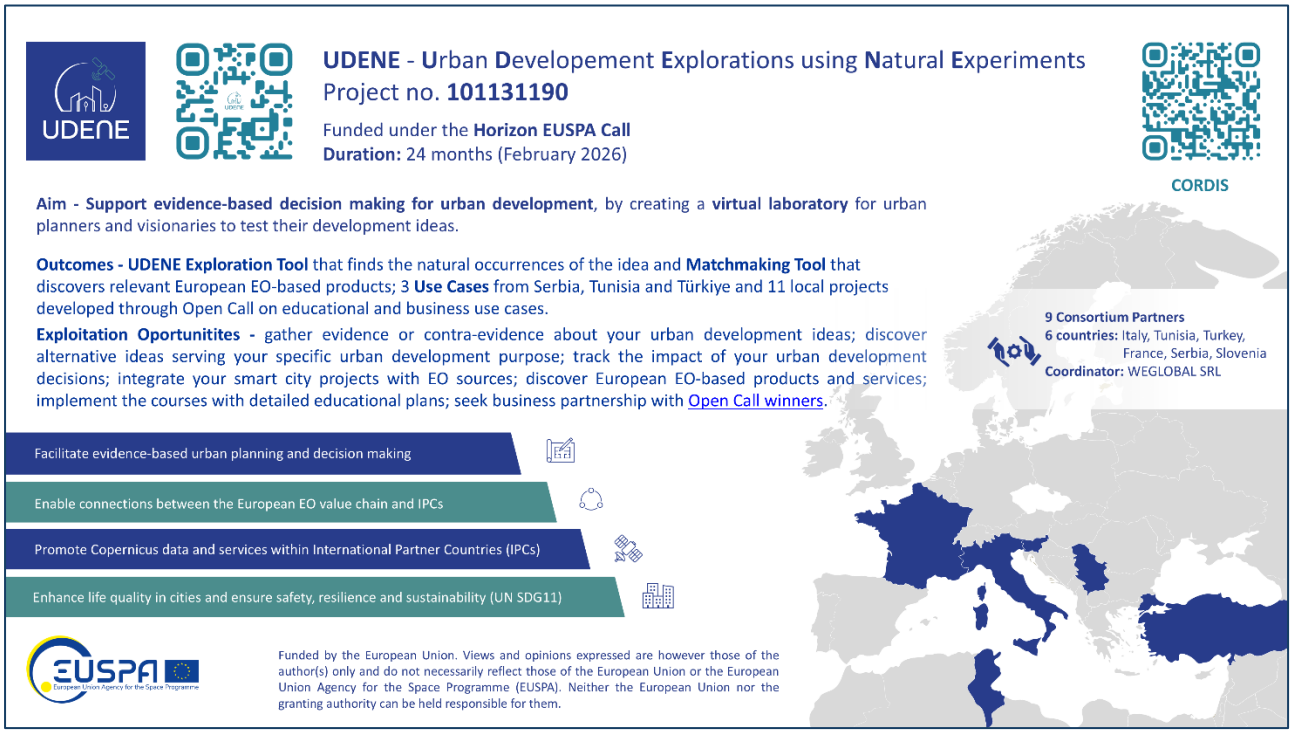
DANIJELA ĆIRIĆ LALIĆ
- moderator

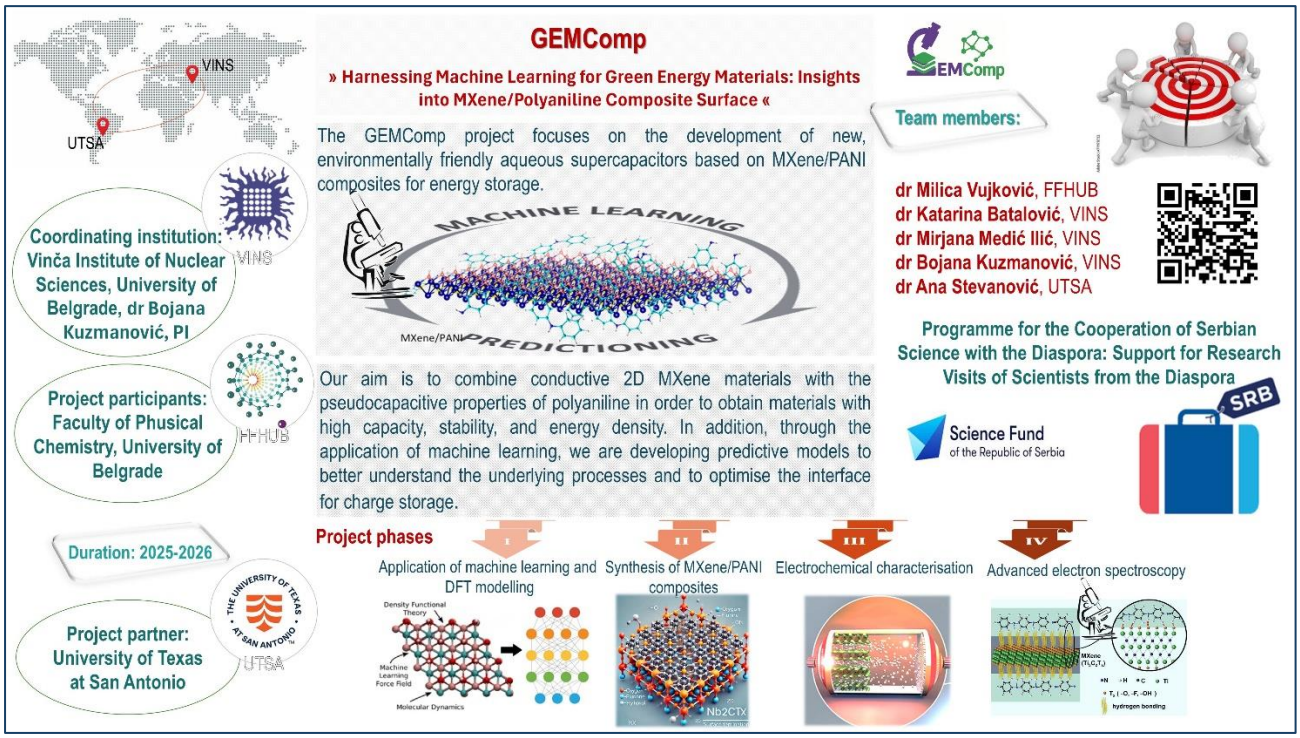
MAJA PETROVIĆ
- moderator

JM ENROL Square is designed as a project communication hub.

A place where results are shared, experiences exchanged, and new partnerships born.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Education and Culture Executive Agency (EACEA). Neither the European Union nor the EACEA can be held responsible for them. Grant agreement number 101085701.


UDENE
UDENE - Urban Developement Explorations using Natural Experiments
Project no. 101131190
Funded under the Horizon EUSPA Call
Duration: 24 months (February 2026)
CORDIS
Aim - Support evidence-based decision making for urban development, by creating a virtual laboratory for urban planners and visionaries to test their development ideas.
Outcomes - UDENE Exploration Tool that finds the natural occurrences of the idea and Matchmaking Tool that discovers relevant European EO-based products; 3 Use Cases from Serbia, Tunisia and Türkiye and 11 local projects developed through Open Call on educational and business use cases.
Exploitation Oportunitites - gather evidence or contra-evidence about your urban development ideas; discover alternative ideas serving your specific urban development purpose; track the impact of your urban development decisions; integrate your smart city projects with EO sources; discover European EO-based products and services; implement the courses with detailed educational plans; seek business partnership with Open Call winners.
9 Consortium Partners
6 countries: Italy, Tunisia, Turkey, France, Serbia, Slovenia
Coordinator: WEGLOBAL SRL
Facilitate evidence-based urban planning and decision making
Enable connections between the European EO value chain and IPCs
Promote Copernicus data and services within International Partner Countries (IPCs)
Enhance life quality in cities and ensure safety, resilience and sustainability (UN SDG11)
EUSPA
Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Union Agency for the Space Programme (EUSPA). Neither the European Union nor the granting authority can be held responsible for them.


VINS
UTSA
Coordinating institution: Vinča Institute of Nuclear Sciences, University of Belgrade, dr Bojana Kuzmanović, PI
Project participants: Faculty of Phusical Chemistry, University of Belgrade
FFHUB
Duration: 2025-2026
Project partner: University of Texas at San Antonio
GEMComp
» Harnessing Machine Learning for Green Energy Materials: Insights into MXene/Polyaniline Composite Surface «
The GEMComp project focuses on the development of new, environmentally friendly aqueous supercapacitors based on MXene/PANI composites for energy storage.
MACHINE LEARNING
PREDICTIONING
MXene/PANI
Our aim is to combine conductive 2D MXene materials with the pseudocapacitive properties of polyaniline in order to obtain materials with high capacity, stability, and energy density. In addition, through the application of machine learning, we are developing predictive models to better understand the underlying processes and to optimise the interface for charge storage.
Project phases
I Application of machine learning and DFT modelling
II Synthesis of MXene/PANI composites
III Electrochemical characterisation
IV Advanced electron spectroscopy
Nb2CTx
EMComp
Team members:
dr Milica Vujković, FFHUB
dr Katarina Batalović, VINS
dr Mirjana Medić Ilić, VINS
dr Bojana Kuzmanović, VINS
dr Ana Stevanović, UTSA
Programme for the Cooperation of Serbian Science with the Diaspora: Support for Research Visits of Scientists from the Diaspora
Science Fund of the Republic of Serbia
SRB

Metalloestrogen biomonitoring in women with lung carcinoma

Coordinating institution: **Faculty of Medicine**
Coordinator: **Nataša Milošević, PhD, full professor**
Duration: **2025-2026**

Research gap

Metalloestrogens are a class of inorganic xenoestrogens that affect gene expression and disrupt the normal function of estrogen-dependent cells. Increased exposure to heavy metals and metalloids is associated with oxidative stress, impaired normal mitochondrial function, DNA damage, cell growth disorders, and cell death. Due to the high affinity of heavy metals and metalloids (As, Cr, Ni) for estrogen receptors and their impact on the function of estrogen-dependent cells, women are considered to be particularly vulnerable. The presence of heavy metals and metalloids (As, Cr, Ni) in morning urine samples has been recognized as a biomarker in the development of various cancers.

Methodology

The study will randomly select 60 women over 18 years of age diagnosed with inoperable advanced non-small cell lung cancer (stage IIIB and IV) and 30 healthy women over 18 years who have not previously been diagnosed with cancer (control group). Data on age and gender will be collected from the subjects. The concentration of metalloestrogens (As, Cr, Ni) in morning urine will be determined by validated inductively coupled plasma mass spectrometry (ICP-MS).

Research aims

to determine the incidence of metalloestrogens arsenic (As), chromium (Cr) and nickel (Ni) in 60 women over 18 years of age diagnosed with inoperable advanced non-small cell lung cancer (stage IIIB and IV) based on the content in morning urine samples

to determine the incidence of metalloestrogens arsenic (As), chromium (Cr) and nickel (Ni) in 30 healthy women without a previous diagnosis of cancer older than 18 years based on their content in morning urine samples

Outcomes

The results of this project will provide, for the first time, insight into the degree of exposure to metalloestrogens (As, Cr, Ni) in women diagnosed with inoperable advanced non-small cell lung cancer (stage IIIB and IV) compared to healthy women in the territory of the Autonomous Province of Vojvodina.

РЕПУБЛИКА СРБИЈА
АУТОНОМНА ПОКРАЈИНА ВОЈВОДИНА
ПОКРАЈИНСКИ СЕКРЕТАРИЈАТ ЗА ВИСОКО ОБРАЗОВАЊЕ
И НАУЧНОИСТРАЖИВАЧКУ ДЕЛАТНОСТ

Exposure to plasticizers in couples undergoing in vitro fertilization

Coordinating institution: **Faculty of Medicine**
Coordinator: **Prof. Dr. Artur Bjelica**
Duration: **2025-2028**

Project Aims

1. To investigate the occurrence of phthalic acid esters and bisphenols in the morning urine samples of couples who are candidates for in vitro fertilization (IVF).
2. To examine the association between urinary levels of phthalic acid esters and bisphenols, and reproductive hormone levels, metabolic parameters, as well number of total oocytes obtained with aspiration, (im)mature oocytes, fertilized egg cells, and even lifestyle-related factors in women undergoing IVF.
3. To examine the correlation of phthalic acid ester and bisphenol A levels with the number, motility and morphology of sperm based on spermogram findings in men.

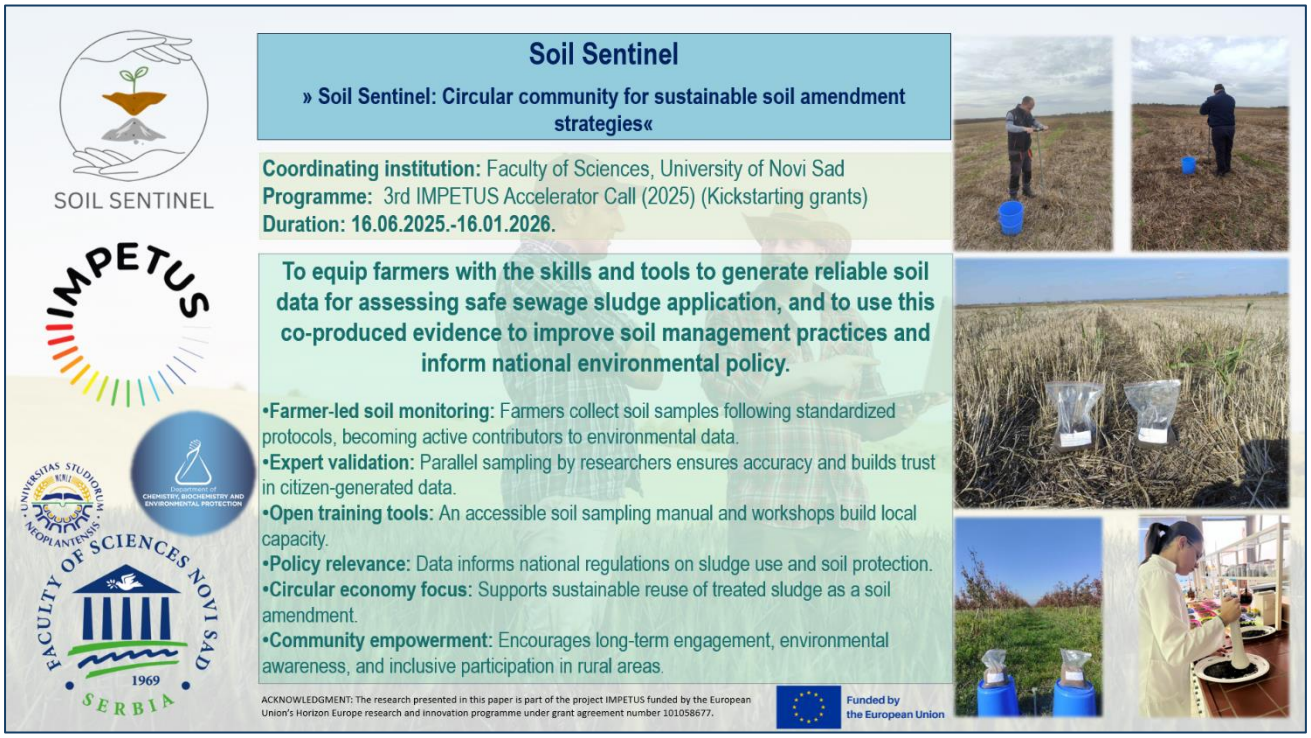
Methodology

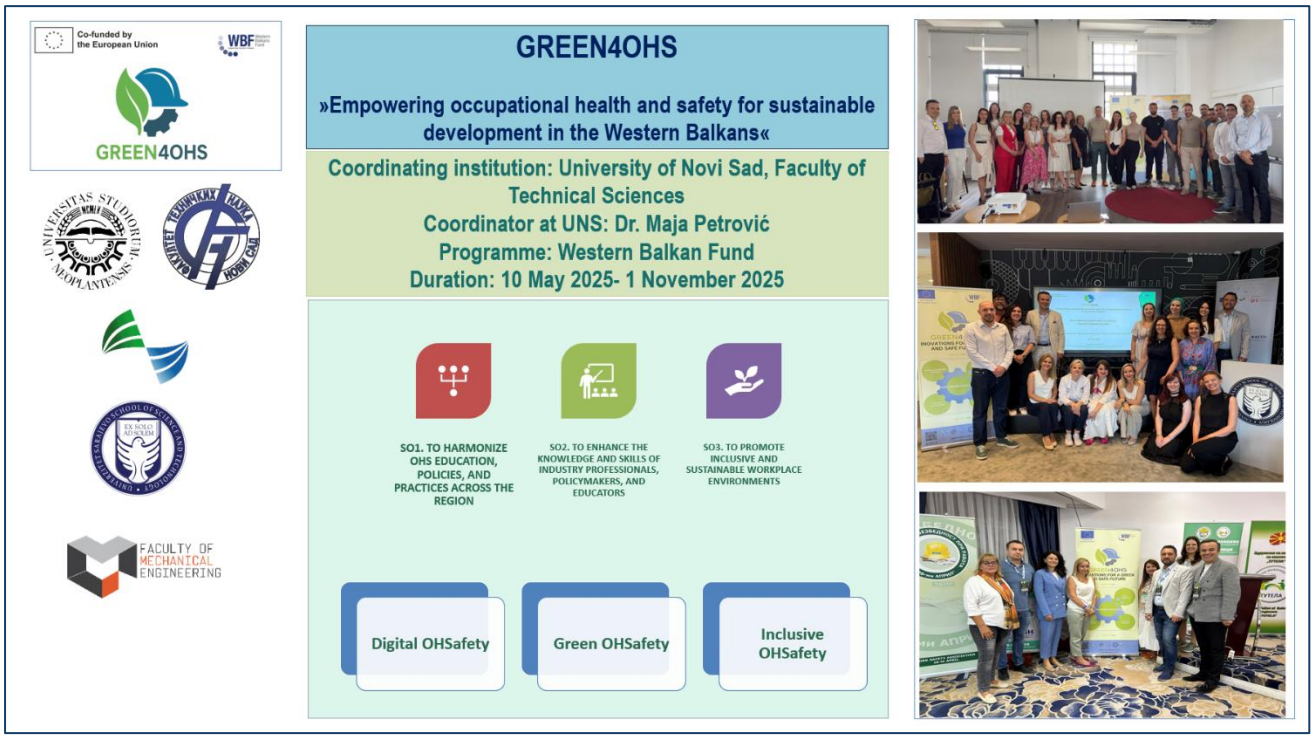
- **A cross-sectional study that includes 50 couples with diagnosed infertility, age between 18 and 45 years that are candidates for IVF**
- **The ten phthalate metabolites:** mono-ethyl phthalate (MEP), mono-(2-ethylhexyl) phthalate (MEHP), mono-methyl phthalate (MMP), mono-n-propyl phthalate (MPP), mono-n-butyl phthalate (MBP), mono-iso-allyl phthalate (MiAP), mono-n- allyl phthalate (MnAP), mono-cyclohexyl phthalate (MCHP), mono-benzyl phthalate (MBzP), and mono-n-octyl phthalate (MOP), together with **bisphenol A and S** will be quantified using developed GC-MS method.

Project impact

- For the first time, the association between phthalates and bisphenols levels with dietary habits, daily lifestyle, personal and family disease history, demographic characteristics, as well as laboratory parameters of couples undergoing IVF will be examined.
- Identification of lifestyle habits that lead to increased exposure to phthalates and bisphenols can help medical doctors and patients to reduce exposure and thus support a holistic approach to the success of the in vitro fertilization process.

РЕПУБЛИКА СРБИЈА
АУТОНОМНА ПОКРАЈИНА ВОЈВОДИНА
ПОКРАЈИНСКИ СЕКРЕТАРИЈАТ ЗА ВИСОКО ОБРАЗОВАЊЕ
И НАУЧНОИСТРАЖИВАЧКУ ДЕЛАТНОСТ


SOIL SENTINEL
Soil Sentinel
» Soil Sentinel: Circular community for sustainable soil amendment strategies«
Coordinating institution: Faculty of Sciences, University of Novi Sad
Programme: 3rd IMPETUS Accelerator Call (2025) (Kickstarting grants)
Duration: 16.06.2025.-16.01.2026.
To equip farmers with the skills and tools to generate reliable soil data for assessing safe sewage sludge application, and to use this co-produced evidence to improve soil management practices and inform national environmental policy.
•Farmer-led soil monitoring: Farmers collect soil samples following standardized protocols, becoming active contributors to environmental data.
•Expert validation: Parallel sampling by researchers ensures accuracy and builds trust in citizen-generated data.
•Open training tools: An accessible soil sampling manual and workshops build local capacity.
•Policy relevance: Data informs national regulations on sludge use and soil protection.
•Circular economy focus: Supports sustainable reuse of treated sludge as a soil amendment.
•Community empowerment: Encourages long-term engagement, environmental awareness, and inclusive participation in rural areas.
ACKNOWLEDGMENT: The research presented in this paper is part of the project IMPETUS funded by the European Union's Horizon Europe research and innovation programme under grant agreement number 101058677.
Funded by the European Union


Co-funded by the European Union
GREEN4OHS
GREEN4OHS
»Empowering occupational health and safety for sustainable development in the Western Balkans«
Coordinating institution: University of Novi Sad, Faculty of Technical Sciences
Coordinator at UNS: Dr. Maja Petrović
Programme: Western Balkan Fund
Duration: 10 May 2025- 1 November 2025
SO1. TO HARMONIZE OHS EDUCATION, POLICIES, AND PRACTICES ACROSS THE REGION
SO2. TO ENHANCE THE KNOWLEDGE AND SKILLS OF INDUSTRY PROFESSIONALS, POLICYMAKERS, AND EDUCATORS
SO3. TO PROMOTE INCLUSIVE AND SUSTAINABLE WORKPLACE ENVIRONMENTS
Digital OHSafety
Green OHSafety
Inclusive OHSafety
FACULTY OF MECHANICAL ENGINEERING

ESG4PMChange

» Project Title: The ESG Imperative for the Project Management World: Alliance for Developing and Empowering Changemakers «

Coordinating institution: University of Novi Sad
Coordinator at UNS: Doc. Dr. Danijela Ćirić Lalić
Programme: Erasmus+ Alliances for Education and Enterprises
Duration: 2024 - 2027

The ESG4PMChange project advances the integration of ESG principles into project management education across 8 countries, uniting HEIs, VET providers, the PM² Alliance, and industry partners. It conducts a comprehensive gap analysis to align current programs with labor market needs, and develops standardized professional profiles and a competency framework. The project also introduces an ESG-focused learning model with Living Labs, a digital hub with MOOCs and OER, and a micro-credential system to formally validate ESG project management competencies.

Funded by the European Union

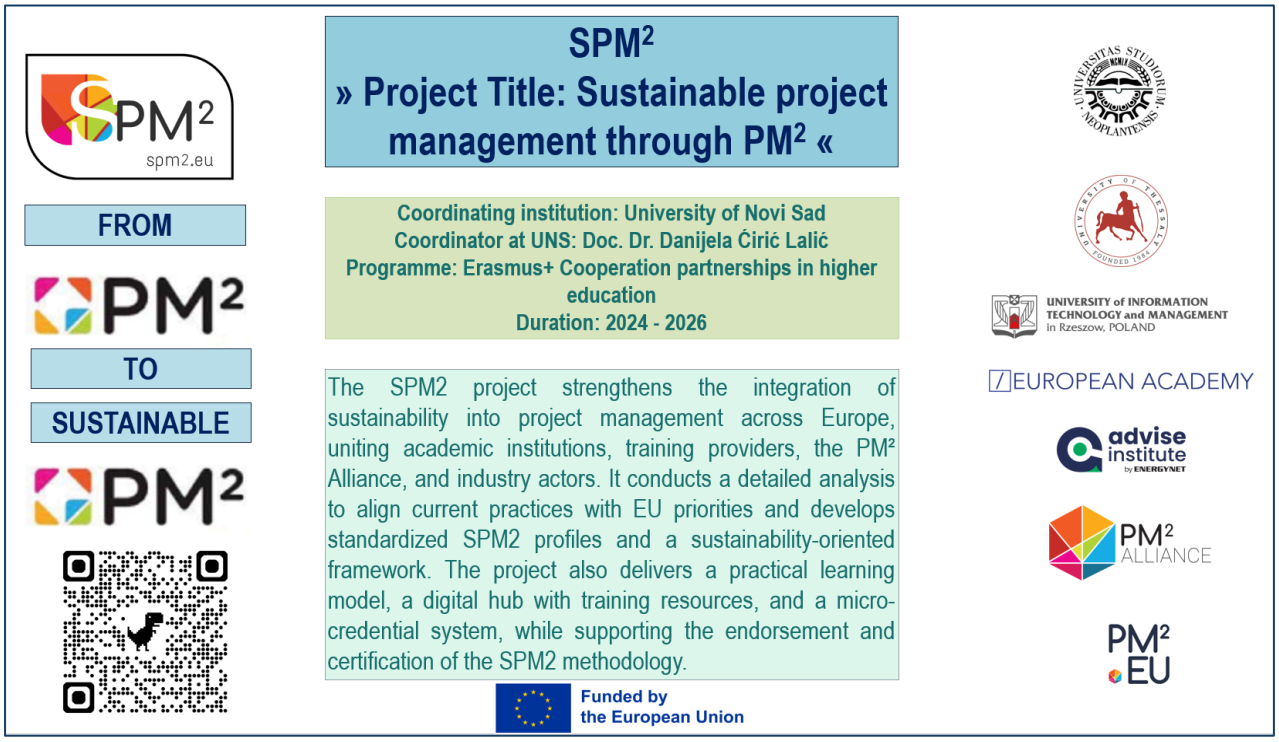
GreenTech Horizons

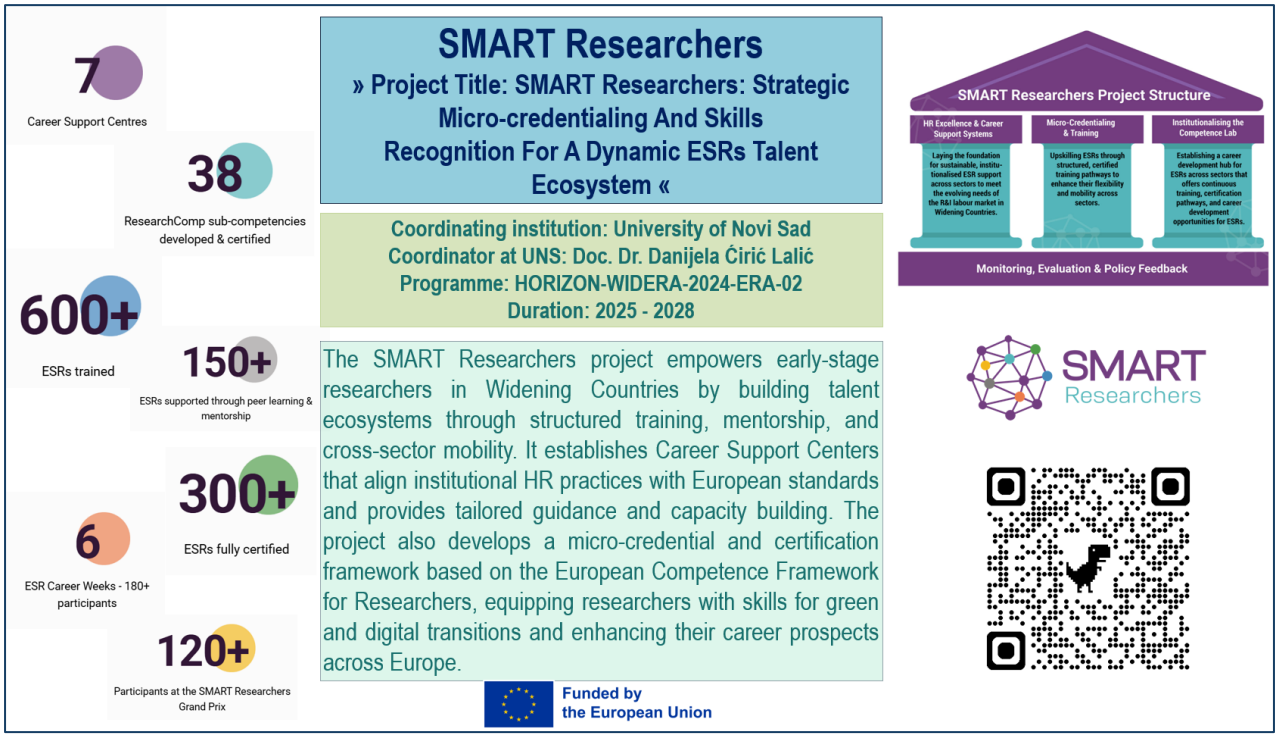
» Project Title: Fostering Dual Green and Digital Transitions through Education and Innovation in the Neighbourhood East, Central Asia, and Asia «

Coordinating institution: University of Novi Sad
Coordinator at UNS: Doc. Dr. Danijela Ćirić Lalić
Programme: Erasmus+ Capacity Building in Higher Education
Duration: 2024 - 2027

The GreenTech Horizons project drives green and digital transition across eight countries, bringing together 17 institutions to build essential twinning competencies in green, digital, and business skills. It focuses on strengthening workforce readiness in Azerbaijan, Kazakhstan, and Mongolia through a competency-oriented learning ecosystem that supports sustainable growth. The project modernizes higher education by applying the green and digital transition talent triangle to curriculum development and creates an eLearning ecosystem with innovative courses and MOOCs to ensure broad, effective access to training.

Funded by the European Union


SPM²
» Project Title: Sustainable project management through PM² «
FROM
PM²
TO
SUSTAINABLE
PM²
Coordinating institution: University of Novi Sad
Coordinator at UNS: Doc. Dr. Danijela Ćirić Lalić
Programme: Erasmus+ Cooperation partnerships in higher education
Duration: 2024 - 2026
The SPM2 project strengthens the integration of sustainability into project management across Europe, uniting academic institutions, training providers, the PM² Alliance, and industry actors. It conducts a detailed analysis to align current practices with EU priorities and develops standardized SPM2 profiles and a sustainability-oriented framework. The project also delivers a practical learning model, a digital hub with training resources, and a micro-credential system, while supporting the endorsement and certification of the SPM2 methodology.
Funded by the European Union
UNIVERSITY of INFORMATION TECHNOLOGY and MANAGEMENT in Rzeszow, POLAND
EUROPEAN ACADEMY
advise institute by ENERGYNET
PM² ALLIANCE
PM² EU


SMART Researchers
» Project Title: SMART Researchers: Strategic Micro-credentialing And Skills Recognition For A Dynamic ESRs Talent Ecosystem «
7
Career Support Centres
38
ResearchComp sub-competencies developed & certified
600+
ESRs trained
150+
ESRs supported through peer learning & mentorship
300+
ESRs fully certified
6
ESR Career Weeks - 180+ participants
120+
Participants at the SMART Researchers Grand Prix
Coordinating institution: University of Novi Sad
Coordinator at UNS: Doc. Dr. Danijela Ćirić Lalić
Programme: HORIZON-WIDERA-2024-ERA-02
Duration: 2025 - 2028
The SMART Researchers project empowers early-stage researchers in Widening Countries by building talent ecosystems through structured training, mentorship, and cross-sector mobility. It establishes Career Support Centers that align institutional HR practices with European standards and provides tailored guidance and capacity building. The project also develops a micro-credential and certification framework based on the European Competence Framework for Researchers, equipping researchers with skills for green and digital transitions and enhancing their career prospects across Europe.
Funded by the European Union
SMART Researchers Project Structure
HR Excellence & Career Support Systems
Micro-Credentialing & Training
Institutionalising the Competence Lab
Monitoring, Evaluation & Policy Feedback
SMART Researchers

ZePi

A green approach for antibiotic removal for the sustainability of the aquatic environment
Zeleni pristup u uklanjanju antibiotika za održivost vodnog okoliša (ZePi)

Funded by the European Union
NextGenerationEU

University of Zagreb Faculty of Chemical Engineering and Technology
Coordinator at UNS: Monika Šabić Runjavec, PhD
Programme: Proof of concept (PoC), NPOO.C3.2.R3-I1.05.0207
Duration: 10/01/2025 – 10/01/2026

The increased consumption of antibiotics has led to an increase in the emergence of antibiotic resistance, which is one of the of today's main challenges in the context of preserving people's health. In order to solve the mentioned problem, a new innovative product is planned in the form of a microbial isolate for the biodegradation of complex compounds such as antibiotics.

The goal of this project is to provide a green approach by applying a microbial isolate removal of antibiotics for the sustainability of the aquatic environment. The target groups included in the project are scientific community and primarily sectors that produce waste streams with increased concentrations of antibiotics, such as are healthcare, agriculture and animal husbandry and the industry of production of specific pharmaceutical products.

Funded by the European Union – NextGenerationEU. The views and opinions expressed are solely those of the author and do not necessarily reflect the official views of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.