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4th International Student Conference

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OCCUPATIONAL
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University of Novi Sad

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Faculty of Technical Sciences, University of Novi Sad, Serbia

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PREFACE

Welcome to the Abstract Book for DISC2024 – a forward-thinking collection that captures the synergy of robust academic research and innovative project work. Over the course of this transformative conference, we have witnessed 112 scholarly research contributions alongside 19 inspiring project presentations, each delving into topics critical to shaping our sustainable future. This year's themes include:

- **Environmental Protection and Sustainable Development**
- **Occupational Safety and Health**
- **Strategic Human Resource and Business Management**
- **Sustainable Project Management**
- **Civil Engineering**
- **Education 3.0**

In addition to the main sessions, we were honored to host a special session featuring our distinguished guest, Arijana Filipić from National Institute of Biology, Slovenia. Her captivating presentation, "Mission Possible: Successful Scientific Presentation," provided invaluable insights into delivering impactful and persuasive scientific discourse, setting a high benchmark for academic excellence.

Hosted in the vibrant city of Novi Sad this December, DISC2024 has provided a dynamic forum where experts, practitioners, and emerging scholars converged to exchange ideas, challenge conventional boundaries, and chart new paths in research and practice.

We extend our sincere gratitude to every author, presenter, and mentor whose contributions have enriched this publication. I also wish to recognize our entire organizing team for their remarkable efforts in bringing this event to life. In particular, my heartfelt thanks go to Dr. Nevena Živančev, Dr. Jovana Topalić, MSc. Dunja Istrat and MSc. Tijana Adamov for their visionary leadership and steadfast commitment. Your invaluable contributions have been the cornerstone of this event's success.

As you explore the abstracts and project summaries contained within these pages, we hope you find the insights and innovations presented here as inspiring as they are thought-provoking – fueling future collaborations and breakthroughs in your respective fields.

Looking ahead, we eagerly anticipate welcoming you once again in December 2025 as we continue to build on the success and collaborative spirit of DISC. May your journey of discovery and innovation continue unabated in the coming years.

With warm regards,

Dr. Maja Petrović

Associate Professor and Editor

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ANALYSIS OF ASYMMETRIC COMPOSITE SLIM FLOOR BEAMS WITH WEB OPENINGS

Đukić M.[1], *Marković Z.*[2], *Lučić D.*[1]

[1]Faculty of Civil Engineering, University of Montenegro, Džordža Vašingtona bb, 81000 Podgorica, Montenegro (e-mail: millenijum3@yahoo.com)

[2]Faculty of Civil Engineering, University of Belgrade, Bulevar kralja Aleksandra 73, 11000 Belgrade, Serbia

Abstract:

Asymmetric composite slim floor beams with web openings present modern structural system in composite steel-concrete construction. These beams integrate steel girders within concrete slabs, reducing structural depth and self-weight while improving economic and spatial efficiency. Development of shear connections utilizing concrete dowels within the web openings, optionally reinforced with tie-bars, replaces traditional shear studs for achieving composite steel-concrete connection. Experimental and numerical analyses reveal that parameters such as web opening size and concrete strength significantly influence the shear connection's performance. Despite these advancements, such beams are not explicitly covered by Eurocode 4 standards. Numerical analyses using ANSYS software evaluated the effects of web opening shapes and sizes on beam performance, revealing significant differences between Eurocode-based calculations and numerical results, particularly in neutral axis positioning and stress distributions. The study highlights limitations of existing design methodologies and underscores the need for modified standards to account for these complex geometries. Key findings reveal that Eurocode underestimates the load-bearing capacity of these beams. Numerical models suggest that stress distributions deviate significantly from simplified Eurocode calculations. Future experimental testing aims to validate numerical models, refine Eurocode methods, and account for real beam geometries. This research advances the understanding of asymmetric slim floor beams, emphasizing their potential for larger spans and improved construction practices. By combining numerical and experimental approaches, it seeks to establish a more accurate design methodology aligned with modern engineering demands.

Keywords: *Slim floor beam; Composite steel-concrete structure; Eurocode 4, Experimental test; Numerical model.*

Acknowledgement

This work was supported by the Ministry of Science of Montenegro, through the programme of supporting excellence in PhD research, and by the Faculty of Civil Engineering, University of Montenegro, through its laboratory resources.

USE OF RECYCLED PET FIBERS IN CONCRETE COMPOSITES

Kljako A.[1], *Džiho R.*[1], *Husnić N.*[1]

[1]"Džemal Bijedić" University, Faculty of Civil Engineering, Sjeverni logor bb Mostar BiH
(email: asjakljako@gmail.com)

Abstract:

Modern construction practices increasingly recognize the importance of developing alternative methods and materials that can reduce the negative ecological impact of the construction sector. By utilizing recycling processes, the need for the exploitation of natural materials, which are non-renewable resources, is reduced, thereby minimizing waste and contributing to environmental protection. With the aim of exploring the use of microfibers in concrete, which can potentially increase the material's strength, we are conducting an experiment with recycled PET bottles as part of a professional project in the field of Environmental Infrastructure Management. Using a filament extruder, we produced plastic strips with diameters ranging from 0.04 mm to 1 cm. Further processing with a PET bottle cutter resulted in fibers with a thickness of 1.8 mm, while the ideal fiber thickness for use in concrete mixtures is 0.2 mm, which we achieved with the help of a 3D printer. In the laboratory, we prepared three concrete mixtures. The first one is a reference mixture, the second one is contains 1% plastic PET fibers and the third one is contains 1% industrial prepared fibers. The samples were tested for various mechanical properties, including compressive strength, flexural strength, freeze resistance, freeze-thaw and salt resistance, and water impermeability.

Keywords: *recycled PET fibers; concrete mixtures; sustainable construction.*

Acknowledgement

We would like to take this opportunity to express our sincere gratitude to our supervisor, Professor Merima Šahinagić Isović, whose invaluable guidance and support made this project possible. Her expert advice and mentorship have been instrumental in guiding us through every stage of this work. The entire experiment was conducted at Institute for Testing Materials at the Faculty of Civil Engineering, at "Džemal Bijedić "University Mostar.

HEALING MATERIALS FOR SELF-HEALING CONCRETE

Mirjanić J.[1], *Milović T.*[1], *Bulatović V.*[1]

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Civil Engineering and Geodesy
(e-mail: jelena.mirjanic@uns.ac.rs)

Abstract:

Significant factor that impairs the reliability and durability of concrete structures is the appearance of structural cracks. They are almost inevitable and it is difficult first to discover their existence and size, and then repair them so that they do not lead to deterioration that can eventually lead to the collapse of structure. Generally, cracks in cement-based composites can occur autogenously or as a result of loading. The demands of sustainable development and following the circular economy trend have led to the creation of the self-healing concrete. Self-healing concrete, also known as self-repairing concrete, can be defined as a cement-based composite with the ability to repair small cracks automatically, without any external diagnosis or human intervention. There are two types of self-healing approaches for which are used two types of materials: (i) autogenous, and (ii) autonomous. Autogenous self-healing methods include the application of mineral additives, fibers, nanofillers, and curing agents, while autonomous approaches include electrodeposition, shape memory alloys, capsules, vascular networks, and microbial technologies. While autogenous healing methods are limited to healing the cracks with width up to 150 μm, the autonomous healing methods have shown a better performance in the cracks healing. Self-healing concrete, with biomimetic properties such as the use of bacteria, capsules, shape memory alloys or vascular systems represents an innovative material in the field of materials science and allows concrete structures to adapt to environmental conditions. The application of these healing materials in cement-based composites opens the way to the development of more resilient concrete structures.

Keywords: *Cracks; Autogenous materials; Autonomous materials; Supplementary cementitious materials; Bacteria*.

Acknowledgement

This research has been supported by the Ministry of Science, Technological Development and Innovation (Contract No. 451-03-65/2024-03/200156) 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" (No. 01-3394/1).

QUANTITATIVE EVALUATION OF HYDROLOGICAL CONNECTIVITY IN RIVERS USING OPTICAL SATELLITE IMAGES: A CASE STUDY OF THE HUNGARIAN DANUBE

Mohsen A.[1,2], *Szabo-Meszaros M.*[1], *Baranya S.*[1]

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

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

Abstract:

Hydrological connectivity in rivers plays a crucial role in maintaining riverine health and ecological productivity by facilitating mass and energy exchange between the mainstem and its surrounding landscape. However, widespread human interventions in rivers globally have significantly impacted hydrological connectivity. Channelization, construction of levees and dams, embankments, and urbanization along the Danube River have led to terrestrialization, continuous riverbed incision, floodplain sedimentation, and the loss of crucial habitats and riparian vegetation. This study proposes a remote sensing-based quantitative approach for evaluating lateral hydrological connectivity (G) in rivers, considering the Hungarian Danube as a case study. Functional connectivity was represented by water surface ratio and river network density, while structural connectivity was assessed through graph theory. These parameters were derived from 55 mosaicked Sentinel-2 images covering the Hungarian Danube (2020-2024). Hydrological conditions were characterized by discharge data measured at eight stations. The analysis was conducted for the entire river reach and 14 hydromorphological segments. Also, historical connectivity was analyzed and compared with current values. Findings indicate generally good connectivity along the Hungarian Danube (mean G= 0.25±0.14; R^2=0.86), and connectivity during floods (mean G=0.44±0.24; R^2=0.93) was twice as high as during low-flow stages (mean G=0.22±0.08; R^2=0.72). Interannual analysis revealed a decreasing trend in connectivity from 2020 to 2022, followed by an increasing trend from 2022 to 2024. Segment-specific analysis showed decreased connectivity in the Budapest River reach, moderate connectivity in the reach 70 km south of Budapest, and elevated connectivity in the remaining segments. Historical analysis revealed an 8% decline in connectivity for the entire Hungarian Danube, corroborated by hydromorphological segments analysis. While the proposed approach demonstrates promising results, incorporating SAR images is warranted to capture a broader range of hydrological conditions, particularly during floods.

Keywords: *Sentinel-2; hydromorphological segments; Hydrological connectivity index; Open CV; Graph theory.*

Acknowledgement

This work was supported by the DANUBE4all project, funded by the European Union's Horizon Europe research and innovation program under grant agreement no. 101093985.

THEORETICAL, EXPERIMENTAL AND NUMERICAL RESEARCH OF BEAM-COLUMN JOINT IN ALUMINIUM STRUCTURES – COLUMN WEB RESISTANCE IN TRANSVERSE COMPRESSION

Muhadinović M.[1], Lučić D.[2]

[1]Faculty of Civil Engineering, University of Montenegro, Dzordza Vasingtona bb, 81000 Podgorica, Montenegro (e-mail: mladen.m@ucg.ac.me)

[1]Faculty of Civil Engineering, University of Montenegro, Džordža Vašingtona bb, 81000 Podgorica, Montenegro

Abstract:

Aluminum alloys, as structural materials, are still not sufficiently presented to the professional public in our region to use them unhindered in everyday engineering practice. Low weight, resistance to corrosion and the extrusion process allow aluminum alloys to be competitive compared to classic steel structures for certain project situations, that is, for certain objects. Seeing those metal structures, as a basic advantage compared to structures made of other materials, tend to form ready-made elements in the workshop and install them on the construction site, the need to study bolted connections is imposed as an imperative (special attention is given to the connection with end plate and bolts). The connection between the beam and the column is an essential element of the structure that ensures the global stability of the building. The study of this type of connection and the specific component of the connection (column web resistance in transverse compression) in aluminum structures is a current problem, whose research will contribute to the development of the application aluminumnium structures. Real models from aluminium alloys EN AW 6082-T6 and EN AW 6061-T4 are made, whose load capacity testing is carried out in the laboratory of the Faculty of Civil Engineering in Podgorica. The results of the experimental research were confirmed with the theoretical and numerical research that had been done previously. Comparative analysis of the results obtained experimentally and those obtained by numerical analysis is underway. The results of the research would contribute to the development of European standards - Eurocodes for aluminium structures (EN 1999) - through the correction and addition of the proposed expressions for determining the resistance of the specific component of the connection, given in the draft of the innovated standard, which should be adopted in the near future. The implementation of the research will make a huge contribution to the field of aluminium structures, here and in the world.

Keywords: *aluminium alloys; connections; web resistance in transverse compression.*

ANALYSIS OF ALUMINIUM LATTICE STRUCTURE WITH K-JOINTS

Nikolić N.[1], *Šćepanović B.*[1]

[1]Faculty of Civil Engineering, University of Montenegro, Džordža Vašingtona bb, 81000 Podgorica, Montenegro
(e-mail: nikolicnina1991@gmail.com)

Abstract:

Aluminium, renowned for its lightweight, corrosion resistance, and high strength, is increasingly favoured for applications in industrial buildings, bridges, and public structures. K-joints, formed by welding narrower brace elements to wider chord elements, are critical stress points in lattice structures due to the pronounced stress concentrations in the heat-affected zone (HAZ). This research delves into the numerical analysis of aluminium lattice structures with uniplanar K-joints, emphasizing the critical role of accurately modelling these connections in structural engineering. The finite element modelling (FEM), by means of ANSYS, is employed to analyse various parameters, including joint geometry, material properties, and the impact of welding processes. Different FEM models were evaluated to balance computational efficiency with predictive accuracy. The study underscores the importance of modelling the HAZ and welds, as their inclusion significantly influences stress distribution and deformation predictions. Experimental validation remains essential for further refinement of numerical models that demonstrated the best balance of accuracy and practicality. Key contributions of the study lie in addressing the gaps in existing European standards, which inadequately cover aluminium structural connections, especially welded K-joints. This research aids in optimizing numerical models for better structural performance, cost-efficiency, and safety in aluminium construction. It provides valuable insights for advancing the design and construction of aluminium structures, aligning with the growing demand for sustainable and innovative materials. Future efforts will focus on experimental testing to validate and enhance the accuracy of FEM models. By refining these numerical approaches, the study aims to contribute to the development of comprehensive design codes for aluminium structures, enabling safer and more efficient construction practices globally. The outcomes will not only support engineering applications but also strengthen the integration of aluminium into modern architectural and industrial designs.

Keywords: *Aluminium lattice structures; K-joints; Finite element modelling (FEM); Heat-affected zone (HAZ); Structural engineering design codes.*

Acknowledgement

This work was supported by the Ministry of Science of Montenegro, through the programme of supporting excellence in PhD research, and by the Faculty of Civil Engineering, University of Montenegro, through its laboratory resources.

DIAGNOSTIC OF THE STATE OF THE OBJECT FROM THE OTTOMAN PERIOD

Ratkušić M.[1], Kuloglić A.[1], Čolak Z.[1]

[1]"Džemal Bijedić" University, Faculty of Civil Engineering, Sjeverni logor bb Mostar BiH
(mratkusic19@gmail.com)

Abstract:

Realistic assessment of the condition of the object in practice is an extremely complex process, which requires experience and knowledge in various fields of construction: construction materials, laboratory destructive and non-destructive testing, design and exploitation conditions. The diagnostic process of existing structures is essentially divided into three basic steps: obtaining documentation (designs and calculations), visual inspection of the building, testing and monitoring, calculation and decisions on construction action in the future. As a part of this work, a diagnosis of the state of construction of the Roznamedžija mosque in Mostar from the Ottoman period was carried out, which is located on the corner of Kresina Street and Braća Fejić Street, on left bank of the Neretva River in the city center. The building is a cultural and historical heritage, built before 1620. According to the inscription on the plaque above the entrance door, the mosque was thoroughly repaired in 1897. During its useful life, the building was renovated and expanded several times, changing its original purpose on several occasions, from religious to gallery space. As part of the professional project in the field of Environmental Infrastructure Management, detailed architectural drawings of the existing condition were prepared, the facility was materialized, damage was recorded with determined destruction mechanisms, laboratory and in situ testing (sclerometer) was performed, and the condition was assessed with recommendations for the rehabilitation and possible reconstruction of the facility.

Keywords: *diagnosis, reconstruction, testing*

Acknowledgement

This work was supported by Džemal Bijedić University of Mostar, Faculty of Civil Engineering. We would like to acknowledge and give warmest thanks to our supervisor professor Merima Šahinagić-Isović who made this work possible. Her guidance and advice carried us through all the stages of writing out project.

ESTIMATION OF CONCRETE AMOUNT FROM EXISTING BUILDINGS FOR PRODUCTION OF GREEN CONCRETE USING ARTIFICIAL INTELLIGENCE

Senjak Pejić M.[1], *Peško I.*[1], *Petrović M.*[2], *Terzić M.*[1], *Stanojević D.*[1], *Radović M.*[3], *Mučenski V.*[1]

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

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

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

Abstract:

The circular economy (CE) is recognized as one of the important strategic concepts of the green transition, both in the world and in the Republic of Serbia. The need for resources is constantly growing, and the linear concept of the economy implies that they are unlimited. To reduce waste disposal and the extraction of natural resources, it is necessary to adopt strategies such as recycling, reuse, and waste reduction. As concrete is the second most consumed material in the world, after water, it is imposed as one of the priorities for achieving circularity in the production and consumption system. Existing buildings in the CE concept represent banks of materials that can be recycled or reused. However, the non-sorting of construction waste in the Republic of Serbia complicates the process of reusing construction waste as a resource, and it is necessary to estimate the amount of material before removing the building to improve waste management methods. Artificial Intelligence (AI) can be used as a tool to estimate the amount of concrete in existing buildings that can be fully utilized to produce green concrete and prevent its disposal in landfills. Estimation models based on neural networks, support vectors, and other machine learning algorithms achieve over 90% accuracy in estimating concrete amounts. By estimating the amount of concrete installed into a building before its removal, more accurate waste management is possible, as the waste concrete becomes a resource for producing green concrete, thus preventing the disposal of concrete in landfills. Considering that concrete accounts for 30-40% of total landfill waste, a circular approach facilitated by a prior estimation of the amount for easier waste management enables significant reductions in landfill waste.

Keywords: *Circular economy; Green concrete; Civil Engineering; Artificial Intelligence; Recycling.*

Acknowledgement

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LATERAL TORSIONAL BUCKLING AND BATTEN PLATES

Subotić P.[1], *Šćepanović B.*[1]

[1]Faculty of Civil Engineering, University of Montenegro, Dzordza Vasingtona bb, 81000 Podgorica, Montenegro
(e-mail: petarsub@ucg.ac.me)

Abstract:

Steel as a building material is characterized by relatively high mechanical properties, on one hand, and high cost per unit weight, on other hand, compared to other building materials. In order to lower overall steel consumption in buildings and make steel structures competitive, steel sections and members are optimized thus making them relatively slender (both locally and globally). This inherent slenderness of steel members made them susceptible to various forms of buckling. For I-members subjected to major axis bending, the most problematic form of stability loss is lateral torsional buckling (LTB). LTB is a complex spatial phenomenon where lateral movement of the compressed flange is accompanied by twisting and warping of the cross section. The occurrence of LTB can significantly reduce the resistance of I beams thus making it a problem that needs to be resolved. One novel and possibly cost effective way of increasing LTB resistance of I beams is the use of batten plates. Batten plates of appropriate width and thickness are welded to the flanges of I beams thus creating a set of closed form segments along the beam length. The hypothesis is that these local closed form segments with high torsional stiffness, although rather short compared to the overall beam length (L), will result in a significant increase in LTB resistance. During preliminary research various configurations of batten plates were explored and the validity of set hypothesis was tested. Conducted research showed that only two pairs of batten plates with widths of 0,1 L placed near beam ends can increase the elastic critical lateral torsional buckling moment over 100 % thus making the use of batten plates a viable alternative to traditional measures for increasing LTB resistance. This method can further optimize steel beams design and is a highly relevant topic for further research.

Keywords: *Steel I beams; Lateral torsional buckling; Batten plates.*

APPLICATION OF AI TOOLS FOR VISUALIZING SCANDINAVIAN MODERN STYLE INTERIORS

Tadić M.[1], *Vukas M.*[1], *Cocek R.* [1], *Dakić B.*[1], *Đurić I.* [1], *Krstanović L.* [1]

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Fundamentals Sciences, Computer Graphics Chair, Novi Sad, Serbia
(e-mail: marko99tadic@gmail.com)

Abstract:

AI tools for image generation have found applications in diverse fields, improving efficiency and offering greater variety, especially in interior design visualizations. Creating a realistic interior design scene in a specific style requires technical skills in detailed 3D modeling, texturing, and rendering, which can be time-consuming. In contrast, AI tools that utilize text-to-image and image-to-image input prompts can quickly generate realistic interior images. This paper examined the application of free online AI tools for visualizing interiors inspired by the Scandinavian modern style, known for its minimalism, functionality, and natural materials. The focus was on generating realistic interior images based on textual descriptions and basic 3D scene renders. The aim of the research was to evaluate the efficiency of AI tools in replicating reference interiors and to identify the advantages and disadvantages of using AI tools in creative design processes. The methodology was based on creating rendered scenes with primitives arranged according to reference images of Scandinavian-style interiors. Positive and negative textual prompts were defined, with experiments focusing on their order and structure. For testing the methodology, the Fabrie AI tool was used as it allows negative prompts, input images, and is intended for interior design, among others. The generated results were compared visually with the reference images to assess similarity. The project demonstrated that Fabrie AI can generate images that largely resemble reference interiors, though it is not always successful in accurately reproducing details. The tool often overlooks specific elements or parts of the prompt, indicating limitations when precise requirements are needed. The study concludes that AI tools can be useful for accelerating the conceptualization process, supporting early stages of design, as well as facilitating the rendering process in architecture, enabling faster creation of visualizations that usually require extensive manual work.

Keywords: *AI tools; architectural design, Scandinavian modern style; interior visualization.*

THE ROLE OF WASTEWATER TREATMENT PLANTS IN THE CIRCULAR ECONOMY DEVELOPMENT PROGRAMME IN SERBIA

Topalić J.[1], *Mučenski V.*[1], *Petrović M.*[2]

[1]Department of Civil Engineering and Geodesy, Faculty of Technical Sciences, University of Novi Sad (e-mail: jovanatopalic90@uns.ac.rs)

[2]Department of Environmental Engineering and Occupational Safety and Health, Faculty of Technical Sciences, University of Novi Sad

Abstract:

With increasing emphasis on circular economies, municipal wastewater treatment plants (WWTPs) are considered resource recovery facilities. The circular economy is recognised as an important strategic concept for the green transition of the Republic of Serbia, which in recent years has been placed high on the list of priorities for the development of our society. Following the concept of circular economy, it is necessary to foresee the use of all secondary products and waste generated in the wastewater treatment process. In general, achieving circularity in the water management segment in the Republic of Serbia will be of great importance for preserving watercourses and ensuring a sufficient amount of water for the needs of the economy and the population in the coming period. This is important because Serbia is awaiting a big step ahead, which is the process of entering the European Union. According to EU legal regulations, there is a norm for wastewater treatment plants that every settlement with more than 2000 inhabitants has to comply with. The biggest challenge will be the construction of new capacities for treating municipal water waste, which is necessary to achieve a higher degree of water recycling. The circular economy principles also support SDG6. If decisions are made in the wastewater treatment process without considering socioeconomic and environmental parameters, consequences will be seen in time. Because of that, the important role of wastewater treatment plants in the circular economy development programme in Serbia is identified.

Keywords: *wastewater; circular economy; plant; SDG.*

Acknowledgement

The research has been conducted within the project "Scientific and experimental research and improvement of educational process in the field of civil engineering, geodesy and disaster risk management and fire safety", developed at the Department of Civil Engineering and Geodesy, Faculty of Technical Sciences, University of Novi Sad, Serbia.

EDUCATION 3.0

EDUCATIONAL INTERACTIVE VISUALIZATION OF MOLECULES USING IMMERSIVE VIRTUAL REALITY

Hasanović Z.[1], *Cocek A.*[1], *Šušić A.*[1], *Novaković T.*[1], *Krstanović L.*[1], *Đurić I.*[1]

[1]Univeristy of Novi Sad, Faculty of Technical Sciences, Department of Fundamentals Sciences, Computer Graphics Chair, Novi Sad, Serbia
(e-mail: zlatan2908@gmail.com)

Abstract:

Education 3.0 revolutionized the way students acquire knowledge. Advances in modern computing technologies, such as advanced rendering tools and VR (Virtual Reality), enable the creation of increasingly complex and interactive visualizations. Educational interactive visualizations typically rely on a multidisciplinary approach that combines modern immersive technologies to facilitate the understanding of various scientific phenomena. This research is part of an ongoing project in the Interdisciplinary Scientific Visualization course within the Master's program at the Computer Graphics Chair, Faculty of Technical Sciences. It integrates molecular visualization with VR as an educational tool. An educational VR game has been developed with the goal of engaging students in learning the fundamentals of molecular chemistry. At the same time, the project provides teachers with an innovative tool for presenting complex topics, thereby modernizing the educational process. The game was designed to allow students to assemble molecular components into more complex structures within a virtual classroom environment, aiming to create a chocolate molecule. This involves identifying and combining four molecules: Flavonoid, Theobromine, Caffeine, and Vanillin, within the interactive VR environment. The virtual classroom simulates a realistic space, where users can manipulate molecular parts as physical objects — picking them up, rotating them, and assembling them into larger structures. The system provides real-time feedback, helping students correct mistakes and improve their problem-solving strategies. A reward system has been introduced for correct task completion, as well a penalty system for mistakes. The technical aspects of the project were realized using Unreal Engine to create the VR environment. Molecular structures were modeled in Blender, with careful attention to the accuracy of molecular structures to ensure scientific precision. Textures were created using Substance Painter. The research results highlight the importance of combining scientific and technical knowledge to develop high-quality and functional solutions of educational interactive visualizations.

Keywords: *Interactive visualization; Molecular visualization; Education 3.0; Virtual reality.*

APPLICATION OF COMPUTER VISION FOR RECOGNITION OF EYE BLINK AND HAND MOVEMENT

Milekić D.[1], *Krstanović L.*[1]

[1]Univeristy of Novi Sad, Faculty of Technical Sciences, Department of Fundamentals Sciences, Computer Graphics Chair, Novi Sad, Serbia
(e-mail: danijelamilekic@uns.ac.rs)

Abstract:

This paper presents a system for recognizing eye blinks and hand movements using the MediaPipe library. The suggested method detects hand and face landmarks in real time by using pre-trained computer vision models. Distances and angles are computed through analyzing the connections among key points for the purpose of identifying certain movements. For blink detection, horizontal and vertical lines drawn across the eye are used to monitor changes in aspect ratios, enabling accurate recognition of blinking events. The results demonstrate successful detection of blinks for both eyes and desired hand movements, which were further applied in interdisciplinary contexts, such as controlling user interfaces and character movement in gaming environments. The system demonstrates potential for use in technologies that assist individuals with disabilities, human-computer interaction, gesture-based control systems, and education.

Keywords: *Computer vision; AI; MediaPipe; movement recognition.*

ENVIRONMENTAL PROTECTION AND SUSTAINABLE DEVELOPMENT

PESTICIDE RESIDUE ANALYSIS IN HONEY IN CASE OF SOUTH WEST ETHIOPIA

A/Jebel M.[1]

[1]Jimma University, Institute of Health, Department of Environmental Health Sciences and Technology, Jimma, Ethiopia

(e-mail: mohammedabbajabal@gmail.com)

Abstract:

Pesticide application in crops can contaminate soil, air, water, and the flowers from which bees collect nectar for honey production, which may cause the introduction of those toxic chemicals into the food chain which might result secondary poising, affecting human health. In Ethiopia, nonetheless, the available information on the side effects of pesticides under local situations are little and incomplete as well as remaining obscure. This study aimed to determine organochlorine pesticide residues in honey collected from different southwest geographical sites of the honey belt of Ethiopia. An experiments study was conducted to determine the pesticide residues level in honey. A total 22 honey samples were collected from 11 site located in four different zones of Southwest, Ethiopia. The collected samples were transported to Jimma University, Chemistry Laboratory for extraction. After extraction, the pesticide residues were analyzed by using Gas Chromatography with ECD in Laboratory of environmental science and technology. Dispersive Liquid–Liquid Microextraction (DLLM) was used to extract residues from the honey samples. All the extracted samples were investigated for the presence of nine organochlorine pesticide residues. Out of the total samples analyzed, the organochlorine pesticide residues were detected in samples collected from seven sites. There are seven organochlorine pesticide residues identified from Channa, sampled during major harvesting time with the highest concentration of DDT and Heptachlorepoxide. Out of the major harvesting time sample from Channa, 69.29% were contaminated with DDT. Also the sample collected during minor harvesting time from Limmu has DDT residue with the percentage of more than half of the sample 17.81%. A total 9.09% of the honey samples collected in apiaries of the southwest under study, showed concentrations below the MRLs, 54.35 % of the honey samples exceeding the MRLs and 36.36% the samples were free from measurable pesticide residues. Comprehensive research into the effects of pesticides on honeybees and their products decline to which this study targeted to contribute is important.

Keywords: *Organochlorine pesticide residues; honey contamination; Dispersive Liquid-Liquid Microextraction (DLLM); Gas Chromatography.*

DECODING LEACHATE DYNAMICS FROM LANDFILL TO GROUNDWATER

Adamov T.[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:

Landfills pose significant environmental challenges through the generation of leachate—a complex mixture of water, organic matter, heavy metals, and synthetic chemicals. Many of these contaminants, such as endocrine-disrupting compounds and persistent organic pollutants, can interfere with biological processes and have detrimental effects on ecosystems and human health. Leachate pollution modeling provides essential tools for assessing and managing these risks by simulating the generation, transport, and fate of contaminants in groundwater, surface water, and soil. Various modeling approaches address the complexity of leachate dynamics. Hydrological models simulate water flow to identify pathways of contamination, while geochemical models focus on chemical transformations and interactions. Risk assessment models quantify the likelihood and severity of environmental impacts, aiding in decision-making and policy development. Integrated models combine multiple approaches to provide comprehensive insights into landfill management and pollution control. Emerging technologies, such as machine learning and real-time monitoring systems, enhance the accuracy and applicability of these models. Key tools include hydrological models such as the Hydrologic Evaluation of Landfill Performance (HELP) model, which simulates water infiltration and flow through landfill systems, and geochemical models that assess chemical interactions and contaminant transformations within leachate. Risk assessment tools like the Groundwater Modeling System (GMS) evaluate the likelihood and severity of groundwater contamination. Integrated waste management models, combining multiple datasets and processes, provide holistic assessments of landfill leachate impacts. Emerging computational tools, including machine learning algorithms and real-time monitoring systems, enhance the accuracy of predictions and facilitate dynamic updates to model parameters. Addressing knowledge gaps and integrating these tools into landfill management practices emphasizes the potential for effectively and sustainably mitigating environmental risks.

Keywords: *leachate pollution models; landfill leachate; environmental fate; waste management.*

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation (Contract No. 451-03-65/2024-03/200156) 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" (No. 01-3394/1) 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.

TRACING THE BIOACCUMULATION OF BISPHENOL A FROM LANDFILLS TO ECOSYSTEMS IN SERBIA

Adamov T.[1], *Novaković 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, Novi Sad 21000, Serbia
(e-mail: tijana.adamov@uns.ac.rs)

Abstract:

Bisphenol A (BPA) is a well-documented endocrine-disrupting chemical widely utilized for its versatility in various industrial and consumer applications. It is commonly found in products such as food storage containers, the inner coatings of beverage cans, thermal-printed materials (receipts and tickets), dental sealants, polycarbonate plastics, electronics components, and durable construction materials like flooring and glazing sheets. Despite its utility, BPA poses significant environmental risks, particularly through improper waste disposal practices. Inadequate waste management and the absence of systematic waste segregation often result in all waste types being disposed of together. Under these conditions, BPA leaches into the environment through landfill leachate, particularly when exposed to precipitation and the anaerobic decomposition of organic matter. This leachate can infiltrate surface and groundwater systems, where BPA is transported and bioaccumulated in aquatic food webs. Research has shown that even low concentrations of BPA can disrupt endocrine systems in organisms, leading to reproductive, developmental, and metabolic disorders. This study, conducted through three campaigns in 2022 at four Serbian municipal landfills, utilized gas chromatography-mass spectrometry (GC-MS) to measure BPA concentrations in landfill leachates. Although BPA degrades more rapidly compared to persistent organic pollutants, its bioaccumulation in aquatic ecosystems remains concerning. Bioaccumulation factors derived from literature reviews were applied to estimate potential BPA concentrations in various organisms, revealing risks to both aquatic and terrestrial species. The findings emphasize the urgent need for improved waste management practices, particularly in reducing BPA contamination through source separation and recycling initiatives. These results also underscore the importance of further research to quantify the broader ecological and health implications of BPA exposure in landfill-affected habitats.

Keywords: *bisphenol A; landfill management; bioaccumulation; landfill leachate.*

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation (Contract No. 451-03-65/2024-03/200156) 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" (No. 01-3394/1) 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.

WIND ENERGY POTENTIAL IN SERBIA

Antović J.[1], *Elezović N.*[1], *Mihajlović I.*[2]

[1]University of Priština, Faculty of Technical Sciences, Knjaza Milosa 7, Kosovska Mitrovica 38220
(e-mail: jelena.antovic@pr.ac.rs)

[2]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

Abstract:

Serbia has significant wind energy potential, with an estimated development capacity of 1300 to 1500 MW, offering a pathway to enhanced energy independence and sustainable development. This study analyzes wind resources using meteorological data, including wind speed and density, alongside an economic feasibility evaluation of wind energy projects. The methodology integrates data collection from automated meteorological stations and Geographic Information Systems (GIS) to accurately identify optimal sites. Key locations, such as Southern Banat, Eastern Serbia, and parts of Vojvodina, were identified due to favorable climatic conditions and proximity to existing energy infrastructure. Utilizing advanced high-capacity turbines, digital tools for production monitoring and optimization, and strengthening regulatory frameworks could enable the full exploitation of this resource. Given the global urgency to mitigate climate change and meet the growing demand for clean energy, this research underscores Serbia's potential to significantly reduce carbon dioxide emissions through wind farm development. The adoption of cutting-edge technologies, including next-generation turbines and energy storage systems, can further enhance production efficiency and reliability. This study provides a detailed assessment of the current state and future prospects of wind energy development in Serbia, accompanied by scientifically informed policy recommendations. These include regulatory enhancements, the creation of financial incentives, and the promotion of investments in renewable energy, with a focus on achieving sustainable energy growth.

Keywords: *Wind energy; Potential; Serbia; Renewable energy sources; Sustainable development.*

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 Pristina and Contract No. 451-03-65/2024-03/200156 realized by the Faculty of Technical Sciences, University of Novi Sad and through project "Scientific and Artistic Research Work of Researchers in Teaching and Associate Positions at the Faculty of Technical Sciences, University of Novi Sad" (No. 01-3394/1).

IMPROVED EXTRACTION OF PHENOLIC ACIDS FROM CHICORY INTYBUS USING GLUCOSE-BASED NATURAL DEEP EUTECTIC SOLVENTS

Balaž F.[1,2], Bojić A.[1], Arapović K.[1], Tomas Petrović A.[1], Gligorić E.[1], Grujić-Letić N.[1], Teofilović B.[1]

[1] University of Novi Sad, Faculty of Medicine, Hajduk Veljkova 3, Novi Sad, Serbia
(e-mail: 904010d23@mf.uns.ac.rs)

[2] Krka-Farma d.o.o, Beograd, Jurija Gagarina 26v, Novi Beograd, Serbia

Abstract:

Cichorium intybus, Asteraceae, commonly known as chicory, is widely distributed and recognized for its high content of bioactive compounds such as phenolic acids, inulin, and sesquiterpene lactones. These compounds exhibit numerous pharmacological effects, including antimicrobial, anti-helminthic, hepatoprotective, antidiabetic, and antioxidant activities, as documented in the literature. The aim of this study was to compare the extraction efficiency of specific phenolic compounds (gallic and caffeic acids) using natural deep eutectic solvents (NADES) versus conventional solvents such as water, methanol, and ethanol. The aerial parts of chicory, cultivated at the Institute "Dr. Josif Pančić," were used as the sample. Extractions from 10 samples were performed using NADES mixtures (glucose-urea at 1:2 and glucose-glycerol at 1:2), along with water, ethanol, and methanol. Ultrasonic-assisted extraction was applied to detect the content of gallic and caffeic acids. Both NADES mixtures demonstrated superior efficiency in extracting gallic and caffeic acids, with caffeic acid being more dominant, ranging from 4.73 to 14.18 mg/g of crude extract. The highest caffeic acid content was achieved with the glucose-glycerol NADES while in conventional solvents yield ranged from 0.63 to 4.59 mg/g crude extract. Similarly, the gallic acid content ranged from 4.30 to 7.53 mg/g of crude extract, with the glucose-glycerol NADES again yielding the highest levels. On the other hand, the presence of gallic acid in convetional solvents yield range from 0.35 to 1,14 mg/g crude extract. Natural deep eutectic solvents (NADES) are innovative green solvents derived from natural compounds, offering exceptional solubility for both polar and non-polar bioactive molecules. Their unique ability to mimic intracellular environments enables the extraction and stabilization of sensitive compounds, making them highly promising for sustainable extraction technologies in pharmaceuticals, food, and cosmetics, particularly in reducing the toxicity associated with conventional chemical solvents.

Keywords: *NADES; Cichorium intybus; extraction; phenolic compounds.*

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

COPPER-DOPED AND ZEOLITE-COMBINED TiO_2 ON POLYMER CARRIER FOR ADVANCED DYE REMOVAL

Bilić A.[1,2], *Perić M.*[1,2], *Armaković S.*[2,3], *Armaković S.J.*[1,2]

[1]University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovića 3, Novi Sad, Serbia (andrijana.bilic@dh.uns.ac.rs)

[2]Association for the International Development of Academic and Scientific Collaboration (AIDASCO), Sutjeska 2, Novi Sad, Serbia

[3]University of Novi Sad, Faculty of Sciences, Department of Physics, Trg Dositeja Obradovića 4, Novi Sad, Serbia

Abstract:

The synthetic dyes used in industries and households significantly pollute water, causing severe environmental degradation. Methylene blue is a synthetic dye widely used as a colorant for paper, wool, silk, and cotton. Due to its high environmental persistence, toxicity, and carcinogenicity, wastewater containing methylene blue highlights the urgent need for sustainable methods to remove it from water. Various methods, including biodegradation, adsorption, advanced oxidation processes (AOPs), and membrane filtration, have been explored for dye removal from water. Photocatalysis, an emerging AOP, is a promising method for treating dye wastewater because of the generation of highly reactive hydroxyl radicals that rapidly and non-selectively oxidize a wide range of pollutants. In this study, the material based on copper-doped TiO_2 photocatalyst in combination with zeolite was deposited as a layer on poly(methyl methacrylate) and used for methylene blue removal from ultrapure water. After 240 min of simulated solar irradiation, the materials demonstrated a high methylene blue removal efficiency of 21.2 %. The results of photocatalyst activity combined with the elimination of the need for water filtration revealed the practical utility of the novel materials.

Keywords: *Photocatalysis; PMMA; Water purification; AOPs; Methylene blue.*

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (451-03-66/2024-03/ 200125, 451-03-65/2024-03/200125 & 451-03-66/2024-03/200358), the AIDASCO (https://aidasco.org/), and the Serbian Natural History Society (https://spd.rs/).

SINTHESYS OF NOVEL 1-FERROCENYL-3-((2-(METHYLTHIO)PHENYL)AMINO)PROPAN-1-ONE, POTENTIAL GREEN AGROCHEMICAL AGENTS

Bojanić N.[1], *Minić Jančić A.*[1]

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

Abstract:

In 1951, the compound ferrocene (Fc) was found. Since then, its derivatives have been used in many different fields (e.g., bioorganometallic chemistry, fuel additives, homogeneous catalysis, electrochemistry, new materials including polymer chemistry, anticancer reagents, etc.), indicating the broad significance of this ground-breaking research. Moreover, ferrocene has found usage in agriculture as well. There are several ways for ferrocene and derivatives to be of use in the agriculture world. Agrochemicals can be linked to the ferrocenyl system either directly (for example, ferrocene-containing herbicides and fungicides) or indirectly, as catalysts in the synthesis of organic compounds of interest for agriculture. Notable, taking advantage of reliable redox properties and robustness of ferrocenes, ferrocene-containing showed interesting green properties as quantify compounds of importance in crop protection and/or soil remediation as well as for environment control. Bearing previously mentioned in mind, we designed synthesis of novel 1-ferrocenyl-3-((2-(methylthio)phenyl)amino)propan-1-one, protentional green agrochemical agents. Compound has been obtained pure in 88% yield and fully characterized with standard spectroscopic analyses (IR, ^{1}H, ^{13}C NMR, and elemental analyses).

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.

GREEN INFRASTRUCTURE EFFECT ON THE TRANSPORT GENERATED MICROPLASTICS DISTRIBUTION IN LITHUANIA

Burbulytė A.[1], Khan A.[1], Araminienė V.[2], Uogintė I.[1], Davulienė L.[1],Varnagirytė-Kabašinskienė I.[2], Černiauskas V.[2],Gudynaitė-Franckevičienė V.[2],Džiugys A.[3], Misiulis E.[3], Byčenkienė S.[1]

[1]Center for Physical Sciences and Technology, Department of Enviromental Research, Saulėtekio av. 3, LT-10257 Vilnius
(email: austeja.burbulyte@gmail.com)

[2]Lithuanian Research Centre for Agriculture and Forestry, Instituto al. 1, Akademija, LT-58344 Kėdainiai distr., Lithuania

[3]Lithuanian Energy Institute, Breslaujos st. 3, LT-44403 Kaunas, Lithuania

Abstract:

The transport infrastructure is a significant contributor to the pollution caused by microplastic particles. The main sources include vehicle tire wear and brake pad debris, which accumulate on road surfaces. Nowadays, microplastics have received attention due to their small size (from 1 µm to 5 mm), their ability to infiltrate organisms and tendency to attract toxic compounds. Additionally, miroplastic particles can affect human health as they may enter the respiratory track. Green infrastructure (GI), such as green roofs and urban vegetation, offers a promising solution to mitigate transport-related microplastics. For example, green hedges can retain microplastic particles. This study's main objective is to evaluate the effect of thuja hedge on the microplastic distribution in Kaunas, Lithuania. Considering that microplastic particles vary in size, shape, and color, it is important to investigate the types of particles that the hedges can retain. The experiment design involved collecting microplastic samples at variuos distances from the thuja hedge. The samples were analyzed in a laboratory using a digital optical microscope to examine particles size, shape, color. A µ-FTIR spectrometer was used to determine the chemical composition of the particles. The results showed that the highest contamination of microplastic particles was near the road while the lowest contamination was observed 1 meter from the thuja hedge. The samples, were dominated by fragment-shaped particles, predominantly black in color. To sum up this study demonstrates that green infrastructure, such as thuja hedges, can effectively retain microplastic particles, highlighting their potential in mitigating pollution caused by transport-related activities.

Keywords: *Microplastic particles; Green infrastructure; Distribution*.

THE FUNCTIONALITY OF POWDERED OIL PUMPKIN SEED CAKE (CUCURBITA PEPO, L.) AS A BIOLUBRICANT

Ćoškov A.[1], *Todorović N.*[1], *Kladar N.*[1,2], *Lalić-Popović M.*[1,2]

[1]University of Novi Sad, Faculty of Medicine, Department of Pharmacy, Hajduk Veljkova 3, Novi Sad, Serbia (e-mail: acoskov12@gmail.com)

[2]University of Novi Sad, Faculty of Medicine, Centre for Medical and Pharmaceutical Investigations and Quality Control (CEMPhIC), Hajduk Veljkova 3, Novi Sad, Serbia

Abstract:

Magnesium stearate (MgSt) is a commonly used lubricant in tablet production, but its use can lead to issues affecting the final product's characteristics, and some studies suggest it may cause adverse reactions. Natural excipients are increasingly being used in the pharmaceutical industry and have numerous advantages over synthetic materials. Today, there is great interest in utilizing every product of production, and one such example is powdered oil pumpkin seed cake (*Cucurbita pepo*, L.) - POPSC, a waste product of the food industry. The use of natural raw materials is both in favor of the trend of developing products that do not contain synthetic components, but also in favor of sustainable development. Therefore, this work was aimed at examining the potential of POPSC as a natural lubricant, namely its influence on the characteristics of tablets obtained by direct compression, as well as impact on the release of the active pharmaceutical ingredient (API). The tabletability of microcrystalline cellulose (MCC) and lactose (LAC) with varying proportions of MgSt or POPSC was tested using the multifunctional Gamlen device. After that, tablets containing ketoprofen as an API and MgSt or POPSC as a lubricant were made, and based on the results of pharmacopoeial tests, their characteristics were compared. The results showed that the addition of POPSC in a concentration of 5% has a similar effectiveness as MgSt in a concentration of 0.5%. Tests on mass, thickness, and diameter showed consistent results, with satisfactory tablet hardness. Friability is less than 1% in all formulations, except formulation T6. All formulations disintegrated in under 50 seconds, and POPSC had no effect on API's dissolution rate. Since POPSC did not affect the pharmaceutical-technological characteristics or dissolution profiles of the tablets, it has the potential to replace MgSt in tablets made by direct compression using MCC and LAC as fillers.

Keywords: *lubricants; magnesium-stearate; natural excipients; dissolution test; Gamlen.*

SUSTAINABLE DEVELOPMENT THROUGH NUCLEAR ENERGY: SERBIA'S PATH BEYOND THE MORATORIUM

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:

The consideration of lifting the moratorium on the use of nuclear energy in Serbia opens a discussion on the potential of this energy source in the context of sustainable development. The signing of the Memorandum of Understanding on the application and development of nuclear energy in Serbia formalized between five ministries of the Government of the Republic of Serbia and 20 scientific-academic institutions and institutes, marks a significant step toward energy transition. This Memorandum establishes a framework for collaboration in nuclear technology, emphasizing the need for strict alignment with international nuclear safety standards and the enhancement of national capacities to manage nuclear resources safely. The announcement of amendments to the Energy Law, aiming to lift the moratorium, further highlights the necessity of assessing how nuclear energy can contribute to sustainable development goals, such as reducing greenhouse gas emissions and ensuring energy stability. Plans for lifting the moratorium must include comprehensive environmental impact assessments and the establishment of regulations that ensure the maximum safety of facilities and the protection of citizens. Additionally, it is crucial to educate qualified personnel and strengthen institutional infrastructure to guarantee the safe implementation of this technology.Linking nuclear energy for sustainable development also requires evaluating long-term economic viability, including the costs of building and maintaining nuclear power plants, waste management, and potential risks. While nuclear energy promises stable energy supplies with a minimal carbon footprint, it is essential to develop transparent policies that integrate the principles of nuclear safety, nuclear security, and responsible management. The decision to lift the moratorium must be strategically planned, involving all relevant stakeholders, and assessing the potential implications. This approach would enable nuclear energy to become a sustainable and safe part of Serbia's energy mix, contributing to both global and national climate change mitigation while enhancing environmental security.

Keywords: *Nuclear energy; Sustainable development; Environmental security*; Energy transition; Climate mitigation.

Acknowledgement

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THE EFFECT OF IMPROVED STOVE ON KITCHEN FINE PARTICULATE MATTER (PM2.5) CONCENTRATIONS

Demelash Enyew H.[1], *Beyene Hailu A.*[2], *Tiku Mereta S.*[2]

[1]Debre Tabor University, College of Health Sciences, Department of Public Health
(e-mail: enyew29@gmail.com)

[2]Jimma University, Institution of Health, Department of Environmental Health Science and Technology, Ethiopia

Abstract:

Millions of Ethiopian people cook with biomass fuels using traditional stoves, releasing harmful pollutants and contributing to a significant public health crisis. Improved stoves offer a potential escape route, but their effectiveness needs close scrutiny. This study delves into the impact of chimney-fitted stoves on kitchen PM2.5 concentrations in rural Ethiopian households. We conducted a randomized controlled trial with 86 households equally divided (1:1 ratio) between intervention and control groups. The 24-h average kitchen PM2.5 concentrations was measured using Particle and Temperature Sensor (PATS+) at baseline and after intervention. All relevant sociodemographic and cooking related characteristics were collected at baseline and dynamic characteristics were updated during air monitoring visits. Three distinct statistical models, including independent sample t-tests, paired sample t-tests and one-way analysis of variance were used to analyze the data using Statistical Package for the Social Sciences (SPSS) software for Windows (v 24.0). At baseline, the average 24-h kitchen PM2.5 concentrations were 482 µg/m3 (95% CI: 408, 557) for the control and 405 µg/m3 (95% CI: 318, 492) for the intervention groups. Despite remaining elevated at 449 µg/m3 (95% CI: 401, 496) in the control group, PM2.5 concentrations reduced to 104 µg/m3 (95% CI: 90,118) in the intervention group, indicating a statistically significant difference ($t = 6.97$, $p < 0.001$). All three statistical analyses delivered remarkably consistent results, estimating a PM2.5 reductions of 74% with the before-and-after approach, 76% when comparing groups, and 74% for difference in difference analysis. Beyond the overall reduction, homes with primary school completed women, larger kitchens, smaller family size, and those specifically baking Injera (the traditional energy-intensive staple food), witnessed even greater drops in PM2.5 levels. Pregnant women in our study encountered dangerously high PM2.5 exposures in their kitchens. While the intervention achieved a significant PM2.5 reductions, unfortunately remained above the WHO's safe limit, highlighting the need for further interventions.

Keywords: *Ethiopia; Improved stove; Intervention; Kitchen area; PM(2.5) concentrations*

Acknowledgement

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EFFICIENCY OF WATER USE IN AGRICULTURE IN THE MEDITERRANEAN REGION, AND QUALITY OF RETURN FLUXES

Canatário Duarte, A.[1]

[1]School of Agriculture-Polytechnic University of Castelo Branco, Quinta da Sra de Mércoles, Apartado 119, 6001-909 Castelo Branco, Portugal
(e-mail: acduarte@ipcb.pt)

Abstract:

Climate change scenarios in the Mediterranean basin point to a decrease in the amount of annual rainfall and the increased frequency of drought. The circumstantial, and soon chronic in many areas of the Mediterranean basin, water scarcity puts high pressure on demand, particularly for agriculture. In this framework of greater water scarcity, an increase in irrigation costs is expected. On the other hand, irrigation is regarded as one of the main adaptations to support crop production in response to climate change and population growth, so its rational and efficient use is an unavoidable issue in modern irrigated agriculture. Rational water use must imply its efficient use, and quality conservation after being used and released to the water bodies. This goal can be reached through the use of modern technology and make viable other water sources. For example, in 2010, the volume of unconventional water resources in Spain rose to 4.540 hm^3/year. Of the total used in agriculture, 450 hm^3 of water comes from the reuse of treated water, and 690 hm^3 comes from desalination. The improvement of agricultural water management, through irrigation systems modernization and the application of information and communication technologies to increase crop productivity and reduce the influence of drought and promote water conservation is one of the main objectives of current irrigated agriculture in Mediterranean countries. To face this problem, agriculture will have to be resilient, use water more efficiently, and look for alternative sources of this resource. The use of modern/smart technologies in irrigated agriculture, like information and communication technologies, allows the rapid share of information between all the system components and can promote optimized answers at different scales. Monitoring the quality of return fluxes from agricultural areas is necessary to prevent pollution events in water bodies, is another important issue to reaching good practices in the use of water in agricultural activity.

Keywords: *Efficient water use; Agricultural activity; Irrigation; Return fluxes; Mediterranean region.*

Acknowledgment

This work was supported by the Research Centre for Natural Resources, Environment, and Society (CERNAS), Project UIDB/ Project UIDB/00681/2020.

HYDROLOGY AND NON-POINT SOURCE POLLUTION AT THE LEVEL OF SMALL AGRO-FORESTRY BASIN

Canatário Duarte, A.[1]

[1]School of Agriculture-Polytechnic University of Castelo Branco, Quinta da Sra de Mércoles, Apartado 119, 6001-909 Castelo Branco, Portugal
(e-mail: acduarte@ipcb.pt)

Abstract:

The intensification of agricultural activity, especially irrigated agriculture, implies the massive use of more fertilizers and other agrochemicals. Diffuse pollution from agricultural areas, and its consequence in the contamination of surface water resources, such as eutrophication, is currently a worrying problem. Knowledge of the hydrologic behavior of small watersheds, and an understanding of the dynamics of pollutants, are important to defining good agricultural practices. The study basin has an area of 200 hectares, and is located at the center of Portugal, close to the Natural Park of International Tagus. The soils are mostly Cambisols and Luvisols, the most representative land uses are maize, sorghum, tobacco, young forest of Quercus trees, and an area in fallow. The main stream has 3 order of fluvial hierarchy, and the area is gently slopped with an average slope of 5%. At the outlet of the basin was installed a hydrometric and water quality station, that include a flume with triangular and trapezoidal sections and an ultrasonic probe to evaluate the depth of runoff, and the discharge continuously. The station is also equipped with a multiparameter probe to assess the electrical conductivity, temperature, nitrates, and turbidity of the return fluxes periodically. The production of sediments only reaches the natural drainage network when the runoff has enough energy to transport it. So, the evolution of the cumulative curve of sediments load outside the basin along the winter season, is by levels related to superficial runoff events more intense. The concentration of pollutants, mainly the most soluble, shows a large dependence on the runoff volume.

Keywords: *Hydrology behavior; Non-point source; Small basin; Agro-forestry land use.*

Acknowledgment

This work was supported by the Research Centre for Natural Resources, Environment, and Society (CERNAS), Project UIDB/ Project UIDB/00681/2020.

INTEGRATION OF GREEN BUILDING CERTIFICATION SYSTEMS INTO THE BIM ENVIRONMENT

Dubljević S.[1], *Šunjević, M.*[2]

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Architecture and Urban Planning, Trg Dositeja Obradovića, Novi Sad, Serbia
(e-mail: sanjadubljevic@uns.ac.rs)

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

Abstract:

Numerous green building certification systems are currently in use worldwide, with the American LEED (Leadership in Energy and Environmental Design) and the British BREEAM (Building Research Establishment Environmental Assessment Methodology) among the most prominent. Similar challenges, such as rising energy costs and growing environmental concerns, have prompted the development of comparable and, to some extent, overlapping technical manuals across different assessment schemes. An analysis of green building certification systems reveals notable similarities in the formulation of their categories and the areas they address. These similarities arise from their shared objective of providing comprehensive and detailed assessments of building sustainability while promoting sustainable practices in architecture and construction. Both systems aim to minimize the environmental impact of buildings, improve energy efficiency, reduce greenhouse gas emissions, and enhance user quality of life. As a global need for standardization has emerged to enable better comparison and evaluation of buildings, both systems have adapted and improved over time, resulting in the development of similar and comparable categories. This study examines the LEED and BREEAM certification systems, focusing on their assessment criteria, including site location, design, materials, waste management, indoor environmental quality, water and energy efficiency, innovation, and regional priorities. Furthermore, the research explores the potential for integrating these certification systems into the BIM (Building Information Modeling) environment by parameterizing their requirements. This approach seeks to automate compliance assessments, streamlining evaluations to assist architects, designers, and engineers in navigating green building certification systems. It aims to enhance efficiency not only in the certification process but also in the design of new structures and the reconstruction of existing ones. Such integration has the potential to advance the development of a more environmentally responsible and sustainable built environment.

Keywords: *Green Building Certification Systems (GBCS); Building Information Modeling (BIM); automation; parameterization.*

Acknowledgement

This research has been supported by the Ministry of Science, Technological Development and Innovation (Contract No. 451-03-65/2024-03/200156) and 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" (No. 01-3394/1).

NATIONAL BUILDING LCA DATA ACCELERATOR

Erdelj F.[1]

[1]Green Building Council Croatia, Ulica grada Vukovara 274, Zagreb, Croatia
(e-mail: franciska.erdelj@gbccroatia.org)

Abstract:

The building sector in the EU accounts for 40% of total energy consumption and 36% of energy-related emissions (both direct and indirect). Immediate regulation of WLC emissions is essential for the construction sector to support Europe's goal of achieving climate neutrality by 2050 and meeting the 1.5-degree Paris Agreement target. INDICATE LIFE project aims to equip EU countries with nationally tailored tools, robust data, and policy frameworks to support the building sector in reducing whole life carbon (WLC) emissions. The project generates the methodological and data foundations essential for developing national whole-life-carbon (WLC) across Europe. Reducing the lifecycle emission of buildings is indispensable to ensure the construction sector is on a path to reach carbon neutrality by 2050. On the short term, the project prepares the ground for the effective implementation of the EPBD recast provisions on WLC. INDICATE LIFE aims to fill the gap in building Life Cycle Assessment data needed for the design and rollout of WLC regulations in EU Member States. The objective is to develop WLC benchmarks on national level that support the development of science-based decarbonisation pathways for new construction and renovations. The project collects market and policy insights that will enable the formulation of national and EU level WLC policy recommendations and overall contributes to the much-needed quantitative evidence based that EU and Member State level policymakers urgently require to agree on common guiding benchmarks, targets, thresholds and limit values which will be tightened over time in line with the 2050 decarbonisation trajectory.

Keywords: *Whole Life Carbon; Life Cycle Assessment; EPBD; decarbonisation; emissions*

Acknowledgement

This work was supported by European Climate, Infrastructure and Environment Executive Agency, LIFE Project Grants, Project 101167585 — LIFE23-CET-INDICATE LIFE

INVESTIGATION OF ENVIRONMENTAL AND HEALTH IMPACTS SOLID WASTE MANAGEMENT PROBLEMS AND ASSOCIATED FACTORS IN ASELLA TOWN, ETHIOPIA

Eshete A.[1], Haddis A.[2], Mengistie E.[3]

[1]Arsi University, College of Health Science, Public Health Department, Asella, Ethiopia
(e-mail: amde718@gmail.com)

[2]Jimma University, College of Medicine and Public Health, Department of Environmental Science and Technology, Jimma, Ethiopia

[3]Hawassa University, College of Health Science, Department of Public Health, Hawassa, Ethiopia

Abstract:

Solid waste is substances thrown away by the institutions of individual households in the urban community. The solid waste management practice in Asella town was assessed about environmental pollution and health problems. The main objective was determining the environmental and health impacts of solid waste management problems and associated factors in Asella town. Data collection was carried out through a house-to-house community survey process using a cross-sectional study design. A sample size of 418 households was selected and a simple random and systematic probability sampling technique was implemented. The statistical analysis of the binary logistic regression model was used to perform the correlational test about health issues in Asella town. The indicators of environmental impact were 13.4% soil pollution, 31.6% air pollution, 20.8% environmental deterioration, and 34.2% water pollution. The indicators of health impact were 49.5% respiratory diseases, 18.2% asthmatic (bronchitis) cases, 15.8% diarrheal diseases, 14.8% protozoan illnesses, and 1.7% cancer cases. The significant odds ratio of females AOR = 1.18; , CI:0.48–2.89, educational districts of can't read and write AOR = 2.31: CI = 0.48–11.1, primary cycle AOR = 2.32, CI:0.58–9.21, and Secondary cycle AOR = 2.19, CI = 0.60–7.98, house ownership of government AOR = 2.95, CI:0.54–16.14 and private households AOR = 4.18, 95% CI:0.79–22.16, income group of lower status AOR = 2.0, CI:0.91–4.98 and higher income AOR = 2.8, 95% CI:0.35–23.14, sorting of solid waste AOR = 1.38, CI:0.56–3.40, and reusing of solid waste AOR = 7.90, CI:2.12–29.42. Therefore, the inadequate solid waste management practice was a query for environmental and health impacts in Asella town. The principles of reusing, reducing, and recovering solid waste management practice must be supported by professional interventions and government policy.

Key words:-*Environment, Health, Indicators, House, Government, Solidwaste*

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SUPERPLASMA FOR WATER DECONTAMINATION

Filipić A.[1], *Dobnik D.* [1], *Zaplotnik R.*[2], *Primc G.*[2]

[1]National Institute of Biology, Večna pot 121, 1000, Ljubljana, Slovenia
(e-mail: arijana.filipic@nib.si)

[2]Jožef Stefan Institute, Jamova cesta 39, 1000, Ljubljana, Slovenia

Abstract:

Water scarcity, one of the most pressing global challenges, is made worse by the increasing number and variety of pollutants. Among these contaminants are viruses, such as enteric viruses, which infect millions of people every year, leading to higher rates of hospitalization and mortality. Effective inactivation of these viruses is therefore crucial. One promising technology for waterborne virus inactivation is cold plasma. Plasma, the fourth state of matter, is created by adding sufficient energy to a gas, generating, among others, reactive species with strong antimicrobial properties. However, there are limitations to using plasma for water decontamination, which is why it is sometimes combined with other technologies, such as supercavitation. Supercavitation, a form of hydrodynamic cavitation, is the formation of a single water vapour bubble in liquid due to a drop in pressure. By introducing water vapour (i.e., gas phase) into liquid water, plasma can be directly generated within water, improving virus inactivation and overall water decontamination efficiency. In this study, we employed a patented technology combining supercavitation and cold plasma (SuperPlasma) to treat bacteriophage MS2, a surrogate for human enteric viruses, in tap water under various conditions. These included different initial virus concentrations, water properties such as pH and temperature, and varying levels of inorganic and organic content. The technology was also tested on artificial wastewater and wastewater effluent. Our results showed over 5-log virus inactivation in water within minutes, regardless of water properties or type. These findings suggest that SuperPlasma technology has great potential for rapid and effective virus inactivation in diverse water sources. It represents an innovative solution that can be used alone or in combination with other technologies to successfully decontaminate water, addressing a critical need in the fight against water pollution.

Keywords: *Viruses; Plasma; Supercavitation; Virus inactivation; Water decontamination.*

Acknowledgement

This work was supported by Slovenian Research and Innovation Agency, Projects number Z7-50151, L7-3184, Programmes number P4-0407, P2-0082.

ASSESSMENT OF GROUNDWATER QUALITY FOR DRINKING AND IRRIGATION SUSTAINABILITY: A CASE STUDY IN THE NAFUSA MOUNTAINS, LIBYA

Hgeig A.[1], Albarshny M.[1], Kubbat M.[2], Ftes G.[3]

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

[2] Libyan Advanced Center for Chemical Analysis, Tripoli 1, 218. Libya

[3]Marine Biology Research Center, Tripoli_ Tajoura 1, 218. Libya

Abstract:
Groundwater is a critical resource in arid and semi-arid regions, where surface water availability is limited. This study evaluates the quality of groundwater for drinking and irrigation purposes in the Nafusa Mountains, Libya, an area characterized by increasing water demand and limited natural recharge. A total of 17 groundwater samples were collected from wells across the region in the year 2024 and analyzed for physicochemical parameters, including pH, electrical conductivity (EC), total dissolved solids (TDS), major ions (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Cl^{-}, HCO_3^{-}, SO_4^{2-}), and trace elements. The results were assessed against World Health Organization (WHO) standards for drinking water. Findings revealed that while some samples met the criteria for drinking, others exceeded permissible limits for salinity, nitrate, and fluoride, posing health risks. For irrigation, the analysis indicated moderate to high salinity and sodium hazards in several locations, potentially affecting soil structure and crop yield. The study underscores the need for regular monitoring, enhanced water governance, and alternative water resources to ensure the sustainable use of groundwater in the Nafusa Mountains.

Keywords: *Groundwater quality; drinking water; irrigation; water management*

EVALUATING HOW DIFFERENT FACTORS INFLUENCE THE PHOTOCATALYTIC REMOVAL OF SULPIRIDE FROM WATER

Jovanović D.[1], *Šojić Merkulov D.*[1], *Despotović V.*[1], *Bognár S.*[1], *Finčur N.*[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: dusica.jovanovic@dh.uns.ac.rs)

Abstract:

Psychoactive drugs, such as Eglonyl®, are frequently used in the treatment of diverse mental disorders including acute and chronic schizophrenia and hallucinations. An active pharmaceutical ingredient of this specific drug is substituted benzamide derivative, sulpiride (SLP). Due to the overuse of SLP-based antipsychotics, SLP can reach water bodies through hospital and urban wastewaters. Taking into account the facts that 95% of SLP is excreted unchanged, and that this medicine has the ability to affect brain chemistry, its presence in natural waters is troubling. Therefore, it is essential to remove SLP from the environment. Heterogeneous photocatalytic treatment of water resources offers an eco-friendly and sustainable approach to eliminating SLP from the aquatic medium. This advanced oxidation process, which requires the presence of light and a catalyst, relies on the formation of various reactive species (mainly highly reactive hydroxyl radicals) that actively participate in the degradation of persistent organic pollutants. In the conducted photocatalytic study, commercially available pharmaceutical formulation Eglonyl® was used as a source of SLP. The study focused on assessing how different factors impact SLP removal efficiency under simulated sunlight, with zinc oxide (ZnO) used as a photocatalyst. Optimal conditions for ZnO loading and initial SLP concentration were determined to be 1.0 mg/cm^3 and 0.05 mmol/dm^3, respectively. Additionally, the influence of the used photoreactor type and radiation source on the SLP degradation efficiency was examined. SLP degradation efficiency was monitored using liquid chromatography with a fluorescence detector.

Keywords: *Photocatalysis; ZnO; Organic pollutant; Sulpiride; Eglonyl®.*

Acknowledgement

This research was supported by the Science Fund of the Republic of Serbia (Grant No. 7747845 – *In situ* pollutants removal from waters by sustainable green nanotechnologies – CleanNanoCatalyze) and by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Grant Numbers 451-03-66/2024-03/200125 and 451-03-65/2024-03/200125).

EVALUATION OF MERCURY LEACHABILITY FROM MERCURY-SATURATED ZEOLITES

Jurić A.[1], *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:

Remediation of mercury-contaminated soil, such as the Idrija mine site in Slovenia, is desirable to minimize mercury emissions. Although not easily feasible, green *in situ* and *ex situ* remediation of contaminated areas could be a promising solution using environmentally friendly sorbents such as natural zeolites. In order to increase the selectivity of sorbents towards mercury, sulphur-based modifications are carried out. Therefore, in this paper, natural zeolite (NZ) and natural zeolite doped with iron sulphide species (FeSZ) were used as mercury-binding sorbents. Furthermore, in order to be used in remediation purposes, sorbents with a high sorption capacity and high selectivity towards mercury must also possess characteristics of mercury retention in their structure, i.e. minimal leachability. Therefore, the main aim of this paper is to examine the leachability characteristics of partially and completely mercury-saturated NZ and FeSZ. Saturation for 24 h in batch mode at a solid-to-liquid ratio of 10 g/L for NZ was carried out with a solution of 0.5 and 7.9 mmol Hg/L, and for FeSZ with 0.5 and 10.6 mmol Hg/L, respectively. The characteristics of mercury leachability from saturated samples were evaluated using the Toxicity Characteristic Leaching Procedure, TCLP (USEPA, 1311). Leaching experiments confirmed that the FeSZs retain mercury better than the NZs, which is a consequence of stronger mercury binding to FeSZ since it contains sulphur species that have a strong affinity for mercury. The TCLP procedure indicated the presence of mercury in leachates above the prescribed value of 0.2 mg/L for all mercury-saturated samples, indicating that mercury saturated zeolites represent hazardous waste. This suggests that both zeolites, and especially the modified form, could be used for *ex situ* remediation, after which it should be adequately treated before disposal. A promising solution seems to be stabilization/solidification in a cement composite, which will be the subject of future research.

Keywords: *Natural zeolite; Natural zeolite doped with iron sulfide species; Mercury; Leaching; Toxicity Characteristic Leaching Procedure*.

DISTRIBUTION OF ALKYLPHENOLS IN SEDIMENTS OF LAKE VIKTORIA

Khvalbota L.[1], *Natuhwera M.*[2], *Urban K.*[1], *Onize Ismaila K.*[1], *Nantaba, F.*[2], *Mubiru E.*[2], *Arinaitwe K.*[3], *Ssebugere P.*[2], *Špánik I.*[1]

[1]Institute of Analytical Chemistry, Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava, Radlinského 9, 812 37 Bratislava, Slovakia
(e-mail: liudmyla.khvalbota@stuba.sk)

[2]Department of Chemistry, Makerere University, P.O. Box 7062, Kampala, Uganda

[3]GEOMAR Helmholtz Centre for Ocean Research Kiel, Wischhofstraße 1-3, 24148 Kiel, Germany

Abstract:

Alkylphenols are biodegradation products of alkylphenol ethoxylates (APEs) can be found in aquatic environment especially near municipal and industrial waste discharges. The APEs are produced in large quantities and have wider application in personal care products, house hold products, agriculture and industries where they are used as surfactants and emulsifying agents. During waste water treatment, APEOs are degraded by micro-organisms to relatively stable alkylphenol compounds. Therefore, most of APEOs end up into the environment as alkylphenols. Due to their hydrophobic nature, alkylphenols have a strong affinity for adsorption onto sediments and suspended materials in aquatic ecosystems. These compounds are commonly detected in environmental samples. Alkylphenols possess an estrogenic activity allowing them to mimic or interfere with the function of naturally occurring hormones (estrogens) in living organisms. Consequently, numerous studies have reported the endocrine-disrupting effects of these chemicals, with nonylphenols and octyl phenols being of particular concern. In East Africa, the Lake Victoria basin, which is subject to rapid urbanization, rising population and high agricultural activity, faces increased water pollution from water shed and urban drainage. However, despite growing concern, there is limited research on the environmental distribution of alkylphenol ethoxylate degradation products in the lake. Therefore, the purpose of the study was to determine the distribution of alkylphenols in sediments of Lake Victoria which is the largest fresh water in Africa, identify potential sources and assess ecological risks. In this study 39 samples of sediments obtained throughout Lake Viktoria were analysed by means of GC-MS. Ultrasound-Assisted Extraction (UAE), followed by QuEChERS, was utilized as the extraction step before analysis by GC-MS. 2-Phenylphenol, 4-phenylphenol, 4-*tert*-octylphenol, 4-n-octylphenol, 4-n-nonylphenol and triclosan content were determined. 2-Phenylphenol, 4-phenylphenol, 4-*tert*-octylphenol and triclosane were present in all samples.

Keywords: *alkylphenols; sediments; Lake Viktoria; gas cromatography*

Acknowledgement

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PHEROMONE-INDUCED MATING DISRUPTION TO CONTROL FALL ARMYWORM IN MAIZE CROPS IN IRINGA DISTRICT.

Kiunga A.[1], Mwambala A.[1], Kimbokota F.[2], Mmongoyo J.[2], Dekker T.[3]

[1]Mkwawa University College of education, Faculty of science, Department of biological science, P.O BOX 2513, Iringa Tanzania
(e-mail: ashakiunga@gmail.com)

[2]Mkwawa University College of education, Faculty of science, Department of chemistry, P.O BOX 2513, Iringa, Tanzania

[3]Swedish University of Agriculture (SLU), Faculty of science, Department of plant protection Biology, Box 102,23053 ALNARP, Sundsvgen 14, Sweden

Abstract:

Africa does not have well-established control fall armyworm (FAW) thresholds based on current pheromone techniques. The present study was conducted in open maize farming systems, with two categories: pheromone treatment and control, each replicated three times to evaluate the efficacy of synthetic pheromone. In both categories, delta traps baited with pheromone lures were used for FAW monitoring. The Fall Armyworm Specialized Pheromone and Lure Application Technology (SPLAT-FAW) was applied three times by caulking guns to disrupt mating in the pheromone-treated category. Monitoring the number of male FAW captured and the infestation rate of maize leaves was done every two weeks using delta traps and the Davis scale, respectively. ANOVA revealed a statistically significant difference ($F(1,297) = 33.2$, $p = 5.75E-06$) between the control and treatment categories in relation to the amount of leaf damage. Though the t-test result on the cob length was not statistically significant between the two categories ($t = 1.413$, $p = 0.169$), the cob damage showed there was statistical significance between the two categories by the Mann-Whitney test ($U = 3305$, $p = 0.029$). Similarly, a statistically significant difference ($t = 2.860$, $p = 0.017$) was observed between the mean abundance of male FAW collected in the control (31.33 ± 6.06) and pheromone treatment category (13.17 ± 1.92). Moreover, the frequency of pesticide applications in the pheromone-treated category was reduced by half compared to the control category. The current study shows the use of synthetic sex pheromone is effective in managing FAW population for sustainable agriculture and increasing productivity.

Keywords: *Mating disruption; FAW monitoring; SPLAT-FAW and fall armyworm*.

Acknowledgment

This work was supported by BioInnovate Global AB and ISCA Technologies through Mkwawa University of the College of Education.

UTILIZING WASTE HEMP FIBERS AS A CATIONIC SORBENT FOR OXYANION REMOVAL

Knežević N.[1], Vuksanović M.[1], Marinković A.[2]

[1]University of Belgrade, "VINČA" Institute of Nuclear Sciences - National Institute of the Republic of Serbia, Belgrade, Serbia

(e-mail: natasa.knezevic@vin.bg.ac.rs)

[2]University of Belgrade, Faculty of Technology and Metallurgy, Belgrade, Serbia

Abstract:

Hemp fibers, obtained as a waste material during harvesting, were transformed into a cationically modified lignocellulosic adsorbent through a three-phase process. First, a delignification and defibrillation pretreatment was conducted, followed by the synthesis of an ionic liquid, chlorocholine chloride-urea (DES), and quaternization of the fibers using a synthetic agent. Cross-linking of the modified fibers under pressure, with the use of citric acid, resulted in the formation of a sorbent in the form of a membrane (DES-CM). The removal of oxyanions (As(V) and Cr(VI)) was tested in a batch system for 90 minutes at temperatures of 25, 35, and 45 °C. The structural characteristics and chemical properties of the synthesized materials were analyzed using SEM, FTIR, XPS techniques, as well as porosity and point of zero charge (pHpzc) analyses. The endothermic and spontaneous equilibrium of the system resulted in high adsorption capacities (q_m) of 105 mg g^{-1} for As(V) and 69 mg g^{-1} for Cr(VI) at 25 °C, obtained using the Langmuir model. The adsorption/desorption process over multiple cycles concluded with the transformation of As(V) to As(III) and Cr(VI) to Cr(III), enabling safe disposal. This emphasizes the importance of reducing toxic Cr(VI)/As(V) to less harmful Cr(III)/As(III) for groundwater protection and ecosystem preservation. The precipitation process provided low environmental risk for treated water, while the full biodegradability of the exhausted membrane after 60 days confirmed the circular nature of the developed technology, aligned with sustainability principles.

Keywords: *hemp fibers, chlorcholine, Deep eutectic solvents, removal oxyanions, precipitation*

Acknowledgement

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UTILIZING A SPECTRAL LIBRARY OF COMPOSITE SPECTRA FOR THE FAST ESTIMATION OF SOIL ORGANIC MATTER

Kordić B.[1], *Dragojević S.*[1], *Jović B.*[1]

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

Abstract:

FTIR spectroscopy, combined with spectral library search, has been investigated for the rapid estimation of soil organic matter content and texture. A spectral library has been formed from the theoretical composite spectra. Commercially available chemicals have been utilized as models for soil components. FTIR spectra of these model components were obtained using the ATR technique. The experimentally acquired spectra were processed with OMNIC software (Thermo-Nicolet) and adjusted by multiplying with the coefficient corresponding to the predicted percentage of each component in the soil. Afterwards, the spectra of individual components were combined to create the theoretical composite spectrum of soil. By varying the coefficients for these components, composite spectra for different soil types were simulated. These composite spectra have been used to develop a spectral library. The spectral library of composite spectra has been assessed using real soil samples with known percentages of organic matter. This approach is promising because it enables investigators to create a theoretical spectrum of soil based on any predicted composition. Additionally, it allows for the generation of numerous theoretical composite spectra from just a handful of spectra of predicted model components.

Keywords: *Soil; Soil organic matter; FTIR; ATR; Spectral library.*

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A DFT MODEL PREDICTS REACTIVITY OF METAL DECORATED TiO_2 FOR PHOTODEGRADATION OF ORGANIC POLLUTANTS

Kovačević M.[1], *Vasić Anićijević D.*[1]

[1]Vinča Institute of Nuclear Sciences-National Institute of the Republic of Serbia, University of Belgrade, Mike Petrovića Alasa 12-14, 11351 Belgrade, Serbia
(email: marija.kovacevic@vin.bg.ac.rs)

Abstract:

The expansion of the development of new materials in the previous 2-3 decades imposed the need to introduce new approaches that would accelerate and improve selectivity the obtaining of materials with the target properties. Modern methods of theoretical chemistry, including Density Functional Theory (DFT), supported by the rapid development of computers, represent an ideal tool for modeling and studying materials with potential application in the removal of polluting substances from the environment. In this contribution, a DFT screening of *d*-metal-decorated TiO_2 surfaces was performed in order to define calculable theoretical descriptors to predict their performance as photocatalysts in the degradation of organic pollutants. The resulting model deals with DFT-calculated OH-radical binding energy on TiO_2 surfaces, as the reliable theoretical descriptor which was correlated with experimentally measured photodegradation performance (reaction rate and final efficiency) for the model molecule ciprofloxacin. The obtained results point to a likely volcano-shaped correlation, which was discussed and explained in light of common mechanistic principles of photocatalytic processes.

Keywords: *DFT calculations; Organic pollutants; Photocatalysis; TiO_2;*

Acknowledgment

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TRAINING AND OUTREACH PROGRAMMES FOR A CIRCULAR AND LEVEL(S) BASED REVOLUTION

Leskovar M.[1]

[1]Green Building Council Croatia, Ul. Grada Vukovara 274, 10000 Zagreb, Croatia
(e-mail: martina.leskovar@gbccroatia.org)

Abstract:

Training and Outreach Programme for a Circular and Level(s) based Revolution project aims to empower construction professionals and workers with the skills needed to face the challenges of the whole life carbon and circular approach along a building life cycle, to also support the implementation of the Level(s) Framework by all the actors of the value chain. Innovative VET programmes and activities for white and blue collars will be developed and tested, and specific actions will be undertaken to acknowledge and enhance young talents' preparedness for the future career in the building sector. Women's role will be at the center of the discussion, raising the voice of female professionals and workers to raise awareness for equal opportunities in the field. The countries covered by the project are: Italy, Slovenia, Spain, Hungary, Croatia, and Poland. In addition, a global platform to exploit project outcomes will be designed, that will convene knowledge and training materials from the green building movement actors across Europe and the world. Project partners will produce business plans to place the activities of the project in the real market and take them on after the project's end.

Keywords: *Construction workers; Whole life carbon; Building life cycle; VET programmes; Level(s) framework*

Acknowledgement

This work was supported by European Climate, Infrastructure and Environment Executive Agency, LIFE Project Grants, 101121073.

EFFECTIVENESS OF VARIOUS LOW-COST SORBENTS FOR IBUPROFEN REMOVAL FROM AQUEOUS SOLUTION

Matuzić L.[1], *Nuić I.*[1], *Burčul, F.*[1], *Vučak A.*[1]

[1]Faculty of Chemistry and Technology, University of Split, Ruđera Boškovića 35, 21 000 Split, Croatia
(e-mail: lm20225@ktf-split.hr)

Abstract:

The widespread and uncontrolled consumption of pharmaceutical products on a global scale is becoming a growing environmental problem due to the daily threat to water systems, both through improper disposal of unused or expired products and through ineffective conventional wastewater treatment methods. Pharmaceuticals pose a threat to aquatic organisms by causing physiological, hormonal and reproductive disorders with long-term effects on biodiversity. Ibuprofen, one of the most widely sold over-the-counter pharmaceuticals, has been detected in surface waters around the world, including the Cetina and Jadro rivers in Croatia. Since these water systems are intended for water supply, there is a clear need to develop more effective methods for removing ibuprofen. This study investigates the removal of ibuprofen from an aqueous solution (c_0≈1 mg/L) by sorption on the natural zeolite clinoptilolite, its modified forms (sodium, iron and sulphur) and on fruit processing by-products such as olive, cherry and sour cherry pits. The experiments were conducted in a batch mode at room temperature for 24 h, without pH adjustment (pH_0=5.57). According to the results obtained, only sour cherry pits showed efficiency (30.2%) in removing ibuprofen with a sorption capacity of 0.025 mg/g under the tested experimental conditions. Namely, sour cherry pits had a less negative surface charge compared to other tested sorbents, while at the same time having the lowest pH (5.68) during sorption. The complete ineffectiveness of the zeolite samples and olive and cherry pits is most likely the consequence of a strong electrostatic repulsion between the extremely negative surface charge of the materials used and the deprotonated form of the ibuprofen molecule at higher pH values (6.41–10.52). Future research should focus on adjusting experimental conditions, as well as on modifying materials, respecting green solutions. It is also necessary to ensure proper disposal of pharmaceuticals, as well as their inclusion on the list of priority substances in the analysis of water for human consumption, to preserve biodiversity.

Keywords: *Ibuprofen; Sorption; Zeolites, Fruit processing by-products; Wastewater treatment.*

Acknowledgement

This research was partially supported by the Functional Integration of the University of Split, PMF-ST, PF-ST and KTF-ST through the project KK.01.1.1.02.0018. We thank RETSCH GmbH for the generous donation of a new mill (MM 200) to enable science.

ASSESSMENT 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:

Thiocarbohydrazones have attracted considerable attention due to their important chemical properties and potential biological activities. They exhibit a broad spectrum of biological activities, such as antimicrobial, antioxidant. antifungal, antibacterial, antitumor, and antiviral. Research in the design of biologically active compounds is increasingly focused on understanding the relationship between molecular structure and its physicochemical as well as biological properties. One of the most commonly used molecular descriptors for assessing the potential biological activity of a compound is lipophilicity. In this research, the preliminary assessment of thiocarbohydrazones' lipophilicity and ecotoxicity, was performed by calculating the log*P* (standard measure of lipophilicity) and ecotoxicity parameters by using different software programs. Also, lipophilicity of thiocarbohydrazones was determined experimentally by using reversed phase thin-layer chromatography in mixtures of water – methanol and water – acetonitrile. The relationship between the chromatographic parameters (R_M^0 and m), the partition coefficient log*P*, and ecotoxicity was analyzed using linear regression. Obtained mathematical models indicate that the chromatographic parameters R_M^0 and m can be successfully used to assess both the lipophilicity and ecotoxicity of the thiocarbohydrazone derivatives.

Keywords: *Thiocarbohydrazones; lipophilicity; ecotoxicity; chromatography*

Acknowledgement

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CHARACTERIZATION OF LIGNOCELLULOSIC BIOMASS FROM COMPOSTING PROCESS

Mihalić P.[1], Iveljić F.[1], Krajnović K.[1], Šabić Runjavec M.[1], Oros D.[2], Vuković Domanovac M.[1]

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

[2]Komunalac d.o.o. Bjelovar, Ferde Livadića 14a, 43000 Bjelovar, Croatia

Abstract:

The immense increase in the amount of biodegradable waste on a global scale is one of the biggest challenges that need to be tackled in order to solve the consequences from an economic and environmental point of view. A significant proportion of biowaste, which is made up of food and kitchen waste as well as garden and park waste, consists of lignocellulosic biomass. During the composting process, lignocellulosic waste material is stabilised by microbial degradation. Despite its recalcitrant nature, lignocellulosic biomass can be degraded by different groups of microorganisms that can produce enzymes for the hydrolysis of lignocellulose during the composting process.

In this study, the characterisation of lignocellulosic biomass used for composting was carried out for different types of biowaste (straw waste, wood crisps, mixture of kitchen and garden waste). The physico-chemical analyses carried out showed that the moisture content of the tested waste ranges from 10.6 to 63.3%, while the volatile organic matter content ranges from 66.8 to 93.4%. The average pH value of the biomass tested was 7.53±0.43. Composting of lignocellulosic biomass represents a green solution in the management of biodegradable waste.

Keywords: *Lignocellulose biomass; Biowaste; Composting*

Acknowledgement

This research was funded by a short-term scientific grant from the University of Zagreb under the title “Research of sustainable processes: Modelling and assessment” (121198). The above support is gratefully acknowledged.

EFFECT OF OLIVE, CHERRY AND SOUR CHERRY PITS PARTICLE SIZE ON SORPTION EFFICIENCY OF LEAD AND ZINC IONS

Mileta S.[1], *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:

Contamination of natural water bodies with heavy metals from industrial effluents, mining activities, agricultural and urban runoff is a significant environmental problem due to its adverse effects on ecosystems and human health. Since heavy metals make water unsuitable for human consumption and economic activities, efforts are needed to develop efficient and cost-effective wastewater treatment methods. This study investigated the use of readily available fruit-processing by-products (olive, cherry and sour cherry pits) as green and inexpensive sorbents for treatment of aqueous solutions containing ≈3 mmol/L Pb or Zn. The effect of particle size (0.045–0.09 mm; 0.09–0.56 mm and 0.56–1.00 mm) on sorption efficiency was investigated in a batch mode for 24 h and at room temperature. Under the experimental conditions tested, the pits showed increased sorption efficiency towards both metals by decreasing particle size, as a consequence of the larger specific surface area, indicating adsorption as the main removal mechanism. For lead, the best efficiency of 63% was achieved by sour cherry pits, followed by cherry pits (44%), while the lowest efficiency of 28% was achieved by olive pits. In the case of zinc, the similar trend was observed, with sour cherry pits efficiency of 35%, cherry pits of 34%, and finally olive pits of 26%. It is observed that sour cherry pits were the most efficient towards both metals, but also, all pits were more efficient towards lead than towards zinc. This is probably a result of the pits composition and the present functional groups that interact with metal cations, which will be the subject of future research. Although the prescribed levels of lead and zinc concentrations were not met, nevertheless, fruit processing by-products showed promising potential, contributing to the economically and environmentally sustainable treatment of water polluted with heavy metals.

Keywords: *Olive, cherry and sour cherry pits; Particle size; Lead; Zinc; Low-cost wastewater treatment.*

Acknowledgement

We thank RETSCH GmbH for the generous donation of a new mill (MM 200) to enable science.

TEMPORAL IMPACTS OF BONFIRE AND FIREWORK EVENTS ON URBAN AEROSOL RADIATIVE PROPERTIES

Minderytė A.[1], *Byčenkienė S.*[1]

[1]Center for Physical Sciences and Technology, Department of Environmental Research, Savanorių Ave. 231, LT-02300 Vilnius, Lithuania
(e-mail: agne.minderyte@ftmc.lt)

Abstract:

Aerosol particles interact with light primarily through scattering or absorption, processes influenced by their chemical composition, while the chemical composition depends on the source. Sulfate and nitrate, for example, are well-known contributors to light scattering. Even though there are numerous studies on aerosol particles originating from fireworks or biomass burning, a consensus on the strength of the radiative effect of the aerosols has not been reached. This case study examines how two major events - a nationwide bonfire-burning celebration during Midsummer and fireworks on New Year's Eve – impact aerosol black carbon (BC) mass concentration and optical properties at an urban background site in Vilnius. BC mass concentration was measured using an Aethalometer (AE33, Magee Scientific) and aerosol scattering properties were recorded using a Nephelometer (TSI model 3563). The analysis focused on changes in aerosol BC source contributions, absorption and scattering Ångström exponents (AAE and SAE), and single scattering albedo (SSA) during two specific periods: 15th December (2021) to 28th February (2022) and 1st June to 18th August (2022). On the night of 23rd June, during the Midsummer celebration, a 3-fold increase in the total BC mass concentration was observed. The extensive bonfire burning resulted in a 7-fold increase in BC_{BB} (BC from biomass burning) compared to the season average. This high BC_{BB} contribution enhanced aerosol light absorption, reducing the SSA by 12%, which indicates an increased warming effect on the atmosphere. During New Year's Eve, the BC mass concentration doubled, and the SSA decreased by 17%. This multi-parameter investigation highlights two short-term, high-pollution events, providing a deeper understanding of biomass-burning-related aerosols and their impact on atmospheric radiative transfer.

Keywords: *Black Carbon; Aerosol particles; Radiative forcing; Urban background environment.*

RELEVANCE OF PROBABILITY DISTRIBUTION OF EFFLUENT QUALITY PARAMETERS FOR THE TREATMENT PLANTS DESIGN

Mitrinović D.[1], *Perović M.*[1], *Miodrag P.*[1], *Kovačević S.*[2], *Matić B.*[3]

[1]Jaroslav Černi Water Institute, 80 Jaroslava Černog St., 11226 Belgrade, Republic of Serbia
(e-mail: david.mitrinovic@jcerni.rs)

[2] Faculty of Technical Sciences, University of Novi Sad, 6 Dositeja Obradovića Sq., 21000 Novi Sad, Serbia

[3] Educons University, 21208 Sremska Kamenica, Serbia

Abstract:

The basic legislative requirements for the wastewater treatment plants (WWTPs) are that the quality of selected parameters in effluent should be below the stipulated values, and that this is considered to be fulfilled if no more than certain percent of samples during one year do not conform to limits. In the Serbian legislation, for WWTPs with capacity larger than 50,000 PE minimal number of samples (24h composite) per year is 24, of which 3 can be non-conforming (12.5%), providing that the BOD_5 and TSS value are not more than 100% and 150% above the limit, respectively. The starting point for setting the inlet quality used in the design is the probability distribution of legislatively relevant wastewater quality parameters. For sewage outlet "Sajam", largest in Belgrade, Gumbel distribution of BOD_5 concentrations provided the best match with the laboratory determined values, with mode (most frequent value) 250 mgO_2/l and scale parameter 60 mgO_2/l. In order not to overstep the limit value in more than 12.5% of samples, wastewater with the BOD_5 concentration of 390 mgO_2/l, which is 90th percentile, should be used in the design. The designed WWTP based on this value should be tested (using software modeling tool or calculation spreadsheet used for developing the design) on 99.9th percentile of BOD_5 concentration i.e. 640 mgO_2/l, present in the influent approximately ones in 1000 sampling, or once in 40 years (which is more than the normal lifespan of the plants) for 24 samples a year. If the calculated effluent BOD_5 concentration is less or equal to 200% of 25 mgO_2/l limit value (50 mgO_2/l) for this BOD_5 concentration then all the conditions stipulated in the legislations will be met. The same methodology should be used for COD and TSS.

Keywords: *WWTP; Legislation; Probability distribution.*

ANN PREDICTION OF THE DIMETHOATE DEGRADATION EFFICIENCY IN WASTEWATER BY PLASMA NEEDLE

Mitrović T.[1], *Lazović-Pašti T.*[2], *Lazović S.*[1]

[1]Institute of Physics, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia
(e-mail: tmitrovic@ipb.ac.rs)

[2]Department of Physical Chemistry, Vinča Institute of Nuclear Sciences, University of Belgrade, Mike Petrovića Alasa 12-14, P. O. Box 522, Belgrade, Serbia

Abstract:

This study presents the application of artificial neural network (ANN) models for predicting the degradation rate of Dimethoate in an aqueous solution using plasma needle. The input parameters for the model included: treatment time (0-30 min), plasma feed gas flow rate (0.5, 1 and 2 dm^3/min), pesticide initial concentration (1×10^{-3} M, 1×10^{-4} M and 1×10^{-5} M), and sample volume (10, 25, 50 mL). Concentration of Dimethoate was determined using UPLC analysis. A general regression neural network (GRNN) was employed to identify the parameter which the most significantly influence the degradation outcome. The data for Dimethoate degradation were randomly partitioned into distinct sets: a training data set (used for adjusting the weighting factors), a model validation set (employed to determine the smoothing factor), and a model testing set (utilized to evaluate the overall performance of the GRNN). These sets were divided in the ratios of 65-70 % for training, 20 % for validation, and 10-15 % for testing, respectively. The obtained Individual Smoothing Factor (ISF) values highlighted the importance of each input parameter. Based on the ISF values, it was demonstrated that the most critical factor in the Dimethoate oxidation process was the treatment time (ISF=3.00). The effects of the feed gas flow rate, volume, and initial sample concentration were comparable, indicating that their contributions to the oxidation efficiency were approximately equal (ISF=0.13-0.55).

Keywords: *Dimethoate; Plasma needle; GRNN; UPLC.*

OXIDATION OF AG 25 DYE IN WATER BY ATMOSPHERIC PRESSURE PLASMA

Mitrović T.[1], *Nenin T.*[2], *Lazović S.*[1]

[1]Institute of Physics, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia
(e-mail: tmitrovic@ipb.ac.rs)

[2]Jaroslav Černi Water Institute, Jaroslava Černog 80, 11226 Belgrade, Serbia

Abstract:

The plasma needle has been investigated for its efficacy in oxidation Acid Green 25 (MW= 622.58 g/mol, $C_{28}H_{20}N_2Na_2O_8S_2$) anthraquinonic dye through both decolorization and organic matter degradation. The decolorization process was monitored using UV/VIS spectrophotometry, focusing on the wavelength of 643 nm, while the degradation of organic matter was assessed via total organic carbon (TOC) measurements. Both processes were analyzed as a function of plasma treatment time. The dye solutions were prepared using distilled water with an initial concentration of 50 mg/L, and a total volume of 25 mL. A magnetic stirrer was employed to maintain solution homogeneity during the treatments and the Argon was used as plasma feed gas with the flow rate 4 dm^3/L. The results indicate differing rates for the decolorization and degradation processes. Complete color loss was observed after 150 minutes of treatment time, attributed to the destruction of the dye's main chromophoric group (–N=N–). Despite achieving full decolorization, TOC measurements revealed that the degradation of organic contaminants was less progressive, with only 15 % reduction in total organic carbon for the same treatment time. This reduction corresponds to the breaking of bonds in the dye's aromatic structure (C–C, C=C, C–N, C–S). To achieve complete oxidation of total organic carbon to carbon dioxide and full removal of the azo dye, further optimization of the experimental parameters is necessary.

Keywords: *Acid Green 25; Plasma needle; TOC.*

STUDY OF SOLVATOCHROMIC PROPERTIES OF SELECTED ORTHO AND META SUBSTITUTED ASYMMETRIC BISTHIOCARBOHYDRAZONE DERIVATIVES

Mrdjan G.[1], *Vastag Gy.*[1], *Apostolov S.*[1], *Mekić D.*[1], *Matijević B.*[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: gorana.mrdjan@dh.uns.ac.rs)

Abstract:

Asymmetric bisthiocarbohydrazones are compounds obtained by the condensation of both amino groups of thiocarbohydrazide by different aldehydes or ketones. Many of these derivatives studied so far have proven to be excellent antioxidant, antimicrobial, and anticancer agents. It is known that the potential biological activity of a compound may depend on the type and strength of the interactions it can achieve with the surrounding medium. Quantification of these interactions can be performed with a simple spectrophotometric technique, using different solvatochromic models. In this paper, UV-Vis absorption spectra of ten newly synthesized asymmetrical bisthiocarbohydrazones were recorded in eighteen solvents of different properties, in the range from 200 to 400 nm. The effect of the solvent used was quantified by the linear solvation energy relationship (LSER) method, applying Kamlet-Taft's and Catalan's solvatochromic models. In addition to the solvent effect, to obtain more information about the present intermolecular interactions, correlations were made with Hansen's parameters of the solvent.

Keywords: *Catalan; Hansen; Kamlet-Taft; thiocarbohydrazones; UV-Vis spectroscopy.*

Acknowledgment

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THE INFLUENCE OF AIR POLLUTANTS ON RESPIRATORY HEALTH: A CASE STUDY OF KANO METROPOLIS, NIGERIA

Musa, Y. F.[1]

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

Abstract:

Air pollution has been identified as a significant public health concern in urban environments worldwide. This paper investigates the relationship between Critical Air Pollutants (CAPs) and respiratory health outcomes in the Kano metropolis. Using Aeroqual Portable Monitor S500 V6 ENV and HoldPeak Aerosol Mass Monitor, ambient concentrations of CAPs were measured at 34 randomly sampled locations monthly for 12 months. Also, medical records were collected from the four public hospitals in the metropolis on Chronic Obstructive Pulmonary Disease (COPD), asthma, Upper Respiratory Tract Infections (URTIs), pneumonia and lung cancer. The data were analysed using a stepwise multiple regression model. Results revealed that the prevalence of asthma significantly correlated (R^2=0.92, $p<0.05$) with $PM_{2.5}$. The COPD was significantly influenced (R^2=0.84, $p<0.05$) by CO and O_3; and occurrence of pneumonia by NO_2 (R2=0.700, $p<0.05$). Likewise, cases of URTIs were associated (R^2=0.890, $p<0.05$) with $PM_{2.5}$ and SO_2 and lung cancer significantly linked (R^2=0.967, $p<0.05$) to $PM_{2.5}$. This underscores the critical need for air quality interventions in the Kano metropolis to mitigate the adverse health impacts of pollution. The paper seeks the enactment of public health policy initiatives aimed at reducing pollutant levels to prevent respiratory illnesses and improve overall community health. Further researches are needed to explore the long-term effects of air pollution on public health in similar urban settings.

Keywords: *Air Pollution; Health; Kano metropolis; Critical Air Pollutants; Urban.*

Acknowledgement

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LEACHING OF METALS FROM NiMH BATTERIES: TEMPERATURE IMPACT ON METAL RECOVERY

Mušović J.[1], *Tekić D.*[1], *Jocić A.*[1], *Marić S.*[1], *Dimitrijević A.*[1]

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

Abstract:

Nickel-metal hydride (NiMH) batteries are a valuable secondary resource for critical metals such as cobalt, nickel, cerium, and lanthanum. This study examines the efficiency of metal leaching from anodic material using 4 mol/L nitric acid under two temperature conditions: 25°C (room temperature) and 75°C, with a leaching duration of 2 hours and a solid-to-liquid ratio of 1:12. Results highlight the significant impact of temperature on metal dissolution. At 75°C, cobalt achieved a concentration of 4.33 g/L, markedly higher than 3.23 g/L at 25°C. Similarly, nickel reached 56.8 g/L at the elevated temperature compared to 36.4 g/L at room temperature. For rare earth elements, cerium showed slightly better recovery at 25°C (2.19 g/L) compared to 2.02 g/L at 75°C, while lanthanum followed a similar trend with 15.80 g/L at 25°C versus 14.34 g/L at 75°C. These findings underline the temperature sensitivity of cobalt and nickel leaching, with higher temperatures favoring their dissolution, whereas rare earth elements exhibited marginally better recovery at lower temperatures. The results provide crucial insights into optimizing leaching processes to selectively recover metals from spent NiMH batteries, contributing to sustainable recycling practices.

Keywords: *NiMH batteries; Leaching; Cerium; Lanthanum; Nickel; Cobalt.*

Acknowledgement

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EXTRACTION OF COBALT AND NICKEL USING TETRABUTYLPHOSPHONIUM SALICYLATE IN AQUEOUS BIPHASIC SYSTEMS

Mušović J.[1], *Tekić D.*[1], *Jocić A.*[1], *Marić S.*[1], *Dimitrijević A.*[1]

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

Abstract:

Cobalt and nickel are critical components of cathode materials in various lithium-ion batteries, making their recovery essential for sustainable recycling processes. This study explores the extraction efficiencies of cobalt and nickel using aqueous biphasic systems (ABS) formed with ionic liquid tetrabutylphosphonium salicylate ([TBP][Sal]) and two salts: ammonium sulfate and ammonium nitrate. The results reveal stark differences in metal partitioning between the phases depending on the salt type. With ammonium sulfate, both metals remained predominantly in the salt-rich phase, resulting in extraction efficiencies near zero. Conversely, the systems with ammonium nitrate facilitated the successful extraction of cobalt and nickel into the ionic liquid-rich phase. These findings underline the influence of salt selection on the phase behavior and extraction efficiency in ABS. This study provides valuable insights for designing efficient and selective extraction systems for metal recovery from battery leachates.

Keywords: *Cobalt; Nickel; Ionic liquids; Aqueous biphasic systems; Battery recycling.*

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation 686 of the Republic of Serbia (Contract number: 451-03-66/2024-03/200017).

THE BENEFITS OF UTILIZING BLACK SOLDIER FLY IN AN INNOVATIVE APPROACH TO ORGANIC WASTE MANAGEMENT

Najdanović A.[1], *Stanisavljević N.*[1], *Batinić B.*[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: andjelanajdanovic4@gmail.com)

Abstract:

The two major problems challenging the world today are related to the constant increase in human population. The first issue is the rising demand for food due to population growth, which puts pressure on natural resources. The second challenge is associated with the increasing generation of organic waste. Faced with this type of problem, the application of Black Soldier Fly (BSF) treatment appears as a very effective in organic waste management. BSF larvae, (*Hermetia Illucens*), has the ability to significantly reduce a huge amount of organic waste, and at the same time, it can offer valuable livestock feed (using only organic waste from fruits and vegetables) with a high composition of nutrients. Previous research has shown that the total amount of organic waste produced on a daily basis can be reduced by 65-78% with application of BSF. Larvae are usually able to reduce the organic waste by 50% of the original volume. By mixing different waste streams, the efficiency of process can be significantly increased and the limitations of using only one type of stream can be compensated. For example, the larvae reared on abattoir waste (mixed with 50% of fruit and vegetables) grew largest. In comparation with one group of waste samples, this mixture was declared as a highly suitable substrate for BSF treatment. Moreover, based on some studies it is concluded that BSF treatment of organic waste offers an environmentally relevant alternative due to low greenhouse gas (GHG) emissions and potentially high global warming potential (GWP) reduction. Studies conclude that BSF larvae can reduce waste by 78%, producing sustainable protein, lower emissions and offering waste management solutions in line with the circular economy principles.

Keywords: *Black Soldier Fly; Organic waste treatment; Food; Livestock*

SUSTAINABLE ARCHITECTURE IN THE ERA OF CLIMATE CHANGE

Nikolić I.[1], *Vasić K.*[1], *Ratković A.*[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:

Climate change represents one of the greatest challenges of the modern era, and architecture plays a key role in mitigating and adapting to its consequences. This paper explores the principles of sustainable architecture as a response to global climate change, focusing on reducing the carbon footprint of the construction sector, improving energy efficiency, and integrating nature into urban and rural spaces. The paper provides a detailed analysis of futuristic projects such as "Green Float", a floating city with negative carbon emissions, and "Subbiosfera 2", an underwater city that ensures complete ecological self-sufficiency. These projects represent examples of innovative solutions that not only minimize the environmental impact but also create new living conditions aligned with sustainability principles. In addition to these projects, emphasis is placed on the use of passive climate control systems that reduce energy consumption, as well as measures that contribute to reducing CO_2 emissions, such as recycling and the application of renewable technologies in all phases of the life cycle of buildings. The paper also discusses the challenges in implementing sustainable solutions, including economic, technological, and regulatory barriers that can affect the successful implementation of sustainable architecture. Issues such as high initial innovation costs, insufficient legal regulations, and the need for training experts to apply new technologies and solutions in daily practice are analyzed. It is also important to note the significance of an interdisciplinary approach in design and urban planning that involves collaboration between architects, engineers, urban planners, and other professionals to create solutions that are not only technologically sustainable but also economically viable and socially acceptable. Through case studies of successful projects, the possibilities for creating resilient communities ready to adapt to climate change while improving the quality of life of their inhabitants are explored. These projects show that a paradigm shift in architecture is not only possible but necessary to ensure a future that will be resilient to climate crises. The paper also offers recommendations for integrating sustainable practices into all aspects of architectural and urban design, with the aim of creating more resilient and environmentally friendly communities that can endure in the era of climate change.

Keywords: climate change; sustainable architecture; carbon footprint reduction; energy efficiency; renewable energy; recycled materials; innovative projects.

WASTEWATER MANAGEMENT: A CORE STRATEGY FOR ACHIEVING MULTIPLE SUSTAINABLE DEVELOPMENT GOALS

Novaković M.[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, Novi Sad 21000, Serbia
(e-mail: mladenkanovakovic@uns.ac.rs)

Abstract:

Considering that the accomplishment of up to 11 out of 17 sustainable development goals (SDGs) demonstrates the beneficial impacts of wastewater management, its contribution is substantial. Improved water quality, lowering greenhouse gas emissions, lessening the ecological foot, and improving health and well-being (by lowering the risk of diseases) are some of the primary contributors. Numerous and detailed research studies regarding the demand for adequate and cost-effective technology for wastewater treatment (WWT) has been investigated to comprehensively analyse within the scientific community. The highlight of this research is to emphasize the importance and contribution of proper wastewater treatment to the achievement of multiple SDGs. Nevertheless, there is still a gap present for the decision-makers to select the optimum WWT process based on the correct criteria. Though life cycle assessment (LCA) could be utilized as an initial stage toward determining the most suitable treatment, its primary shortcoming consists of the fact it solely takes environmental factors into consideration. Establishing sustainable WWT requires careful consideration of potential flaws and a precise explanation of the criteria. These norms ought to be divided into five distinct categories: effluent water quality (durability of operation, efficiency of elimination, etc.), technological (robustness, adaptability, etc.), social (public consciousness and agreement), environmental (sludge production and disposal, water reuse potential, etc.), and economic (waste stream disposal cost, energy consumption, etc.). Besides this traditional approach, multi-attributes rating technique is employed for a thorough assessment of the appropriate WWT. This methodology implies assigning weights to selected sustainability indicators ('triple bottom line' approach) which leads to composite index for the final evaluation. Recent studies have shown that photocatalytic membrane reactor was highlighted as the best technology. The establishment of an enhanced sustainability evaluation methodology for WWT, which incorporates SDG criteria for every relevant water target groups, should serve as the foundation for future decisions.

Keywords: *Water footprint; SDG indicators; Sustainability assessment methodology; Sustainability guidelines.*

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ENVIRONMENTAL OCCURRENCE, DISTRIBUTION, AND CHALLENGES OF PFAS: A GLOBAL PERSPECTIVE

Perović M.[1]

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

Abstract:

Per- and polyfluoroalkyl substances (PFAS) are a rapidly expanding group of synthetic compounds, often referred to as "forever chemicals," due to their exceptional chemical stability and resistance to degradation. These substances are widely used in various products, including cosmetics, textiles, fire-fighting foams, food packaging, and agricultural applications. PFAS are persistent, bioaccumulative, and pose potential health risks, leading to their classification as persistent organic pollutants. The presented research provides an overview of concentration levels and key characteristics of the most prevalent and extensively studied PFAS, such as PFOS and PFOA, which influence their environmental behaviour, aiding in tracing their sources and explaining their long-term presence in the environment. PFAS are found in surface and groundwater at concentrations ranging from ng/L to µg/L. Short-chain PFAS (with up to 8 carbon atoms) are more mobile in surface waters, while long-chain PFAS (with more than 8 carbon atoms) tend to accumulate in sediments and biota. Reviewed research has demonstrated that perfluorinated PFAS are highly stable and resistant to degradation, whereas polyfluorinated substances are less stable and tend to degrade into persistent perfluorinated components. Despite regulations like those under the EU Water Framework Directive and the Stockholm Convention, PFAS contamination remains widespread. Their global distribution is amplified by long-range atmospheric transport and regional industrial hotspots. Traditional wastewater treatment methods have proven largely ineffective at removing PFAS, allowing their continuous discharge into aquatic environments. While some countries have set regulations for PFAS in water, soil, and food products, there is a pressing need for more coordinated global efforts and innovative treatment technologies. This research aims to review the existing literature on the presence, characteristics, fate, and concentrations of PFAS in surface waters and groundwater globally, with an emphasis on understanding the specific traits of these compounds to better trace their sources and predict their transformation in aquatic environments.

Keywords: *PFAS; PFOS; PFOA; water bodies*.

REGULATORY FRAMEWORK AND LEGAL RESPONSIBILITIES FOR OWNERS OF CONSTRUCTION AND DEMOLITION WASTE

Perović M.[1]

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

Abstract:

This research offers an overview of the requirements outlined in the relevant Serbian legislative framework, aiming to define the legal obligations of waste owners in construction and demolition activities, particularly in light of recent regulatory updates in this field. This paper outlines the necessary steps within the environmentally friendly and responsible handling of construction and demolition waste. The legal requirements for construction and demolition waste producers include the development of a waste management plan, obtaining approval for the plan, and organizing its implementation. The waste owner's responsibilities, including sorting, collection, storage, record-keeping, transport, disposal, and waste testing, are thoroughly discussed, with a particular emphasis on ensuring that hazardous construction waste is separated on-site. The study also examines the obligations of project investors and contractors to maintain records, submit required documentation to competent authorities, and adhere to environmental protection measures during the construction or demolition process. The costs that the waste owner is responsible for, including those related to the treatment, recycling, and disposal of construction and demolition waste are also outlined. The importance of regulating the construction and demolition waste sector in Serbia lies in ensuring adherence to the waste management hierarchy, which promotes waste prevention, reduction, and recycling, thus minimizing environmental impacts. Proper registration and compliance with these regulations are essential for efficient waste management and the sustainable development of the country's infrastructure. Lastly, the research emphasizes the importance of proper waste management in construction projects for ensuring compliance with Serbian environmental regulations and promoting sustainable construction practices. Through the analysis of the legislative framework and practical obligations in managing construction and demolition waste, the paper aims to improve waste management practices and ensure that waste producers minimize their environmental impact.

Keywords: *Construction and Demolition Waste; Legal Obligations.*

POSSIBILITIES AND CHALLENGES IN USING RDF AND SRF AS FUEL

Petrić D.[1], *Batinić 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: petricdanica7@gmail.com)

Abstract:

Population growth and diminishing fossil fuels reserves represent one of the main problems of today's society. The waste management system, especially in less developed countries, is not adequate. While huge amounts of waste are generated more and more due to population growth, landfills are getting bigger, and the emissions emitted from waste unfortunately affect human life and health, as well as the environment. Engineers have taken these two global problems, creating a dual goal: reducing disposal of waste and recovering energy from waste. Municipal solid waste can be used, if treated correctly, as a good source of fuel in energy-intensive industries such as cement plants, lime industries, coal-fired power plants, and others. Improved management of refuse-derived fuels (RDF) and solid recovered fuels (SRF), recovered from municipal solid waste, can be a solution for rising waste production as well as a new source of energy in energy-intensive industries. Refuse-derived fuel and solid recovered fuels need to be treated before usage, following certain standards as well as standards of the industry that will use this type of fuel. Standards in Europe, such as EN ISO 21640:2021, are key to classifying SRF (Solid recovered fuel) based on several characteristics (physical and chemical properties) and of importance for industries and users that will use it in their production system. Approximately 34 % of total municipal waste contains paper and cardboard, textiles, wood, and rubber, suitable for RDF production. RDF needs to go through a mechanical and other types of treatments before usage. However, the uptake of RDF is subject to certain technical and economic limitations (energy content, moisture content, contaminating and polluting elements, physical requirements). Development and investment in this technology, strict compliance with environmental regulations, and communication with the public are essential for their application.

Keywords: *Waste; SRF; RDF; Standards; Treatment; Processing*

Acknowledgment

This work was supported by the Jean Monnet Module ENROL (101085701). Views and opinions expressed are however those of 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.

LOAEL FOR SIX SERIES OF NEW SUCCINIMIDE DERIVATIVES: IN SILICO SURVEY

Pinter D.[1], *Milanović M.*[1], *Vrkatić A.*[1], *Vidović D.*[1], *Jovičić-Bata J.*[1], *Banjac N.*[2], *Milošević N.*[1]

[1]Univeristy of Novi Sad, Faculty of Medicine, Department of Pharamcy, Hajduk Veljkova 3, 21 000 Novi Sad, Serbia (e-mail: 904009d23@mf.uns.ac.rs)

[1]Univeristy of Belgrade, Faculty of Agriculture, Food Technology and Biochemistry, Nemanjina 6, Zemun, 11080 Belgrade, Serbia

Abstract:

Succinimide moiety is known for various pharmacological effects including antiepileptic, antiproliferative, analgesic, antipsychotic, anticholinesterase, antioxidative, antifungal etc. Continual research and structural modification of existing succinimide derivatives led to design of six new series (A-F) of succinimides with various polarity, lipophilicity and aqueous solubility. Some of the derivatives have already proven with antiproliferative and antimicrobial activity. Given their possible application, their lowest observed adverse effect level (LOAEL) become one of the most important parameter for further preclinical studies. A total of 71 succinimide derivatives was tested through the free online tool pkCSM for LOAEL (Oral Rat Chronic Toxicity) expressed in log of mg/kg per body weight/day. The lipophilicity expressed as logP and aqueous solubility given as logS were determined through the preADMET online software. All observed compounds had LOAEL between 1.041 and 2.500 log mg/kg per body weight/day with the highest LOAEL for the least lipophilic series C (1.496-2.500) and D (1.442-2.499) and the lowest LOAEL for the most lipophilic series B (1.041-1.868) and F (1.110-1.847). The obtained results indicated statistically significant variations of the LOAEL values between the series depending on their substituents. The LOAEL was statistically significant reversely associated with lipophilicity given as logP of the analysed compounds (r^2=0.303, $p<0.001$), as the more lipophilic the succinimide derivative is, the lower LOAEL was determined. On contrary, there was positive association between LOAEL and solubility given as logS of the compounds observed (r^2=0.310, $p<0.001$) with compounds of higher aqueous solubility expressing higher LOAEL. The LOAEL of succinimide derivatives is strongly governed by their lipophilicity and aqueous solubility and depends on the substituents attached to their core. More lipophilic compounds and those with more polar substituents and thus more soluble in polar (aqueous) environment are expected to exhibit lower LOAEL.

Keywords: *LOAEL; succinimides; lipophilicity; aqueous solubility*

THE PHOTOCATALYTIC DEGRADATION PROCESS AND MECHANISMS OF LDPE MICROPLASTICS USING NANOCOMPOSITES BASED ON TIO_2 AND CLAY MINERALS

Pleskytė S.[1], *Uogintė I.*[1], *Byčenkienė S.*[1]

[1]Center for Physical Sciences and Technology, Department of Environmental Research, Saulėtekio Ave. 3, Vilnius, Lithuania

(e-mail: sonata.pleskyte@ftmc.lt)

Abstract

It is now clear that plastic pollution is one of the major environmental threats, as plastics break down into smaller particles, known as microplastics (< 5 mm), which can enter the human body. This highlights the urgent need for effective technologies to mitigate pollution from these particles and minimize their impact on ecosystems. Considering the degradation of microplastic through photocatalysis, this method shows promissing potential due to its high degradation efficiency and simplicity. The photocatalytic degradation causes oxidation processes of the polymer chain leading to the formation of low molecular weight volatile compounds (aldehydes, ketones, alcohols, carboxylic acids, ethers), which eventually degrade to H_2O and CO_2. In this study, the degradation of LDPE was evaluated through mass loss measurements and functional group analysis at fixed time intervals. The highest mass loss was observed after 480 minutes of UV-A assisted photocatalytic degradation with TiO_2-kaolinite. After photodegradation process, surface functional group analysis of LDPE revealed weak signals of new functional groups attributed to the formation of carbonyl groups. The carbonyl index (CI) showed that prolonged UV irradiation time led to the formation of more oxygen-containing functional groups. The highest value of the carbonyl index (1.41) was obtained with TiO_2-kaolinite after 480 minutes of UV irradiation. Most importantly, this study provides information regarding the change in functional groups of LDPE and possible photocatalytic degradation pathways.

Keywords: *Low-density polyethylene; microplastics; photocatalytic degradation; titanium dioxide; clay.*

PAH DERIVATIVES IN SEDIMENTS AND FISH FROM THE WHITE NILE, EAST AFRICA: SOURCES, BIOTA-SEDIMENT ACCUMULATION FACTORS AND HEALTH RISKS

Ssentongo D.[1]

[1]Department of Chemistry, Makerere University, P.O Box 7062, Kampala, Uganda
(e-mail: ssentongodeo2020@gmail.com)

Abstract:

The environmental impact of oil production activities in sub-Saharan African countries remains understudied, particularly regarding their potential to release toxic pollutants, such as polycyclic aromatic hydrocarbons (PAHs) and their derivatives into ecosystems. This study investigated the concentrations and distribution of nitro-, oxy- and hydroxy-derivatives of PAHs in fish species and sediments from the White Nile near Melut oil fields in South Sudan. Analytes were extracted from fish and sediment samples using accelerated solvent extraction and ultrasonic agitation, respectively, with hydroxy-PAHs derivatized by using BSTFA+TMCS, before analysis with Gas Chromatography-Tandem Mass Spectrometry (GC-MS/MS). Levels of PAH derivatives in sediments (61.8-757, 10.7-182, and 0.34-124 ng g-1dw for nitro-, oxy-, and hydroxy-PAHs, respectively) showed no significant variations amongst sampling locations. In fish, mean levels of the pollutants (748-955, 77.8-242, and 95.7-291 ng g-1ww, for nitro-, oxy-, and hydroxy-PAHs, respectively) were significantly higher in Lates niloticus compared to Oreochromis niloticus and Clarias gareepinus. In all samples, low molecular weight compounds (2-3 rings) were more abundant than high molecular compounds (contributed 77%, and 81% to the ∑PAH derivatives in fish and sediments, respectively). Diagnostic ratios suggested that the PAH derivatives were primarily petrogenic, but health risk assessments suggested minimal health risks to humans through the consumption of fish from the White Nile. Biota-sediment accumulation factors (BSAF) values in fish revealed higher bioaccumulation of lower molecular weight PAH derivatives compared to high molecular weight derivatives. The findings underscore the need for follow-up studies within the river system and its catchments to fully understand the environmental and health implications of oil production activities in the region.

Keywords: *GC-MS/MS; PAHs; BSAFs; Environmental impact.*

TRANSFORMING COFFEE WASTE AND HAZELNUT SHELL WASTE INTO SUSTAINABLE TOYS: A NEW FRONTIER IN ECO-FRIENDLY PRODUCT DESIGN

Stefanovska T.[1], Djokikj J.[2], Klopchevska J.[2]

[1]Faculty of Mechanical Engineering, Ss. Cyril and Methodius, Rudgjer Boskovic 18, 1000 Skopje, N. Macedonia (e-mail: stefanovskatamara@gmail.com)

[2]Faculty of Technology and Metallurgy, Ss. Cyril and Methodius, Rudgjer Boskovic 16, 1000 Skopje, N. Macedonia

Abstract:

As sustainability becomes a driving force in consumer markets, the repurposing of waste materials presents an innovative path for eco-conscious product development. This paper explores the potential of using coffee waste and hazelnut shell waste as a raw material in toy manufacturing, turning an abundant byproduct into a valuable resource. By examining the processes involved in transforming coffee grounds and hazelnut shell into bio composites and other biodegradable materials, this study highlights the environmental and economic benefits of utilizing coffee waste and hazelnut waste in the toy industry. The paper discusses key technical considerations such as material durability, safety standards, and the aesthetic versatility of coffee-based composites in toy design. It also addresses the broader implications for reducing waste in supply chains and decreasing the environmental footprint of plastic toys. Through case studies of companies pioneering the use of coffee waste in product development, the research illustrates how this innovation supports circular economy principles, enhances sustainability, and promotes environmental responsibility among manufacturers and consumers. This paper offers valuable insights for product designers, sustainability advocates, and manufacturers interested in exploring alternative materials that contribute to both ecological preservation and market differentiation. The use of coffee waste in toy production not only redefines what is possible in sustainable design but also sets a new standard for environmentally friendly innovation. Rich in cellulose, hemicellulose and lignin, and proteins the waste can be processed into environmentally friendly alternatives to conventional plastics. Both materials with proper treatment and organic adhesives provide the strength needed for the product. For the future, we need to make market analysis about the adaptation of this kind of products, to see if the customers will be willing to buy toys from waste.

Keywords: *Coffee waste; Hazelnut waste; Nontoxic; Toys; Biodegradable.*

Acknowledgement

This work was supported by Faculty of Mechanical Engineering-Skopje (UKIM). I would like to express my gratitude to Professor Jelena Djokikj and Professor Jana Klopchevska for their guidance and valuable insights. Special thanks for their continued support

THE IMPACT OF ELECTRONIC CIGARETTES ON ENVIROMENT

Stevanovski A.[1], *Ubavin D.*[1]

[1]University of Novi Sad, Faculty of Tehnical Sciences, Department of Environmental Engineering and Occupational Safety and Health, Novi Sad, Serbia
(e-mail: astevanovskiii@gmail.com)

Abstract:

The use of tobacco cigarettes and products is constantly increasing worldwide. In addition, the use of electronic cigarettes has been rising significantly in recent years. Electronic cigarettes are devices consisting of a battery component, a reservoir filled with e-liquid, and a heating element. The device works by heating the liquid through the battery, turning it into an aerosol that the user then inhales. The waste generated from electronic cigarettes is potentially hazardous, because it contains a battery, which is electronic waste, and oil, which is bio-hazardous waste. They represent an environmental burden because management systems for such waste are still underdeveloped and because these devices are often discarded at consumption sites, where they have direct contact with the environment. The greatest environmental burden comes from disposable electronic cigarettes, as they contain the same materials as refillable e-cigarettes but last for a shorter time and quickly become waste. To mitigate greater environmental threats, this type of waste must be managed carefully, with two options available: incineration and recycling. From a health perspective, these devices are currently considered a less harmful alternative to regular tobacco cigarettes. This is supported by chemical, toxicological, and clinical studies conducted on the subject. However, electronic cigarettes can negatively impact the respiratory system and may cause potential toxicity. This type of waste must be handled carefully, and there are two options for its management: incineration and recycling. The biggest issues include smoking in enclosed spaces, disposable electronic cigarettes, attractive flavors (aromas), and the management of potentially hazardous waste from electronic cigarettes. Further research on this topic is needed, along with improvements in the waste management systems for electronic cigarettes.

Keywords: *electronic cigarettes; battery; e – liquid; hazardous waste*

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BIOMASS-DERIVED CARBON MATERIALS AS BIOSORBENTS FOR ORGANOPHOSPHATE PESTICIDE REMOVAL FROM WATER

Tasić T.[1], *Milanković V.*[1], *Kokanov Stanković K.*[2], *Lazarević Pašti T.*[1]

[1] VINČA Institute of Nuclear Sciences-National Institute of the Republic of Serbia, University of Belgrade, Mike Petrovića Alasa 12-14, 11000 Belgrade, Serbia
(e-mail: tamara.tasic@vin.bg.ac.rs)

[2] University of Belgrade – Faculty of Physical Chemistry, Studentski Trg 12–16, 11158 Belgrade, Serbia

Abstract:

The effective control of pests and improvement of agricultural yields often rely on the application of pesticides, including both synthetic and natural types. Among these, organophosphate pesticides are particularly prominent due to their strong efficacy. Despite their benefits, their environmental persistence caused by slow biodegradation has raised significant concerns, such as ecosystem contamination and food chain disruption. These pesticides, known for inhibiting acetylcholinesterase activity, are linked to potential neurological health risks. Malathion, one of the most commonly used organophosphates in mosquito control, crop protection, and pet care, is especially challenging due to its slow degradation in soil and water, leading to its accumulation in effluent zones and posing threats to aquatic organisms and human health. To address these issues, adsorption has gained attention as an effective and environmentally friendly method for removing organophosphates. Biomass-derived carbon materials, with their porous structures and extensive surface areas, show significant promise for this application. This study explores the potential of these materials in adsorbing malathion. The materials were analyzed using SEM, EDX, BET, and FTIR analyses. The adsorption behavior was modeled using Freundlich, Langmuir, Temkin, and Dubinin-Radushkevich isotherms. The experimental data fitted the best using the Freundlich isotherm, suggesting a multilayer adsorption mechanism on the heterogeneous surface of carbon materials. The Langmuir isotherm model showed that the maximum adsorption capacities for MLT onto BMC1 and BMC2 materials were 2377.67 mg g^{-1} and 398.74 mg g^{-1}. The Dubinin-Radushkevich model confirmed that the adsorption mechanism was governed by physisorption, while the Temkin isotherm suggested an exothermic process. The results underscored the high efficacy of these materials in pesticide removal.

Keywords: *Biomass; Malathion; Adsorption; Biosorbent.*

Acknowledgment

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EFFICIENT REMOVAL OF SYNTHETIC DYE E122 FROM WATER USING TETRABUTYLPHOSPHONIUM SALICYLATE-BASED ABS: THE INFLUENCE OF SALTING-OUT AGENTS

Tekić D.[1], *Mušović J.*[1], *Marić S.*[1], *Dimitrijević A.*[1], *Jocić A.*[1]

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

Abstract:

The discharge of synthetic dyes into aquatic systems, resulting from extensive industrial applications, poses a significant environmental threat due to their toxicity and persistence. Wastewater decontamination, therefore, represents a critical challenge in environmental protection. Traditional solvent extraction methods often suffer from the loss of volatile organic compounds, which negatively impacts both the environment and human health. Ionic liquids (ILs), with their negligible vapor pressure, offer a sustainable alternative to address these challenges. Additionally, their designer nature enables optimization for specific extraction processes. This study investigates the use of an aqueous biphasic systems (ABS) with tetrabutylphosphonium salicylate ([TBP][Sal]) with potassium carbonate or ammonium sulfate as salting out agents for the extraction of Acid Blue 9 (E122), a synthetic dye. Phase diagrams were first established to determine the composition of the two-phase region. Results demonstrated that ABS with potassium carbonate achieved superior extraction efficiency, nearing 100%, compared to approximately 90% with ammonium sulfate. The high efficiency observed with carbonate is attributed to its stronger salting-out effect, promoting the preferential migration of E122 into the IL-rich phase. Conversely, while ammonium sulfate also facilitated effective extraction, its comparatively weaker salting-out effect resulted in lower efficiencies. Therefore, ABS with potassium carbonate was further optimized in terms of phase volume ratio, resulting in minimizing the usage of ABS components, while maintaining 100% extraction efficiency. This work highlights the potential of IL-based ABSs for the sustainable removal of dye pollutants from aqueous solutions, emphasizing the role of salt selection in optimizing extraction processes.

Keywords: *Ionic liquids; Aqueous biphasic systems; Synthetic dyes; Wastewater; Acid Blue 9*

Acknowledgement

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NOVEL APPROACH FOR PESTICIDE ADSORBENT REGENERATION USING IONIC LIQUIDS AND SALT ADDITIVES

Tekić D.[1], *Mušović J.*[1], *Marić S.*[1], *Dimitrijević A.*[1], *Jocić A.*[1]

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

Abstract:

Adsorption remains one of the most effective and widely applied methods for removing harmful pesticides from contaminated water due to its simplicity, cost-effectiveness, and high efficiency in capturing contaminants. However, its practical application is limited by challenges such as the saturation of adsorbent materials over time, which significantly reduces their efficacy, necessitating the development of efficient regeneration methods. Traditional regeneration methods are often energy-intensive or rely on the use of hazardous chemicals, presenting environmental and economic drawbacks. Organophosphate pesticides are among the most prevalent contaminants in aquatic environments due to their extensive use in agriculture. Exposure to organophosphates has been linked to neurotoxicity, endocrine disruption, and long-term environmental persistence. In this study, the regeneration of carbon-based adsorbents, which had been saturated with the organophosphate pesticide azinphos-methyl, was investigated using ionic liquid water solutions as environmentally friendly regeneration agents. Ionic liquids are considered green solvents due to their low volatility, thermal stability, and ability to be tailored for specific applications, reducing the need for hazardous chemicals. Aqueous solutions of tetrabutylphosphonium ionic liquids - salicylate and glycolate were synthesized and evaluated for their effectiveness in adsorbent recovery. The results demonstrated that the use of tetrabutylphosphonium salicylate achieved the highest adsorbent recovery, with a regeneration efficiency of 57%. To further optimize the regeneration process, the effect of adding salts, such as sodium citrate and ammonium sulfate, was studied. The addition of sodium citrate significantly enhanced the regeneration efficiency, reaching a maximum of 93%, while the inclusion of ammonium sulfate reduced the efficiency to 40%. These findings suggest that the synergistic effects of ionic liquids and carefully selected salt additives can greatly improve the performance of adsorbent regeneration systems. This study highlights the potential of ionic liquids as tailored, green solvents for advancing adsorption-regeneration cycles, particularly in addressing the challenges associated with pesticide contamination.

Keywords: *Ionic liquids; Pesticide; Adsorption; Wastewater; Azinphos-methyl.*

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation 686 of the Republic of Serbia (Contract number: 451-03-66/2024-03/200017)

EFFECTS OF FULLERENOL NANOPARTICLES ON THE SECONDARY METABOLITES' PROFILE OF FUSARIUM SPP.

Tomić J.[1], Borišev I.[1], Đorđević A.[1], Šarkanj B.[2,3,4], Jović D.[1], Babić J.[2], Sulyok M.[3], Krska R.[3,5], Kovač T.[2,3]

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

[2]Faculty of Food Technology, Josip Juraj Strossmayer University of Osijek, Franje Kuhača 20, 31000 Osijek, Croatia

[3]Institute of Bioanalytics and Agro-Metabolomics, Department of Agrobiotechnology (IFA-Tulln), University of Natural Resources and Life Sciences Vienna (BOKU), Konrad Lorenzstr. 20, 3430 Tulln, Austria

[4]Department of Food Technology, University North, Trg dr. Žarka Dolinara 1, 48000 Koprivnica, Croatia

[5]Institute for Global Food Security, School of Biological Sciences, Queen's University Belfast, University Road, Belfast BT7 1NN, Northern Ireland, UK

Abstract:

The field of nanotechnology has made significant strides, with carbon-based nanomaterials leading the way due to their adaptability and compatibility with biological systems. Among these, in recent years, hydroxylated fullerene derivatives, known as fullerols or fullerenols ($C_{60}(OH)_x$), have demonstrated notable potential in combating mycotoxin contamination. Mycotoxins continue to pose a significant global threat, intensified by environmental changes and climate-related challenges. The presented preliminary studies explored the impact of fullerene nanoparticle $C_{60}(OH)_{24}$ (FNP) on producing secondary metabolites by *Fusarium* spp. fungi. The *in vitro* screening tests evaluated the effects of FNP applied at concentrations of 0.001 to 1 ppm using the LC-MS/MS multi-mycotoxin method outlined by Sulyok et al. (2020). The results revealed that treatment with FNP led to significant changes in the concentration of secondary metabolites, with effects varying depending on both the concentration of FNP and the analysed *Fusarium* species. These findings open new avenues for studying the interactions between nanoparticles and fungi, which could play a crucial role in enhancing food and feed safety. Future research will better understand the mechanisms driving these interactions and explore the practical applications of nanomaterials in controlling mycotoxin contamination.

Keywords: *Fullerenol nanoparticles; Fusarium spp. mycotoxigenic fungi; Mycotoxins; Secondary metabolism*

Acknowledgement

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PHOTOCATALYTIC ACTIVITY OF DOPED CARBON QUANTUM DOTS IN UV DRIVEN FLUROXYPYR DEGRADATION

Tot N.[1], Prekodravac Filipović J.[2], Despotović V[3], Vasiljević B.[2], Marinković D[2]

[1] Technical College of Applied Sciences in Zrenjanin, Đorđa Stratimirovića 23, 23000 Zrenjanin, Serbia (e-mail: natasa.zec@vts-zr.edu.rs)

[2] Vinča Institute of Nuclear Sciences-National Institute of the Republic of Serbia, University of Belgrade, Mike Petrovića Alasa 12-14, 11351 Vinča, Belgrade, Serbia

[3] University of Novi Sad Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia

Abstract:

Photocatalytic degradation of organic pollutants, such as herbicides, represents an efficient and environmentally friendly solution for the removal of harmful substances from natural water sources and soil. Fluroxypyr (FLU), a herbicide from the pyridine carboxylic acid group, is widely used in agriculture, however, its persistence in the environment can have severe consequences for ecosystems. The presence of FLU in water and soil can lead to long-term negative effects, highlighting the urgent need for the development of innovative and efficient methods for its removal. In present study, the photocatalytic efficiency of carbon quantum dots (CQDs) doped with boron (B-CQDs) and nitrogen (N-CQDs) was investigated for the degradation of FLU in aqueous media under UV irradiation. Experiments were conducted using a mercury vapor UV lamp under controlled irradiation conditions for 30 minutes. The results indicated that B-CQDs as photocatalysts achieved limited efficiency, with only 14% removal of FLU, suggesting low photocatalytic activity under set conditions. Similar results were observed for N-CQDs. The results for B-CQDs and N-CQDs demonstrated comparable levels of efficiency in degrading FLU, with both materials showing low removal rates for the selected model herbicide herbicide. These findings emphasise the necessity for additional optimisation of the structure and features of doped carbon quantum dots as well as their integration with other catalysts to improve degrading efficiency. The presented study enhances comprehension of the capabilities and constraints of doped CQDs in photocatalytic processes, setting the path for advancements in water treatment technologies and environmental protection through future research and practical applications.

Keywords: *Herbicides; photocatalytic degradation; fluroxypyr; carbon quantum dots.*

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MICROPLASTICS AS VECTORS FOR UV FILTERS: 4-MBC SORPTION ON PE AND PVC

Vasiljević S.[1], *Simetić T.*[1], *Molnar Jazić J.*[1], *Vujić M.*[1], *Tubić A,*[1].

[1]Department of Chemistry, Biochemistry and Environmental Protection, University of Novi Sad, Trg Dositeja Obradovića 3, Novi Sad, Serbia
(e-mail: tajana.djurkic@dh.uns.ac.rs)

Abstract:

Microplastics (MPs), small plastic particles less than 5 mm in size, are found in various environments, including marine sediments, water bodies, and agricultural soils. These particles interact with a range of chemicals, both organic and inorganic. Organic pollutants like polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, and pharmaceuticals often bind to MPs. Ultraviolet (UV) filters, used in products like sunscreen, makeup, and hairspray, are another type of contaminants very often connected to MPs. Studies have shown that UV filters such as 2-hydroxy-4-methoxybenzophenone (BP-3), 3-(4-methyl-benzylidene) camphor (4-MBC), and EHMC can harm the environment. 4-Methylbenzylidene camphor (4-MBC), a common UV filter in personal care products, is hydrophobic, making it easy for MPs to absorb and transport it in aquatic environments. For this reason, 4-MBC was chosen as a model contaminant to investigate the adsorption behavior of polyethylene (PE) and polyvinyl chloride (PVC) microplastics. The study aimed to evaluate the adsorption capacity of 4-MBC onto PE and PVC microplastics. The PE and PVC particles used had size ranges of 49.7–259 μm and 171–279 μm, respectively, as provided by the supplier. Adsorption experiments were conducted with a pH of 7.30 ± 0.05. Each vial contained 30 mg of MPs and 4-MBC at an initial concentration of 10 μg/L. Samples were taken at intervals of 1, 2, 3, 4, 5, 6, 24, 48, 72, 96 hours, as well as at 7 and 10 days. To understand the adsorption potential of 4-MBC onto PVC and PE MPs, the study examined adsorption kinetics and the time required to reach adsorption-desorption equilibrium. Results showed that equilibrium for 4-MBC adsorption was achieved at 24 hours for PVC and 48 hours for PE. The equilibrium adsorption capacities were 0.013 ± 0.003 μg/mg for PVC and 0.123 ± 0.009 μg/mg for PE.

Keywords: *microplastics; UV filters; adsorption; organic pollutants; 4-MBC.*

Acknowledgement

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ECOLOGICAL SECURITY AS A CORNERSTONE OF SERBIA'S NATIONAL INTEREST

Veljković S.[1], *Ćurčić M.*[1], *Dabetić 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: sanela.veljkovic@vin.bg.ac.rs)

Abstract:

Environmental protection and ecological security have only recently been recognized as integral components of Serbia's national security framework. In the initial draft of the National Security Strategy, environmental protection was not even listed as a national interest. Through concerted efforts and acknowledgment of global ecological threats, this omission was corrected. Despite this, the Strategy lacks clarity in defining precise goals for ecological security throw the operationalization of national interest preservation of the environment and resources. The document emphasizes the significance of safeguarding the environment and resources but fails to outline actionable measures or concrete benchmarks for achieving ecological resilience. The stated objectives appear arbitrary and lack operational guidelines, concerns about the effectiveness of their implementation. This fragmented approach could prevent the country from fully realizing its ecological potential and obligations under global sustainability frameworks. The interdependence between ecological security and other sectors, such as energy, agriculture, and public health, demands an integrated approach. The Strategy overlooks these intersections, hindering a holistic approach to environmental risk management. Without a comprehensive framework, Serbia risks falling short of its sustainability commitments. Given the growing environmental pressures and the challenges posed by climate change, the arbitrary and insufficiently defined goals in the National Security Strategy necessitate urgent revision. Serbia could consider adopting a more evidence-based approach to ecological security, incorporating measurable standards. Such an approach would solidify environmental protection as a core national interest and enhance the country's resilience to emerging ecological threats, ultimately ensuring long-term sustainability and contributing to global environmental governance. National interests shape a country's commitment to protecting environmental resources essential for survival and prosperity. Clear, prioritized ecological goals ensure coordinated efforts, align policies with global standards, and enhance resilience against environmental threats, securing long-term sustainability for future generations.

Keywords: *Ecological security; National interest; Environmental protection; Environmental goals, Sustainable development.*

Acknowledgement

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POTENTIAL OF LACTIC ACID-BASED NATURAL DEEP EUTECTIC SOLVENTS FOR EXTRACTING BIOACTIVES FROM *SALIX*

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: milicavidic92@yahoo.com)

Abstract:

Due to the synergistic action of the bioactive components in willow bark (*Salix spp*., Salicaceae) extracts and their lower potential for causing side effects compared to non-steroidal anti-inflammatory drugs (NSAIDs), there has been a growing interest in using willow extracts as a natural alternative to these medications. Natural deep eutectic solvents (NADES) are novel, environmentally friendly, cost-effective solvents with favorable physicochemical properties, including biodegradability, low volatility and good solubilizing capacity. Considering their efficient absorption of microwave energy, in this research, lactic acid-based NADES ($NADES_{LA}$) were used as solvents in microwave-assisted extraction (MAE). This study aimed to assess the efficiency of MAE-$NADES_{LA}$ for extracting bioactives from the underexplored leaves and bark of *Salix amplexicaulis*. Moreover, the potential of $NADES_{LA}$ to replace conventional solvents was examined by comparing MAE-$NADES_{LA}$ with MAE-water and traditional ethanol maceration. The $NADES_{LA}$, lactic acid: glucose (5:1) and lactic acid: glycerol (1:1) were synthesized using the heating and stirring method. The extracts of *Salix amplexicaulis* bark and leaves were obtained by ethanol maceration and MAE, utilizing water and the two $NADES_{LA}$ as solvents. The extracts were chemically characterized using high-performance liquid chromatography (HPLC). Eleven bioactive compounds from the class of phenolic acids and flavonoids were identified and quantified. The MAE-$NADES_{LA}$ enhanced the extraction efficiency of gallic, vanillic, syringic, trans-cinnamic acid, and flavonoid compounds - rutin, quercetin, and naringenin compared to the aqueous and ethanol extracts. Lactic acid: glucose (5:1) NADES extracted the highest number of phenolic compounds in the highest amount from the bark and leaves of *Salix amplexicaulis*. Given these results, the green method MAE-$NADES_{LA}$, characterized by faster and more cost-effective preparation, high extraction efficiency, and non-polluting properties, opens new possibilities in the field of environmentally friendly technologies. Furthermore, $NADES_{LA}$ are a promising alternative to water and toxic organic solvents in the extraction of bioactive compounds.

Keywords: *Salix; Extraction; NADES; Phenolics*.

Acknowledgement

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

SUSTAINABLE LOGISTICS THROUGH AI: INNOVATIONS FOR ENVIRONMENTAL PROTECTION

Vorina A.[1], *Križanec S.*[1]

[1]Celje School of Economics, Higher Vocational College, Mariborska 2, 3000 Celje, Slovenia
(e-mail: anton.vorina@escelje.si)

Abstract:

This paper explores the impact of Artificial Intelligence (AI) on logistics processes, focusing on supply chain optimization and the automation of routine tasks. The aim of the paper is to examine how AI improves efficiency and reduces costs in logistics, and to analyze case studies of AI applications in major companies like Amazon, UPS, and DHL. The methodology includes a literature review, case study analysis, and examination of real data on the effects of AI in logistics. Various aspects such as route planning, inventory management, demand forecasting, routine task automation, and integration with the Internet of Things (IoT) are analyzed. Findings indicate that AI brings significant advantages, such as a 50% reduction in forecasting errors and a 65% decrease in stockout losses due to improved product availability. Practical examples like Gorenje's implementation of AI to enhance carrier selection and optimize logistics processes highlight the tangible benefits of this technology. Graphs in the paper illustrate growing trends in AI use in logistics, with an average annual growth rate of the market between 2024 and 2033 estimated at 46.72%, predicting that the market will reach USD 565.82 billion by 2033. Additionally, the graphs show reasons for non-use of AI, with major barriers being high costs (35%) and lack of expertise (25%). For example, a 2023 survey found that 35% of companies considering AI implementation cited high costs as the biggest barrier, while 25% cited a lack of relevant expertise. The practical application of this paper is to help companies understand the benefits and challenges of integrating AI into their logistics processes. With this paper, companies can better plan and implement their strategies for optimizing supply chains, leading to improved efficiency, cost reduction, and better customer service. Additionally, the paper provides insights into future trends and development directions that are crucial for long-term market competitiveness.

Keywords: *Artificial Intelligence; Logistics; Supply Chain Optimization; Automation; Inventory Management.*

CLASSIFICATION OF GROUNDWATER QUALITY FOR IRRIGATION PURPOSES

Vranešević M.[1], *Perović M.*[2], *Živančev N.*[3]

[1] University of Novi Sad, Faculty of Agriculture, Department of Water Management, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia
(e-mail: milica.vranesevic@polj.edu.rs)

[2] Jaroslav Černi Water Institute, Jaroslava Černog 80, 11226 Belgrade, Serbia

[3] 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

Abstract:

Groundwater could play a role in sustaining agricultural activities besides surface water, especially in regions where irrigation is essential. This study assesses and classifies the quality of groundwater in the Kovin-Dubovac area, Serbia, to determine its usability for irrigation purposes. A total of 143 groundwater samples were collected and analyzed between 2010 and 2018. For different classifications such as FAO, USSL, Stebler's and Nejgebauer's, the water analysis includes the assessment of major cations and anions (Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, $SO4^{2-}$, and HCO^{3-}), total dissolved solids (TDS), electrical conductivity (EC) and pH values. The Piper plot and specific ionic diagrams indicate that the dissolution of carbonate and silicate minerals, along with cations exchange processes significantly influences the groundwater chemistry. According to classifications with a relatively mild rating shuch as FAO and Stebler's, the most of the samples (around 80%) show no restriction in use. According to more restrictive classifications, such as USSL, 80% of the samples fall into the C2-S1 class, while Nejgebauer's classification identified only 5 samples as unsuitable for irrigation Based on all classification, the analyzed groundwater is generally considered suitable for irrigation purposes in terms of quality. However, its use should be followed by monitoring and the implementation of appropriate irrigation techniques. Future research could expand on these findings by investigating long-term changes in groundwater quality and their effects on agricultural productivity.

Keywords: *Water quality; Classification; Groundwater; Irrigation*

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CHARACTERIZATION OF VELIKA RUSANDA SODA LAKE IN SERBIA BASED ON CHEMICAL PROPERTIES

Živančev N.[1], *Kovačević S.*[1], *Milovanović D.*[1], *Mihajlović I.*[1]

[1]University of Novi Sad, Faculty of Technical Sciences, Trg Dositeja Obradovića 6, Novi Sad, Serbia
(e-mail: nevenazivancev@uns.ac.rs)

Abstract:

Velika Rusanda is one of the largest soda lakes in Vojvodina, Serbia. It is part of a protected area under the Nature Park "Rusanda" and is included in the Natura 2000 Network under the designation "Pannonic Salt Steppes and Salt Marshes", highlighting its recognized ecological significance. Seasonal variations strongly influence the physicochemical composition of Velika Rusanda's water. This paper focuses on its chemical properties by analyzing major ion concentrations (Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, SO_4^{2-}, HCO_3^-, CO_3^{2-}) and categorizing the lake based on ionic composition using equivalent ionic composition calculations. Results from the autumn sampling campaign indicate that reduced rainfall led to a "Saline" classification characterized by Cl^- as the dominant ion, exceeding 45e%, followed by SO_4^{2-}, with over 33e%. According to previous studies, this classification is typical for the summer period, emphasizing how prolonged dry conditions in the area influence ionic composition. The observed seasonal shifts indicate the lake's sensitivity to precipitation and environmental changes. Due to the vulnerability of soda lakes and pans to such fluctuations, particularly in Serbia, further research and conservation measures are crucial. Sustaining these ecosystems' ecological functions and biodiversity is essential to ensuring their resilience to climate change. For Velika Rusanda, a potential future measure to mitigate the effects of drought could involve supplying additional water during dry periods. This approach would require careful monitoring of water quality and continuous assessment of its impact on the lake's physical, chemical, and biological properties to prevent unintended ecological consequences. By implementing innovative management practices, Velika Rusanda can be preserved as a vital ecological and biodiversity hotspot.

Keywords: *Velika Rusanda; soda lake; ionic composition; equivalent percentage*

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NATURE BASED SOLUTION (NbS) IN THE RESTAURATION OF WETLANDS IN SERBIA

Živković M.[1,2], *Matić A.*[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, Serbia
(e-mail: zivkovic.m.milica@gmail.com)

[2] University Business Academy, Faculty of Economics and Engineering Management, Cvećarska 2, Novi Sad, Serbia

[3] Faculty of Political Sciences, University of Belgrade, Jove Ilića 165, Belgrade

Abstract:

Wetlands today occupy only about 5% of the Earth's surface, while about 40% of the world's biodiversity is found in wet habitats, along with rain forests and coral reefs, these habitats are the most productive ecosystems on planet. In the last 50 years, there has been a rapid loss of wetland habitats. In Serbia, about 10% of wetland habitats (about 33,000 hectares) remain compared to the former area. Among the main causes degradation of wet habitats are urbanization, drying for agriculture, pollution and exploitation resources. Droughts and floods indicate an urgent need to restore these ecosystems. Wetlands store large amounts of carbon, reducing its concentration in the atmosphere, regulate the local microclimate and help protect against extreme weather conditions. One type of conservation of wetlands is application of nature-based solutions (NbS). NbS are nature-inspired, nature-supported, cost-effective, while delivering environmental, social and economic benefits and helping to build resilience. In the restoration of wet habitats, NbS have been applied for several years, primarily in protected natural resources. Examples of good practice in the application of such solutions are: SNR "Gornje Podunavlje", SNR "Obedska bara", SNR "Carska bara", SNR "Kraljevac" and others. Some examples of such solutions are: the return of the natural dynamics of floods through water level regulation, the removal of artificial barriers, the planting of indigenous plant species that stabilize the habitat (stabilize the coast and prevent soil erosion), the introduction of phytoremediation as a solution to prevent water pollution, the removal of invasive plant species through grazing (cows, buffaloes...). The result of the application of such solutions is improved defense against floods and droughts, increased ability of wet habitats to store carbon, increased ability to filter water, preserved biodiversity (they provide a habitat for a large number of animals) and others.

Keywords: *Nature based solutions (NbS); wetlands; protect area; Serbia.*

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OCCUPATIONAL SAFETY AND HEALTH

MARKET PRESENCE OF RESORCINOL IN COSMETICS AND ITS POTENTIAL THYROID DISRUPTION

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:

Resorcinol (RCO) is a synthetic organic compound with a phenolic structure, widely used in the cosmetic industry as a preservative in hair dyes, shampoos, and anti-acne products. Additionally, RCO serves as a food preservative. RCO is considered as a potential endocrine disruptor due to its ability to inhibit thyroid peroxidase, an enzyme essential for thyroid hormone synthesis. The aim of this research was to examine the presence of RCO in cosmetic products available on the Serbian market by analyzing product declarations. Besides, this study aimed to evaluate *in silico* binding affinity of RCO to thyroid receptors and thyroxine-binding globulin enzyme (TBG). The sampling of the cosmetic products was conducted in drugstore and pharmacy chains, including their online stores. The binding affinity of RCO for the thyroid receptors (TRα; PDB entry: 1NAV and TRβ; PDB entry: 1NAX) and TBG (PDB entry: 4X30) was assessed using GOLD molecular docking tool and expressed as ChemPLP fitness score. 2D protein-ligand interactions were visualized using the academic version of MAESTRO Schrödinger software. Market analysis included 59 randomly selected cosmetic products. Among them, RCO and its derivatives were identified in 18 products (15 brands of hair dyes and 3 anti-acne products), which represents 30.51% of the entire sample. In the docking study, binding affinities of RCO were 41.98, 45.39, and 38.45 for TRα, TRβ, and TBG, respectively, compared to co-crystallized ligand affinities of 88.89, 99.00, and 81.72, respectively. The obtained ChemPLP scores suggest moderate to weak thyroid-disruption potential. However, the visualizations of protein-ligand interactions revealed that RCO fits into TBG's binding pocket, forming bonds with amino-acid residues crucial for binding with endogenous ligand, thyroxin. This suggests the possibility of RCO to interfere with thyroxine transport, presenting another potential mechanism of thyroid disruption. RCO's market presence and thyroid effects necessitate further safety assessments of this compound.

Keywords: *Resorcinol; Endocrine disruptors; Molecular docking; Personal care products*

Acknowledgement

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NEUROPROTECTIVE EFFECTS OF ERINACINE A FROM HERICIUM ERINACEUS MYCELIA

Gavran S.[1], *Marček T.*[1], *Crevar B.*[1], *Miličević B.*[2], *Babić J.*[1], *Kovač T.*[1]

[1] Faculty of Food Technology, Josip Juraj Strossmayer University of Osijek, Franje Kuhača 18, 31000 Osijek, Croatia (e-mail: sgavran@ptfos.hr)

[2] Faculty of Tourism and Rural Development in Požega, Josip Juraj Strossmayer University of Osijek, Vukovarska 17, 34000 Požega, Croatia

Abstract:

The lion's Mane (*Hericium erinaceus*) is a medicinal mushroom that has attracted great interest due to its ability to protect the nervous system thanks to its bioactive metabolites. Studies have found that its compounds hericenones and erinacines have the ability to cross the blood-brain barrier, which is crucial for their effectiveness. One of the bioactive compounds of *H. erinaceus*, erinacin A, found in the mushroom mycelium, is known to support the synthesis of nerve growth factor (NGF), which is important for the maintenance and regeneration of neurons. Erinacin A has strong antioxidant activity and anti-inflammatory properties that help prevent neuroinflammation — a key factor in diseases such as Alzheimer's and Parkinson's disease (PD). Erinacin A and the mycelium of *H. erinaceus* have been found to support the defence of neurons against damage from neurotoxins such as MPTP (1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine), which causes Parkinson's symptoms in animal studies. The protective effects for the brain are mainly related to activation pathways that contribute to the reduction of oxidative stress and inflammation. *In vivo* studies have shown that *H. erinaceus* mycelium and its isolated compound erinacin A can help protect neurons and reduce cell death associated with diseases such as Parkinson's by arresting damage and apoptosis. In addition, these bioactive compounds support the function of dopaminergic neurons, which are commonly affected in PD, by further regulating the endoplasmic reticulum stress response and associated inflammatory pathways, showing encouraging results in reducing MPTP-induced neuronal damage. Erinacin A from the *H. erinaceus* mycelium could be beneficial for the treatment of neurodegenerative diseases such as Parkinson's and Alzheimer's disease.

Keywords: *Hericium erinaceus; erinacine A; neuroprotection; neurodegenerative disease*

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ANALYZING FACTORS AFFECTING FARMERS' SAFE PESTICIDE HANDLING PRACTICES IN SOUTHWEST OF ETHIOPIA: IMPLICATIONS FOR POLICY

Hussen H.[1], Astatike H.[1], Mekonen S.[2], Fekadu S.[3]

[1] Department of Environmental Health Science and Technology, Jimma University, Jimma, Ethiopia
(e-mail: hawihussen81@gmail.com)

[2] Ethiopian Institute of Water Resources, Water and Health, Addis Ababa University, Addis Ababa, Ethiopia.

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

Abstract:

Pesticides play a crucial role in enhancing agricultural productivity by controlling pests. However, their unsafe usage has become a global concern in the agricultural sector. Inadequate pesticide handling practices have a considerable adverse impact on human health. Nevertheless, there is limited knowledge regarding the extent of safe pesticide handling practices, particularly in low-income settings like Ethiopia. Hence, this study seeks to evaluate the implementation of safe pesticide handling practices and identify the factors associated with the status of the handling practices in low-income settings, focus on Jimma Zone, Ethiopia. A cross-sectional study was undertaken, involving 468 farmers randomly selected for participation. Data collection was carried out through structured questionnaires and face-to-face interviews. The analysis aimed to assess the proportion of safe pesticide handling practices (SPHP) and investigate the factors associated with SPHP was done using binary logistic regression. Explanatory variables with a P-value < 0.25 were included in the final analysis. The factors were determined based on adjusted odds ratios and 95% confidence intervals, p-value <0.05. Model fit was evaluated using the Hosmer and Lemeshow tests. From the findings of our study, only 45.7% of farmers practiced SPHP, with factors such as education, experience, pesticide usage, and attitude towards safe practices influencing their practices. Farmers with education status primary and above were two times more likely to practice good handling of pesticides than those who didn't attend formal education. Farmers with a maximum of 5 years of experience in vegetable farming were 2.4 times more likely to exhibit good handling practices compared to their counterparts. Furthermore, farmers with favorable attitudes towards pesticide handling were 4.2 times more likely to engage in good pesticide handling practices than those with unfavorable attitudes. Therefore, the key stakeholders should focus these factors in order to mitigate the associated risks.

Keywords: *Ethiopia, Vegetable, Farmers, Safe, Handling, Pesticide, Factors*

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THE USE OF ARTIFICIAL INTELLIGENCE TOOLS IN OCCUPATIONAL SAFETY AND HEALTH: A BRIEF OVERVIEW

Istrat D.[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:

In the recent advancements in science and technology, many of us are familiar with the results of the rapid development of artificial intelligence (AI) technologies in numerous fields. When it comes to occupational health and safety (OHS), AI tools represent innovative solutions for increasing the productivity and safety of employees through optimized identification and assessment of risks, as well as their reduction or elimination. Automated risk assessment, real-time monitoring of workplace conditions and predictive modeling for accident prevention are key examples of artificial intelligence applications. Machine learning algorithms for the analysis of huge amounts of data related to occupational safety and health make it possible to identify trends and patterns that would very often go unnoticed. Wearing AI-powered devices makes monitoring workers' health and environmental indicators easier. Additionally, incident report analysis and decision-making have evolved with natural language processing tools. Despite the numerous advantages and potential of applying artificial intelligence tools, there are also challenges. Some of these are users' non-acceptance and mistrust, data privacy concerns and algorithmic bias. Moreover, a lack of standardization complicates the wider adoption and application of AI tools in OHS. Interdisciplinary cooperation would help to overcome these challenges and to enable the effective and ethical use of artificial intelligence in ensuring a safer work environment and better workers' health. Future research should focus on defining a framework for the fair and legal application of artificial intelligence in the practice of occupational health and safety. If used in the right way, artificial intelligence can help organizations reduce hazards, improve the health and safety of their employees and develop jobs sustainably.

Keywords: *Artificial Intelligence (AI); Occupational Health and Safety (OHS); Risk Assessment; Workplace Monitoring; Predictive Modeling.*

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EFFECT OF PERFLUOROOCTANOIC ACID TREATMENT ON CASPASE-3 EXPRESSION IN FEMALE MICE LIVER

Ivelja I.[1], *Vukčevič J.*[1], *Marković Filipović J.*[1], *Andrić N.*[1]

[1]University of Novi Sad, Faculty od Sciences, Department of Biology and Ecology, Dositej Obradović Square 2, Novi Sad, Serbia
(e-mail: ivana.ivelja@dbe.uns.ac.rs)

Abstract: Perfluorooctanoic acid (PFOA) is a synthetic compound widely used in industrial and consumer products due to its water and oil-resistant properties. However, PFOA's environmental persistence and bioaccumulation raise concerns about its safety. Exposure to PFOA has been associated with various adverse health effects, including hepatotoxicity. Caspase-3, a crucial enzyme in the apoptotic pathway, plays a pivotal role in programmed cell death and cellular homeostasis. The aim of this study was to examine whether different doses of PFOA affect caspase-3 expression in the liver of female Swiss mice. Twenty-four female Swiss mice were divided into four groups (6 per group) and treated via drinking water with 0, 0.06, 1.15, and 22 mg PFOA/kg body weight (b.w.) for 14 days. After the treatment, liver tissues were collected, formalin-fixed, and embedded in paraffin. Sections of 5 µm thickness were prepared and immunostained with an anti-caspase-3 antibody. Quantification of caspase-3 expression was performed using the ImageJ program to analyze the number of positive cells, including the percentage of high positive, positive, low positive and total positive cells. Statistical analysis was conducted using STATISTICA® version 13.0 (StatSoft, Inc). Comparisons between control and treated groups were made using one-way analysis of variance (ANOVA) followed by Tukey post-hoc tests. Our analysis revealed an increase of the number of high positive, positive, low positive and total positive cells across treated groups; however, these changes were not statistically significant when compared to the control group. These findings suggest that PFOA exposure at the tested doses does not significantly alter caspase-3 expression in the liver of female Swiss mice.

Keywords: *Perfluorooctanoic acid; Mice; Caspase-3.*

Acknowledgement

This work was supported by the Science Fund of the Republic of Serbia, Grant #7010, Integration of Biological Responses and PBTK Modeling in Chemical Toxicity Assessment: A Case Study of Perfluorooctanoic Acid (PFOA), ToxIN

EFFECT OF PERFLUOROOCTANOIC ACID TREATMENT ON CREATININE LEVEL IN FEMALE MICE

Ivelja I.[1], *Marković Filipović J.*[1], *Vukčevič J.*[1], *Andrić N.*[1]

[1]University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Dositej Obradović Square 2, Novi Sad, Serbia
(e-mail: ivana.ivelja@dbe.uns.ac.rs)

Abstract:

Perfluorooctanoic acid (PFOA) is a synthetic, fluorinated carboxylic acid, characterized by an eight-carbon fully fluorinated chain and a terminal carboxylic acid group. Known for its environmental persistence and bioaccumulation, it is associated with various toxicological effects, including developmental, hepatic, and immunological impacts. The aim of our study was to determine whether PFOA treatment affects creatinine level in female mice. Female *Swiss* mice, 40 days old at the beginning of the experiment were exposed to PFOA added to the drinking water in doses of 0, 0.06, 1.15 and 22 mg/kg body weight (b.w.) for 14 days. At necroscopy whole blood was collected in BD Vacutainer SST II Advance, and creatinine level was analyzed using the DiaLab Autolyser. Statistical analysis was performed by the Statistica® software using one-way analysis of variance (ANOVA) followed by Dunnett's post hoc test. Doses of 0.06 and 1.15 mg/kg increased, while the highest applied dose decresed the creatinine level. However, statistical analysis revealed that observed changes are not significant. Our results, showing unaffected creatinine levels upon PFOA exposure, indicate that under the applied experimental conditions, PFOA did not disturb kidney function.

Keywords: *Perfluorooctanoic acid; Mice; Creatinine.*

Acknowledgement

This work was supported by the Science Fund of the Republic of Serbia, Grant #7010, Integration of Biological Responses and PBTK Modeling in Chemical Toxicity Assessment: A Case Study of Perfluorooctanoic Acid (PFOA), ToxIN

COMPARISON OF SAGE EXTRACTS OBTAINED WITH DEEP EUTECTIC SOLVENT AND WATER

Janić M.[1], *Zdolšek N.*[1], *Brković S.*[1], *Valenta Šobot A.*[1], *Momić T.*[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:

Salvia officinalis L. or common sage belongs to the Lamiaceae genus *Salvia*. The pharmacological activities of the sage leaf include antidiabetic, anticancer, antimicrobial, anti-inflammatory activity, cognitive, and memory-enhancing effects. Recently, due to their beneficial properties, more attention has been paid to the extraction of sage water-soluble components like phenolics. The phenolics found in sage are mainly caffeic acids (phenolic diterpenes- carnosic acid and carnosol, rosmarinic acid) and flavonoid derivatives (apigenin, luteolin, kaempferol and quercetin and their glycosides). Methanol is used for the conventional extraction of plant material and it is known that methanol exhibits varying degrees of toxicity to human cells, tissues, and environment. Deep eutectic solvents (DESs) are a new group of efficient and environmentally friendly green solvents. They are defined as ionic liquids consisting of two or more components, ionic bond acceptor and ionic bond donor. The most common acceptor of ionic bonds is choline chloride (ChCl). DESs are non-toxic, biodegradable, biocompatible, low-cost, and simple for preparation. In this study, we determined the total phenolic content (TPC), total tannin content (TTC), and total flavonoid content (TFC) of sage extracts obtained with choline chloride mixed with urea (ChCl:$Ur_{(1:2)}$) with added 10% of water and compared it to water extract of sage prepared under the same extraction procedure. In addition, we examined the antioxidant activity of extracts using DPPH and ABTS assays. Based on our results, in a sample obtained with DES TPC, TTC, and TFC were higher. DPPH assay indicates that lower IC_{50} and higher antioxidant potential had DES extract. For the ABTS assay, lower IC_{50} and higher antioxidant potential had sage water extract, assumed to be due to different mechanisms of action. The results indicated that the DES combined with 10% water had better effects on the extraction of phenolics from sage leaf than water extract.

Keywords: *Antioxidant; Deep eutectic solvent; Green extraction; Phenolics; Sage*

Acknowledgement

This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Grant no. 451-03-66/2024-03/200017).

INTEGRATION OF BIOLOGICAL RESPONSES AND PBTK MODELING IN CHEMICAL TOXICITY ASSESSMENT: A CASE STUDY OF PERFLUOROOCTANOIC ACID (PFOA) – ToxIN PROJECT

Kokai D.[1], Stanic B.[1], Markovic Filipovic J.[1], Lalic-Popovic M.[2], Pogrmic-Majkic K.[1], Andric N.[1]

[1]University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Trg Dositeja Obradovica 2, 21000 Novi Sad, Serbia
(e-mail: dunja.kokai@dbe.uns.ac.rs)

[2]University of Novi Sad, Faculty of Medicine, Serbia

Abstract:

Current chemical toxicity assessments primarily rely on traditional animal studies and epidemiological data, which are used by various regulatory bodies for legislative purposes. However, these approaches have notable limitations: animal studies often fail to fully capture human health effects, while epidemiological data may be confounded by numerous influencing factors. Additionally, existing toxicity assessments do not account for the unique characteristics of different populations, making them potentially inadequate for protecting vulnerable groups such as those with pre-existing diseases or obesity. The ToxIN project, supported by the Science Fund of the Republic of Serbia (Program PRISMA), aims to address these challenges by developing a probabilistic model for assessing the impact of chemicals on human health. This model integrates a combination of in vitro and in vivo biological assays with physiologically-based toxicokinetic (PBTK) modeling. The project uses perfluorooctanoic acid (PFOA) as a model compound to test this novel approach. The project's goal is to create a new methodology and assessment score that will determine tissue- and population-specific sensitivity to PFOA. This will enable more accurate risk assessments and better protection for both the general adult population and sensitive groups. The ToxIN project is poised to make a significant contribution by offering an innovative solution for the future screening a wide range of environmental chemicals with limited toxicity data. Its findings could provide novel scientific evidence to improve chemical regulation, leading to safer chemical exposure thresholds, reduced healthcare costs, and positive economic impacts by decreasing the incidence of chemical exposure-related illnesses. The ToxIN project has assembled an interdisciplinary research team consisting of biologists (toxicologists) and pharmacologists, thus enabling networking, collaboration, and sharing between the disciplines and strengthening professional competences of the researchers involved in the project.

Keywords: *ToxIN project; perfluorooctanoic acid; physiologically-based troxicokinetic modeling; chemical risk assessment*

Acknowledgement

This study was supported by Science Fund of the Republic of Serbia, #7010, Integration of Biological Responses and PBTK Modeling in Chemical Toxicity Assessment: A Case Study of Perfluorooctanoic Acid (PFOA) – ToxIN.

WORKPLACE WELL-BEING STRATEGIES FOR SUSTAINABLE EMPLOYEE HEALTH AND PRODUCTIVITY

Krivokuća M.[1], *Petrović M.*[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: marijakrivokuca155@gmail.com)

Abstract:

The concept of workplace well-being has gained prominence in the modern business landscape, as organizations face increasing challenges related to mental health, employee engagement, and productivity. Insights from studies such as the Gallup Employee Engagement Survey, Deloitte's Mental Health in the Workplace, and LinkedIn's Happiness at Work Survey underline the significant role of mental health and emotional well-being in shaping employee performance and organizational outcomes. Companies that invest in workplace well-being programs consistently report higher employee satisfaction, reduced stress levels, and decreased turnover rates. Key factors for achieving these results include flexible work arrangements, management support, and fostering social connections among employees. Despite these advancements, the stigma surrounding mental health remains a critical barrier. Addressing this requires open dialogue, education, and the establishment of a supportive organizational culture. This research highlights strategies such as implementing comprehensive well-being programs, promoting flexible work practices, enhancing communication, and ensuring access to resources for professional development. These efforts align with the United Nations Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-Being) and SDG 8 (Decent Work and Economic Growth), by fostering healthier workplaces and contributing to sustainable business growth. The findings suggest that adopting these measures can lead to healthier and more productive workplace environments, ultimately benefiting both employees and organizations. Organizations that prioritize employee well-being have the potential to build engaged, satisfied, and high-performing teams. In a rapidly changing world, focusing on workplace well-being is not only an ethical obligation but also a strategic approach to achieving long-term success and sustainability. By fostering a supportive culture and reducing barriers to mental health support, organizations can create positive and lasting changes in workplace dynamics and performance.

Keywords: *well-being; mental healt; productivity; sustainability*

Acknowledgement

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CREATING A SURVEY ON CRANE OPERATOR SAFETY – NOISE, PREVENTIVE MEASURES, AND PERSONAL DOSIMETRY

Kužet Ž.[1], *Mučenski V.*[2]

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

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

Abstract:

Annually, approximately 30 million workers are exposed to high levels of noise, and since the effects of this harmful exposure are not immediately visible but develop over time, noise is often underestimated as a risk to workers' safety and health. Given that noise is a health hazard, especially in construction due to various machinery and tools, it is essential to measure and monitor noise levels at workplaces using sound level meters and personal dosimeters. Cranes contribute to increasing noise on construction sites, and the noise levels they produce depend on their current condition, load, year of production, and other factors. Crane operators are typically exposed to noise levels ranging from 74 to 98 dB, depending on whether they work in an isolated cabin or operate the crane remotely while being directly exposed to the noisy environment of the construction site. This study aims to develop a survey that would track noise measurements using personal dosimeters. The survey is designed to include various types of questions, including open-ended questions, as well as rating questions on a scale form from 1 to 5. This approach will allow the collection of both detailed and quantitative data, enabling a comprehensive analysis of perceptions about safety, noise exposure, and preventive measures on construction sites. The crane operator safety survey is organized into five areas: basic information, technical data about the crane, management and occupational health and safety sector, workplace – crane operator, and use of personal protective equipment by the crane operator. To prevent hearing loss and other related diseases, it is essential to conduct noise measurements in the working environment to assess crane operators' exposure and include a survey as a useful tool to assess the real picture of workers' exposure and help define preventive measures to protect workers from high noise levels.

Keywords: *noise; personal dosimetry; crane operator; construction site noise*

SILICA DUST IN CONSTRUCTION INDUSTRY

Kužet Ž.[1], *Mučenski V.*[2]

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

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

Abstract:

Construction sites represent a work environment that emits large quantities of polluting substances into the air. Operations like digging, demolition, and wood and tile cutting, involve materials containing silicon dioxide, generating silica dust during the work. This research focuses on silica dust – its origin, health consequences, research overview, and preventive measures. Silica dust has no color, no smell, and its concentrations can only be measured through specialized workplace environment testing. This type of dust mostly causes silicosis as a disease, but it also causes various respiratory diseases, autoimmune disorders, infections, and lung diseases. Potential hazards of silica dust are flammability, irritancy, toxicity, and carcinogenicity. When inhaled, silicon dioxide travels to the lower respiratory tract and alveoli areas, where it forms scars and nodules, and there is no cure for such disease. The average concentration of silica dust at the construction site in one research showed that all eight activities exceeded the risk factor, with the highest risk from surface grinding. Another research revealed that 28% of workers who worked with artificial stone, were diagnosed with silicosis. Companies' negligence in providing personal protective equipment (PPE), inadequate knowledge of workers about risks, and worker's refusal to wear PPE are key factors why the diseases arise. In Spain, one research showed that only 32.6% of workers used PPE, and 84% of workers who were diagnosed with silicosis, actually wore PPE. In an Australian study, only a tiny percentage of workers had access to protective equipment. To lower the risk of silica dust, it is necessary to conduct a risk assessment and set preventive measures against silica dust - water curtains, general mechanical ventilation, tool extraction systems, etc. By presenting silica dust exposure on a global level, through research and innovation, it is possible to reduce worker exposure and prevent diseases like silicosis.

Keywords: *dust; construction site; silica; silicosis*

KNOWLEDGE, ATTITUDES AND PRACTICES OF BEEF PROVIDERS AND CONSUMERS REGARDING MICROBIAL SAFETY MEASURES ALONG THE MAJOR SUPPLY CHAIN IN SOUTHWEST ETHIOPIA

Mamo G.[1], *Mekonene S.*[2], *Tiku S.*[3]

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

[2]Water and Public Health ,Ethiopian Institute of Water Resources (EIWR), Addis Ababa University, Ethiopia

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

Abstract:

Beef meat is popular, and offers diverse nutritional value, but unsafe handling throughout the supply chain poses serious health risks, especially for vulnerable populations. Existing researches repeatedly focuses on beef handlers' safety measures and not address the supply chain, which potential causes of contamination across multiple stages. The objective of this study was to incorporate stakeholders who play a critical role in microbial safety but have not received sufficient attention. A cross-sectional study design was carried out among randomly selected beef retailers' owners, managers (n=44) and systematically selected beef consumers (n=422). The data were collected using semi-structured questionnaires and observation checklists between February 20th and April 20th, 2024. Descriptive analysis and logistic regression were performed. Candidate sociodemographic characteristics with a p-value of ≤ 0.25 in univariate analysis were included in the multivariable logistic regression analysis. Associations were assessed using AORs with 95% CI and statistical significance was set at $p < 0.05$. Majority of beef consumers had poor knowledge (64%), unfavorable attitude (65%), and poor practices (56%) toward microbial safety measures. Beef consumers who had completed college and above were four times more likely to possess good knowledge concerning microbial safety activities than who were unable to read and write [AOR = 4.00, 95% CI: 1.09–14.79]. About 70.5% (31 out of 44) of beef retailers were directed by owners who also served as managers. These owners exhibited poor knowledge (65.6%), unfavorable attitudes (65.4%), and poor practices (78.6%) compared to the managers. Furthermore, beef retailers' owners and managers who completed high school were seven times more likely to have good knowledge [AOR = 7.02, 95% CI: 1.11-2.47] compared to individuals who did not read and write. These findings highlighted a critical need for enhanced education and training programs regarding microbial safety measures for both beef providers and consumers.

Keywords: *Beef consumers; Beef providers; Microbial safety measures; Mizan Aman, Southwest Ethiopia*

Acknowledgement

We thank Jimma University's Institute of Health IRB committee for their ethical approval. We are also grateful to Mizan-Aman Health Science College, Mizan-Aman town administration offices, data collectors, supervisors, and beef retailer owners and managers for their support.

REVOLUTIONIZING OCCUPATIONAL HEALTH AND SAFETY THROUGH INNOVATIVE GEMBA WALKS

Naerac J.[1], Ivanišević A.[2], Petrović M.[1]

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

[2]University of Novi Sad, Faculty of Technical Sciences, Department of Industrial Engineering and Engineering Management, Novi Sad, Serbia

Abstract:

Occupational health and safety (OHS) are essential for ensuring employee well-being and maintaining productivity in the modern workplace. As organizations strive for sustainable and effective risk management, innovative approaches such as GEMBA walks have emerged as a pivotal tool. Derived from the Japanese term meaning "the real place," GEMBA walks involve managers visiting the actual work environment to observe processes, engage with employees, and identify potential hazards. This direct involvement fosters improved communication, trust, and mutual respect between managers and employees while enabling real-time identification and resolution of workplace risks. By integrating GEMBA walks into OHS practices, organizations can adopt a preventive approach to workplace safety. Regular observation and immediate action on identified hazards significantly reduce workplace injuries, illnesses, and associated costs. GEMBA walks also allow for the development of dynamic and flexible safety protocols tailored to the specific needs of diverse work environments, enhancing their effectiveness over static safety measures. The incorporation of advanced technologies, such as mobile applications, real-time monitoring devices, and hazard detection systems, further enhances the impact of GEMBA walks. These tools provide managers with immediate access to workplace data, enabling swift decision-making and the implementation of targeted safety interventions. Additionally, continuous monitoring facilitates ongoing improvements, establishing a foundation for sustainable OHS practices. By bridging the gap between management and frontline employees, GEMBA walks not only address immediate safety concerns but also create an adaptable framework for long-term safety advancements, aligning with best practices in occupational health and safety management.

Keywords: *GEMBA walk; occupational safety and health; improvement; innovation.*

Acknowledgement

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BENCHMARK CONCENTRATION MODELING OF APICAL ENDPOINTS IN HUMAN VASCULAR ENDOTHELIAL CELLS FOLLOWING ACUTE AND CHRONIC *IN VITRO* EXPOSURE TO PERFLUOROOCTANOIC ACID

Opacic M.[1], *Stanic B.*[1], *Andric N.*[1]

[1]University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Trg Dositeja Obradovica 2, 21000 Novi Sad, Serbia
(e-mail: marija.opacic@dbe.uns.ac.rs)

Abstract:

Per- and polyfluoroalkyl substances (PFAS) have been extensively produced and utilized in various industries and consumer products since the 1940s. Recently, these chemicals have drawn significant attention due to their extreme persistence in the environment (often referred to as "forever chemicals"), thus posing substantial risks to both human and environmental health. Among the most studies PFAS, perfluorooctanoic acid (PFOA) has been associated with a myriad of adverse health effects. However, little is known about the effects of PFOA on human vascular endothelial cells and the vascular system in general, particularly regarding the sensitive time points at which the impact of this chemical may be most pronounced. In this study, we employed benchmark concentration modeling to derive and compare points of departure (POD) for apical changes (A-POD) in human vascular endothelial cells EA.hy926 following acute (48 h) and chronic (6 and 12 weeks) exposure to 1, 10, and 100 μM and 1, 10, and 100 nM PFOA, respectively. The following apical endpoints were analyzed: metabolic activity, apoptosis and necrosis, cell cycle progression, endothelial permeability, monocyte adhesion, cell adhesion to the extracellular matrix, cell migration, endothelial tube formation, and the production of reactive oxygen species. We found that A-POD could not be calculated for the 48-h exposure, as none of the apical endpoints showed a concentration-dependent response. However, A-PODs for the 6-week and 12-week exposures were determined to be 3.7 nM and 5.4 nM, respectively. These findings support the idea that chronic *in vitro* exposure may offer a more sensitive approach for assessing the risks of PFOA in human endothelial cells. Our study provides novel insights into the effects of PFOA on human vascular endothelial cells, contributing to a deeper understanding of PFOA-induced vascular toxicity. Additionally, it highlights the potential of employing different *in vitro* approaches in chemical risk assessment.

Keywords: *perfluorooctanoic acid; human endothelial cells; in vitro; benchmark concentration; point of departure.*

Acknowledgement

This study was supported by Science Fund of the Republic of Serbia, #7010, Integration of Biological Responses and PBTK Modeling in Chemical Toxicity Assessment: A Case Study of Perfluorooctanoic Acid (PFOA) – ToxIN.

LEAD EXPOSURE AND LUNG CANCER: PRELIMINARY RESULTS OF SCREENING ANALYSIS IN FEMALE

Ševo M.[1,2], *Sazdanić Velikić D.*[1,3], *Milanović M.*[1], *Milošević N.*[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:

The increasing anthropogenic activities has led to both environmental and occupational exposure to heavy metals. Most of them are identified as global health treat due to the increasing vulnerability to adverse health outcomes associated with their occurrence in water, soil, food and even air. Moreover, exposure to heavy metals might be linked with the increased risk of cancer onset and progression. The screening for elevated heavy metals in urine samples is a method of choice for assessing environmental risk factors in lung cancer. In this study, 25 female patients (older than 18) with inoperable IIIB and IV stadium of adenocarcinoma, diagnosed in the Institute for Pulmonary Diseases of Vojvodina, Serbia, were enrolled. The presence of lead (Pb) in morning spot urine samples was evaluated by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) method. Based on the obtained results, in 28% (7/25) urine samples lead was above the limit of detection (4 µg/L). Pb levels were above 12 µg/L in 20% (5/25) of women patients. The highest Pb urinary concentration was 19.34 µg/L. Lead and its inorganic compounds are classified as possibly carcinogenic to humans- class 2B. According to the available literature data, the elevated Pb concentrations in blood are found in patients with breast and bladder cancer. Among others, Pb have been also identified as non-cancer health risk metal. Apart from mining, manufacturing and recycling activities, different everyday products including traditional home remedies, cosmetics and jewelry might be possible Pb sources. Pb tendency to bioaccumulate was confirmed in Vojvodina i.e. Pb permitted levels were exceeded for potato and carrots which are commonly used in diet in this region. Biomonitoring studies that will include large number of lung cancer patients are needed in order to elucidate the relationship between exposure to lead and the initialization and development of lung cancer.

Keywords: *pollution; heavy metals; risk factors; biomonitoring; ICP-MS*

Acknowledgement

This work was supported by Provincial Secretariat for Higher Education and Scientific Research, AP Vojvodina, Republic of Serbia [Grant number 003076431 2024 09418 003 000 000 001].

PM10 AND PM2.5 RISK ASSESMENT DURING SMALL BUIDLING CONSTRUCTION IN THE CITY OF NOVI SAD

Šunjević M.[1], Obrovski B.[1],Tošić N.[1], Istrat D.[1], Dubljević S.[2], Kustudić M.[3]

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

[2]University of Novi Sad, Faculty of Technical Sciences, Department of Energy and Process Engineering, Trg Dositeja Obradovića 6, Novi Sad, Serbia

[3]College of Management, Shenzhen University, Shenzhen, China

Abstract:

Urban construction sites are significant contributors to air pollution, particularly in the form of particulate matter (PM_{10} and $PM_{2.5}$) emissions. Suspended particles can severely impact air quality, public health, and the ecological integrity of surrounding environments. The study aims to assess the health risks associated with PM_{10} and $PM_{2.5}$ emissions during the construction of a residential building in Novi Sad. The analysis employs a 5x5x5 risk matrix and the calculation of the Health Risk Index (HRI). The methodology involves modeling of PM_{10} and $PM_{2.5}$ concentrations based on typical construction activities. HRI was calculated using chronic daily intake (CDI) and reference dose (RfD) values established by international guidelines. Results indicate that the CDI for PM10 was 0.839 µg/kg/day, while the CDI for $PM_{2.5}$ was 0.419 µg/kg/day. Calculated HRI values for both pollutants suggest low to moderate risks for adult workers and residents. Vulnerable groups, such as children and the elderly, may face higher exposure risks near the construction site. Implementing standard mitigation measures, such as water spraying, physical barriers, and personal protective equipment, can significantly reduce risks. Additionally, the use of the 5x5x5 risk matrix enabled a holistic evaluation of emission impacts and control measure effectiveness. The research contributes to understanding air pollution from construction activities and offers practical guidance for risk management. To minimize adverse impacts on local communities, integrating such analyses into urban planning and construction project design is strongly recommended.

Keywords: *PM_{10};$PM_{2.5}$; construction; risk assessment; air quality*

Acknowledgement

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PM10 AND PM2.5 RISK ASSESMENT DURING MEDIUM BUIDLING CONSTRUCTION IN THE CITY OF NOVI SAD

Šunjević M.[1], Obrovski B.[1],Tošić N.[1], Istrat D.[1], Dubljević S[2], Kustudić M.[3]

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

[2]University of Novi Sad, Faculty of Technical Sciences, Department of Energy and Process Engineering, Trg Dositeja Obradovića 6, Novi Sad, Serbia

[3]College of Management, Shenzhen University, Shenzhen, China

Abstract:

Construction activities contribute around 20% to air pollution, particularly through the generation and emission of particulate matter (PM10 and PM2.5). Particulate pollutants pose serious risks to public health, especially in urban settings, due to their size and possibility to be easily inhaled deep into the lungs. The research assesses the health risks associated with PM10 and PM2.5 emissions during the construction of a four-story residential building in Novi Sad, covering an area of 375 m^2 per floor. The analysis is based on the 5x5x5 risk matrix and the calculation of the Health Risk Index (HRI). The estimated average concentrations of PM10 and PM2.5 were 250 $\mu g/m^3$ and 125 $\mu g/m^3$, respectively, derived from typical construction site activities. Chronic Daily Intake (CDI) values were calculated as 1.398 µg/kg/day for PM10 and 0.699 µg/kg/day for PM2.5. Correspondingly, HRI values exceeded the acceptable reference doses, indicating elevated health risks, particularly for vulnerable groups such as children, the elderly, and individuals with preexisting conditions. The risk matrix analysis generated a high-risk score (75), emphasizing the potential health impacts on workers and the surrounding environment residents. The research highlights the necessity of integrating detailed health risk assessments before start of the construction projects. The health risk assessment could lead to increased public health and promotion of sustainable urban development.

Keywords: *PM_{10};$PM_{2.5}$; construction; risk assessment; air quality.*

Acknowledgement

This research has been supported by the Ministry of Science, Technological Development and Innovation (Contract No. 451 -03-65/2024-03/200156) 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" (No. 01-3394/1).

COMMON REQUIREMENTS OF KEY STANDARDS: A TOOL FOR INTEGRATING MANAGEMENT SYSTEM

Todorović M.[1], *Perović M.*[1]

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

Abstract:

The integration of management systems based on ISO 45001:2018 (Occupational Health and Safety), ISO 14001:2015 (Environmental Management), and ISO 9001:2015 (Quality Management) is facilitated by identifying their common requirements. These standards share essential principles such as risk-based thinking, continual improvement, interested parties' requirements and compliance with legal and other obligations. By embedding these principles into organizational practices, businesses can enhance operational efficiency, ensure legal compliance, and foster long-term sustainability. Aligning shared elements like policy formulation, objective setting, and documentation processes allows organizations to streamline their management systems, reducing duplication and improving efficiency. This unified approach supports continuous growth, mitigates risks, and improves overall performance. Furthermore, aligning procedures, processes, and working methods with the requirements of the standards and legal norms brings significant advantages in quality, safety, health, and environmental protection. The focus is on interested parties' satisfaction through the delivery of high-quality products and services. The integration of these standards also provides a better understanding and control over business processes, increases customer and partner trust, and improves operational efficiency. It strengthens the organization's resilience to risks and enhances its overall image. The research provides a comparative analysis of individual standard requirements within the Integrated Management System (IMS), offering a valuable tool to streamline the integration of health, safety, environmental, and quality management processes. The main benefit of simultaneously implementing multiple standards is a systematic and coordinated approach, which offers several advantages: simplify administration and compliance monitoring, better integration of quality, environmental management, and occupational health and safety, promotion of continuous improvement and innovation, and more efficient legal compliance through systemized monitoring. In summary, IMS enables resource optimization, cost reduction, and increased operational efficiency, while simultaneously ensuring compliance with multiple standards.

Keywords: *Integrated Management System; Standard requirements.*

FROM OLD TO NEW: A SUMMARY OF CHANGES IN THE OCCUPATIONAL SAFETY AND HEALTH LAW

Todorović M.[1], *Perović M*[1].

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

Abstract:

Ensuring the safety and health of employees is critical to mitigating risks and safeguarding their well-being, which ultimately enhances productivity, reduces the number of workplace injuries, and contributes to a more positive and efficient work environment. The new Occupational Safety and Health Law ("Official Gazette of RS", No. 35/2023) introduces several changes related to the implementation of safety and health work duties, particularly regarding individuals responsible for occupational health and safety (OHS) at employers. To perform OHS tasks, individuals must obtain the required licenses, and applications for licensing as an OHS associate or advisor must be submitted to the relevant authorities to confirm that licensing conditions are met. The requirement for license renewal emphasizes that OHS professionals must engage in continuous education and skill development to maintain their licenses, with ongoing professional development being a fundamental condition for renewal. The requirement for a work authorisation before engaging in hazardous tasks, such as working at heights, in confined spaces, in areas with potentially explosive atmospheres, on energy facilities, or handling hazardous chemicals, significantly enhances workplace safety by ensuring that necessary precautions and procedures are in place to protect workers from potential risks. The importance of OHS training becomes evident, as employers are required to provide such training for employees, employee representatives for OHS, supervisors. The Law mandates the creation of a Work Injury Register, which will be an electronic database for reporting work-related injuries. It aims to simplify reporting, facilitate data exchange among authorities, and help injured workers claim rights. The aim of conducted research is to examine the significant changes introduced by the new Law on Occupational Safety and Health (2023) compared to the previous legislation. The research focuses on the improvements and regulations regarding the implementation of OHS measures in the workplace, emphasizing the role of employers and employees in maintaining a safe working environment. The study highlights the importance of these changes in improving worker protection and the overall effectiveness of OHS practices.

Keywords: *Occupational safety and health; Legal Obligations.*

EASY-TO-USE SYSTEM FOR PROMOTING AND ESTIMATING SUBJECT'S PHYSICAL ABILITIES

Varga D.[1], *Krstanović L.*[1]

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

Abstract:

Modern advancements in the field of machine learning have opened up a plethora of ways in ways in which various tasks can be made significantly faster and more efficient. So far, the best approach for estimating the physical abilities of a given subject has been hands-on, requiring a certain amount of time and attention to be set aside for each subject, along with specialized equipment, making this a costly endeavour. This paper aims to utilise developments in machine learning, specifically in computer vision, to lessen the amount of resources needed for the assessment of a given subject's physical abilities by implementing a system that the subject can use independently, requiring only a computer and a webcam. By observing the subject's movement, the system is able to discern if the subject fulfils certain requirements, determined by their performance when completing a number of exercises. This is made possible by *Google*'s machine learning solution for pose detection, *MediaPipe*, which aims to estimate the pose of the subject's body within the current frame pulled from a camera feed. The data acquired in this way is then used to analyse the subject's performance in completing tasks such as recreating the pose shown to them on screen. Multiple aspects of a subject's physical abilities can be estimated in this way, the main focus of the currently implemented exercises being their mobility. A simple, easy-to-understand graphical user interface allows for the subject to run these exercises independently. In this way, testing certain elements of the subject's physical ability is made quicker and easier, seeing as this system can be used independently and doesn't require conditions that are difficult to attain, nor other cost-intensive resources.

Keywords: *machine learning; computer vision; subject's physical abilities.*

ASSESSMENT OF THE HEALTH AND ECOTOXICOLOGICAL EFFECTS OF PHENOLIC COMPOUNDS WITH INSULIN MIMETIC PROPERTIES

Vlatković V.[1], *Mitrović T.*[1], *Lazović S.*[1], *Obradović D.*[1]

[1]Institute of Physics Belgrade, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia
(e-mail: vlatkovic@ipb.ac.rs)

Abstract:

Structurally related phenolic compounds found in the bioenvironment (e.g. phenolic acids, flavonoids) have insulin-mimetic properties and can be used in the treatment of diabetes mellitus. Biomimetic chromatographic systems have been recognized as an effective tool for assessing the health and ecotoxicological effects of target molecules. The immobilized artificial membrane (IAM) chromatography uses stationary phases that mimic the amphiphilic microenvironment of biological membranes and provides the biomimetic results about molecular behaviour. Our research aims to examine the retention behaviour of eleven plant-based insulin-mimetic compounds on phosphatidylcholine (PC)-based IAM stationary phase. The chromatography analysis was performed by using the IAM.PC.DD2 HPLC column (10 µm, 100 x 4.6 mm, Regis technologies), flow rate 0.5 ml/min, and UV detection at 220 nm. The optimal retention was achieved using the mixture of acetonitrile and 10 mM ammonium acetate (pH 7), (30:70, v/v). The obtained values of the logarithm of the retention factor (log*k*) correlate the compound retention with its behaviour in biological environment. The obtained values of log*k* were ranged from -1.77 to 0.59; lowest for apigenin, highest for epigallocatechin. *In silico* analysis showed that different pharmacokinetic and ecotoxicological risks can be expected: plasma protein binding (PPB <90%); volume of distribution (Vds 0.15-0.67 L/kg); toxic results for liver injury; biodegradation probability > 0.9 for phenolic acids (toxic); LC_{50}FM = 2.9 (4-hydroxybenzoic acid), LC_{50}FM = -5.26 (epigallocatechin); bioconcentration factor (log*BCF* = 1.07 for apigenin, log*BCF* = 0.5 for others); and biotransformation half life (normalized to 10 g fish) was ranged from 0.38 (cinnamic acid) to 4.38 log(*days*) (epigallocatechin). The obtained log*k* values show a high correlation with log*BCF* vaules (r > 0.87). The tested chromatographic system, and obtained *in silico* calculations can be used in preliminary screening of health and ecotoxicological effects of structurally related phenolic compounds with insulin-mimetic poperties found in plants and bioenviroment.

Keywords: *Phenolic compounds; Insulin-mimetic properties; Ecotoxicology; Biomimetic chromatography*.

Acknowledgement

This research was supported by the Science Fund of the Republic of Serbia, GRANT No 13534, Proof of Concept – DIAMICA, and from the National Institute of the Republic of Serbia through the grant from the Ministry of Science, Technological Development, and Innovation of the Republic of Serbia.

EXPOSURE TO PERFLUOROOCTANOIC ACID DECREASES THE NUMBER OF ANTRAL FOLLICLES IN THE OVARIES OF MICE

Vukčević J.[1], *Marković Filipović J.*[1], *Ivelja I.*[1], *Andrić N.*[1]

[1]Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 2, Novi Sad, Serbia
(e-mail: jelena.karan@dbe.uns.ac.rs)

Abstract:

Perfluorooctanoic acid (PFOA), a widely used polyfluorinated compound, is an environmentally persistent pollutant found in various industrial and consumer applications due to its chemical stability and resistance to degradation. PFOA exposure, through contaminated water, food, or air, is associated with endocrine-disrupting effects and ovarian toxicity. The aim of our study was to investigate the impact of PFOA exposure on the number of antral follicles in the ovary. Female Swiss mice, aged 40 days at the beginning of the experiment, were divided into 4 groups and exposed 14 days to PFOA in drinking water at doses of 0, 0.06, 1.15, and 22 mg/kg BW/day. After fixation in Bouin's solution, ovarian tissues were dehydrated, embedded in paraffin, and sectioned at 5 µm. The sections were subsequently stained with hematoxylin and eosin. To determine the number of antral follicle, every fifth ovarian section was analyzed under an Olympus light microscope. Statistical analysis was performed using STATISTICA® version 13.0 (StatSoft, Inc). Data from control and treated mice were compared using One-way analysis of variance (ANOVA) for multiple comparisons, followed by Dunnett post-hoc tests. Our results indicate that PFOA exposure leads to a significant dose-dependent decrease in the number of antral follicles when compared with control, suggesting that PFOA may adversely affect ovarian folliculogenesis and potentially impair reproductive function.

Keywords: *PFOA; ovary; endocrine disruption; antral follicles.*

Acknowledgement

This work was supported by the Science Fund of the Republic of Serbia, Grant #7010, Integration of Biological Responses and PBTK Modeling in Chemical Toxicity Assessment: A Case Study of Perfluorooctanoic Acid (PFOA), ToxIN

EFFECT OF PERFLUOROOCTANOIC ACID TREATMENT ON PROLIFERATIVE CHARACTERISTICS OF AORTA IN MICE

Vukčević J.[1], *Marković Filipović J.*[1], *Ivelja I.*[1], *Andrić N.*[1]

[1]University of Novi Sad, Faculty od Sciences, Department of Biology and Ecology, Dositej Obradović Square 2, Novi Sad, Serbia
(e-mail: jelena.karan@dbe.uns.ac.rs)

Abstract: Perfluorooctanoic acid (PFOA) is a synthetic perfluoroalkyl substance widely used in industrial and consumer products for its water and oil-resistant properties. PFOA is environmentally persistent and bioaccumulative, with documented toxic effects including hepatotoxicity, developmental toxicity, immunotoxicity, and potential endocrine disruption in both humans and animals. The objective of our investigation was to examine the effects of PFOA treatment on proliferative characteristics of aorta. Female *Swiss* mice were subacutely (two weeks) treated with 0.06, 1.15 and 22 mg/kg body weight (b.w.) of PFOA. Formalin-fixed paraffin-embedded aortic tissue was cut into 5 μm thick sections and immunostained with anti-proliferating cell nuclear antigen (PCNA) antibody. Using a light microscope the total number of aortic cells (both PCNA-positive and PCNA-negative nuclei) and the number of PCNA-positive nuclei were counted. The proliferative index of aortic cells was calculated as a percentage using the formula: proliferative index (%) = (number of PCNA-positive cells / total number of cells) x 100. Statistical analysis was performed by the Statistica® software using one-way analysis of variance (ANOVA) followed by Dunnett's post hoc test. Proliferative indexes of PFAO-treated groups did not statistically differ from the control group, suggesting that within the framework of this experimental setup PFOA does not influence the proliferation rate of aortic cells.

Keywords: *Perfluorooctanoic acid; Mice; Proliferating cell nuclear antigen; Aorta; Proliferative index.*

Acknowledgement

This work was supported by the Science Fund of the Republic of Serbia, Grant #7010, Integration of Biological Responses and PBTK Modeling in Chemical Toxicity Assessment: A Case Study of Perfluorooctanoic Acid (PFOA), ToxIN

STRATEGIC HUMAN RESOURCE AND BUSINESS MANAGEMENT

EXPLORING THE USE OF eNPS IN MEASURING MEMBER SATISFACTION: A CASE STUDY OF ESTIEM LG NOVI SAD

Arambašić A.[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: arambasic.ana2@gmail.com)

Abstract:

Employee Net Promoter Score (eNPS) is a popular tool used by companies to measure how satisfied and loyal employees are, giving them useful insights into their culture and engagement. This research looks at how eNPS can be applied outside of the corporate world, specifically in a student organization. *The study uses* ESTIEM LG Novi Sad as an example to see how eNPS can help measure member satisfaction and suggest ways to improve how the organization works. The research explains how eNPS helps companies understand factors like leadership, communication, and growth opportunities, which drive employee loyalty. These same ideas are then applied to a student organization to see if they have similar effects in a non-profit setting. A survey was conducted with members of ESTIEM LG Novi Sad to calculate the eNPS score, along with open-ended questions to get deeper feedback on their experiences. The study looks at factors like leadership, communication, workload, and the benefits of being a member to understand their impact on the eNPS score. By analyzing these, the research aims to highlight what the organization is doing well and where it can improve. The results show how eNPS can be a useful tool for student organizations, helping them identify areas for improvement and creating a better experience for their members. This research emphasizes the value of satisfaction and engagement in driving success and growth within any organization.

Keywords: *eNPS; Employees Satisfaction; Student organization; Leadership Skills; Improvement in Engagement of Members.*

Acknowledgement

This research was supported by the ESTIEM LG Novi Sad members who participated in the eNPS survey and provided valuable feedback. Views and opinions expressed are solely those of the author(s) and do not necessarily reflect those of ESTIEM or its affiliated organizations. Neither ESTIEM nor its representatives can be held responsible for the content of this research.

ADDICTIONS IN LEADERSHIP: THE RIPPLE EFFECTS OF NEGATIVE HABITS ON ORGANIZATIONAL SUCCESS AND SOLUTIONS FOR RECOVERY

Bolesnikov M.[1,2], Gajic T.[2], Nobilo I.[2]

[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: minja.bolesnikov@uns.ac.rs)

[2]Swiss School of Business and Management, Geneva, Switzerland

Abstract:

Leadership plays a pivotal role in shaping organizational culture, employee morale, and overall success. However, when leaders succumb to personal addictions—ranging from substance abuse and gambling to digital distractions or workaholism—their negative habits can ripple through the organization, eroding trust, productivity, and long-term sustainability. This paper explores the multifaceted impact of addictions in leadership, highlighting how such behaviors affect decision-making, employee engagement, and organizational performance. It delves into the psychological and sociocultural dynamics that perpetuate these habits, offering insights into why leaders often struggle to address them. Furthermore, the study provides a roadmap for recovery, emphasizing strategies for self-awareness, support systems, and organizational interventions that can foster healthier leadership practices. By addressing these challenges proactively, organizations can mitigate the adverse effects of addictive behaviors, safeguard their culture, and reinforce resilience in both leaders and teams. This research underscores the importance of cultivating a holistic approach to leadership development, where personal well-being and ethical conduct are integral to achieving sustained organizational success.

Keywords: *Leadership addiction, organizational success, negative habits, workplace culture, decision-making.*

PERCEPTION OF BENEFITS IN IT COMPANY

Gudelj M.[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: milicagudelj2001@gmail.com)

Abstract:

This study explores the benefits provided by IT companies to their employees, with a particular focus on employee perception and satisfaction regarding the available perks. The goal of the research is to determine the extent to which employees utilize these benefits, which benefits they consider the most important, and how these benefits influence their motivation and productivity. The research aims to analyze employee expectations in IT companies concerning benefits, identifying what they value most in their current working conditions and what they feel is missing. The research will collect data on the types of benefits most commonly offered by IT companies. The focus will be on examining the significance of benefits such as workplace flexibility, professional development opportunities, health insurance, and work-life balance for employee satisfaction. The study will be conducted within an IT company using a custom-designed questionnaire to be completed by the employees. The research will prioritize understanding which benefits employees value the most ranging from flexible working hours and remote work to financial incentives like bonuses, paid overtime, personal development training, and other perks such as recreational activity benefits, parking, additional leave days, and more. Special attention will also be given to work models, such as hybrid and remote setups, to identify which model employees prefer and why. Furthermore, the study will explore whether transitioning to another company would involve expectations for additional benefits or better working conditions. The findings of this research will provide insights into how benefits can enhance employee satisfaction and loyalty while also improving company efficiency and success. It is hypothesized that flexibility and opportunities for achieving work-life balance will rank among the most appreciated benefits. In conclusion, the study contributes to understanding the relationship between benefits and employee satisfaction, offering IT companies valuable guidelines and recommendations for adapting their policies to meet employee needs effectively.

Keywords: *employee benefits; IT companies; work flexibility; employee satisfaction; work-life balance.*

THE DISRUPTIVE EVENTS AND DISRUPTIVE GENERATION: PROFOUND CHANGES IN MANAGEMENT AHOY

Milošević, Ž.[1]

[1]Faculty of Technical Sciences Novi Sad
(e-mail: zikica_m@yahoo.com)

Abstract:

Every next generation brings something new in terms of HR management: so Generation X was the first rebellious generation, followed by Generation Y, which further accentuated the mismanagement errors and the true nature of liberal capitalism, resulting in „quiet quitting“, often job changes, lack of motivation, and the willingness to work from anywhere (remote working). The rise of Generation Y in the labour force coincided with the Covid-19 pandemic (2020-2022) and the World Economic Crisis (2008-2012) and the discrepancies between the middle management which tried to convince Gen Y members that the system makes sense – and the overall feeling of dissatisfaction with the life and job prospects among the employees. The two disruptive events made clear that the management cannot be the same, since the labour force changed too. The newest Generation Z, which is slowly taking over the labour market, is characterised with the lack of will to work „for beans“ while the system makes rich people richer, the lack of trust in „guaranteed good future“ and the immediate wish to cash in the knowledge. It also leads to the requests for the flexible work environment which has become a new norm for the whole society, but for the Gen Z members especially. The changes in management, especially HR management and imminent and clearly ahoy.

Keywords: *Disruption, generations, management, teleworking, HR*

TALENT MANAGEMENT AS A KEY COMPONENT OF STRATEGIC HUMAN RESOURCES

Morača T.[1]

[1]University of Novi Sad, Faculty of Techical Sciences, Department of Architecture and Urban Planning, Trg Dositeja Obradovića 6, Novi Sad, Serbia
(e-mail: teodora.moracca@gmail.com)

Abstract:

Talent Management represents a modern concept in HR management, focusing on strategically important employees - innovative and creative individuals, emphasizing their recruitment, development, and retention. The roots of the model we now call Talent Management date back to the 1990s when McKinsey & Company introduced the term "The War for Talent". Over time, the concept has evolved to include not only attracting employees but also developing, retaining, and optimally utilizing talent within organizations. With the advancement of digital technologies, companies began using software solutions to track talent, assess competencies, and plan development. Sustainability and ethics are crucial aspects of this model today, with a focus on developing skills necessary for future technologies and business models. Integrating talent management into organizational strategy enables companies to optimally utilize human capital, align it with business goals, and ensure long-term competitive advantage. Establishing a clear connection between talent and organizational strategy is key to sustainable growth and success. One of Talent Management's essential roles in strategic HR is forecasting the organization's future needs - workforce planning, which allows organizations to proactively plan and align their human resources with long-term objectives. The goal is to ensure the timely engagement, development, and retention of the required talent, keeping the organization competitive and resilient to change. A successful example of this strategic HR model is the "Young Leaders" program by Delta Holding from Serbia. The program targets young, university-educated individuals. Through this initiative, the company strengthens its image and ensures continuous renewal of leadership personnel, enabling them to remain competitive in the market. The key to successful talent management lies in a proactive approach, transparency in processes, and aligning strategies with the needs of different employee generations. Organizations that recognize talent as their most valuable resource and invest in their future not only secure their market position but also lay the foundations for sustainable growth and innovation.

Keywords: *Talent Management; Strategic HR; Sustainability; Organizational Strategy.*

STRATEGIC HUMAN RESOURCE MANAGEMENT IN MODERN BUSINESS: ALIGNING PEOPLE WITH ORGANIZATIONAL GOALS

Pećo Findžanović B.[1]

[1]University of Novi Sad, Faculty of Technical Sciences, Department of Human Resource Management, Trg Dositeja Obradovića 6, Novi Sad, Serbia
(e-mail: bojanapeco@gmail.com)

Abstract:

In today's rapidly changing business environment, strategic human resource management (SHRM) plays a key role in ensuring that an organization's human capital is aligned with its long-term goals. This paper explores how SHRM contributes to business success by integrating human resource management practices with organizational strategy to enhance performance, foster innovation, and achieve sustainable growth. Through a detailed analysis, the paper examines key SHRM practices such as workforce planning, talent acquisition, performance management, leadership development, and employee engagement, and their impact on business outcomes. The research emphasizes the importance of a dynamic HR strategy that adapts to changing market conditions and technological advancements, ensuring the development of a workforce that is not only skilled but also resilient and agile. Additionally, the paper presents case studies of companies that have successfully implemented strategic human resource practices, demonstrating the tangible benefits of such approaches in terms of employee productivity, organizational culture, and overall market competitiveness. Finally, the paper argues that companies must view human resources not as a support function but as a strategic partner that directly contributes to the achievement of organizational goals. Aligning the HR strategy with business objectives is crucial for building a sustainable competitive advantage in the modern business environment.

Keywords: *Strategic human resource management; business strategy; workforce planning; employee engagement; organizational success; talent management; competitive advantage.*

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BENEFITS OF MANAGERIAL DELEGATION

Radojević 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: milicaradojevic02@gmail.com)

Abstract:

Delegation is the process of transferring certain functions of a manager to subordinates. This is necessary to achieve the overall goals of the company. The essence of delegation is to determine the limits of access and responsibility of each employee. Managerial delegation is one of the components of effective business leadership. To ensure the smooth operation of a business, a manager must be skilled in delegating tasks and assigning the right person to each task. The research on benefits of delegation in companies was done in 200 organizations with qualitative interviews with employees and managers from diverse industries. The study has shown results that delegation improves productivity, innovations and workforce morale. Managers have more time to focus on more demanding tasks, as they do not need to handle administrative work themselves but can delegate it to other employees. With more time available, they can also dedicate greater attention to their employees. Although delegation requires time initially, it has proven to be highly effective in the long term. The most challenging aspect has been determining which person is best suited for each task and forming teams that work well together. However, a qualified manager succeeds in achieving this. Employees have more freedom in performing tasks, which increases their job satisfaction, makes them feel they can achieve greater progress, and that they are more valued within the company. Working in a team, rather than having the manager handle all tasks alone, leads to solutions more easily thanks to synergy. A problem may arise due to a lack of trust between managers and employees, leading to micromanagement, where employees feel overly controlled. The results show that for a company's strategy to succeed, it is crucial that tasks are delegated effectively and that trust exists among employees.

Keywords: *delegation; productivity; innovations; micromanagement.*

DIFFERENCES IN MOTIVATION AND TEAM DYNAMICS ACROSS GENERATIONS

Tešić J.[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: tesicjelenaa@gmail.com)

Abstract:

In today's diverse workplace, motivation plays a central role in shaping team dynamics and driving organisational success. Effective teamwork depends on understanding the unique motivational factors that influence individual and collective performance. Recognition, goal alignment, autonomy, and meaningful interpersonal relationships are key drivers of engagement, trust, and productivity in teams. Motivation is not a one-size-fits-all concept; it varies significantly across different groups, especially between generations. Addressing these differences is essential for leaders aiming to create cohesive and high-performing teams that can thrive in a rapidly evolving work environment. Generational differences in motivation have become increasingly important in modern organisations. Millennials and Generation Z are often motivated by flexibility, technological innovation, and meaningful work aligned with personal values. They seek workplaces that offer inclusivity, sustainability, and opportunities for personal growth. In contrast, Generation X and Baby Boomers value stability, structured workflows, and recognition of their expertise. These differences reflect distinct generational values shaped by different historical and cultural contexts, influencing workplace expectations and behavior. Organisations must adopt tailored approaches to bridge these generational divides. Strategies such as personalized feedback systems, mentorship programs that pair experienced employees with younger colleagues, and opportunities for intergenerational collaboration are effective solutions. Open communication, mutual respect, and the recognition of both individual and team achievements are also essential for fostering team cohesion. Leaders who embrace these strategies can harness the strengths of generational diversity, driving innovation, improving team dynamics, and achieving better organisational results. This analysis underscores the importance of understanding motivational differences and their impact on team dynamics. It offers valuable insights for organisations looking to adapt to the changing workplace and build inclusive, high-performing teams.

Keywords: *motivation; generational differences; team dynamics; organisational success; intergenerational collaboration.*

MOTIVATION OF WORKERS IN PRODUCTION INDUSTRIES

Tomičić G.[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: goranatomicic@gmail.com)

Abstract:

This research is conducted in a company that manufactures floor coverings, aiming to analyze worker motivation in production industries by measuring various dimensions of job satisfaction. The study evaluates both extrinsic and intrinsic factors. Extrinsic factors, such as salary, benefits, and working conditions, are necessary for preventing dissatisfaction, while intrinsic factors like career growth opportunities and professional development promote employee satisfaction. A standardized test will assess satisfaction with job nature, communication, relationships with superiors, benefits, operational conditions, relationships with colleagues, salary, and promotion opportunities. Employees will rate their satisfaction with these aspects using a Likert scale, ranging from 1 (high dissatisfaction) to 5 (high satisfaction). The research focuses on key motivation factors, including the relationship between shift leaders and workers, task monotony, and benefits such as health insurance, children's scholarships, and sports programs. The effectiveness of the reward system is also explored, particularly in relation to minimizing waste and maximizing production efficiency. It is expected that employee satisfaction varies depending on their position within the technological system. The study anticipates low satisfaction regarding the nature of the job due to its monotonous nature and the physical energy it demands, as well as dissatisfaction with salary, where employees may feel their contributions are undervalued relative to their compensation. The findings will guide the development of strategies to improve the motivation of operational workers, contributing to increased productivity, reduced turnover, and better working conditions. Ultimately, this research aims to provide a deeper understanding of the factors influencing worker motivation in production environments and support top management in making informed decisions to improve organizational culture and the work climate in the production sector.

Keywords: *production industry; employee motivation; standardized test; dimensions of satisfaction*.

THE INFLUENCE OF INTERNAL AND EXTERNAL MOTIVATION ON THE PRODUCTIVITY OF EMPLOYEES AT HIGHER HIERARCHICAL LEVELS

Vuković D.[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: danica.vukovic2003@gmail.com)

Abstract:

Employee motivation is one of the key topics in the field of human resource management and organizational behavior. In modern organizations, especially at higher hierarchical levels, understanding different types of motivation can have a significant impact on employee productivity, engagement and satisfaction. Intrinsic motivation is defined as motivation that comes from within, based on personal satisfaction, interest and needs for achievement. On the other hand, extrinsic motivation includes external rewards, such as financial incentives, recognition and promotions. This paper aims to investigate how these two types of motivation affect the productivity of employees at higher hierarchical levels, with a special focus on their interactions and synergistic effects. The aim of this research is to determine how internal and external motivation affect the productivity of employees at higher hierarchical levels and also to investigate what types of motivation employees prefer and how they affect their engagement. The research will be conducted through a survey that will be distributed to employees in higher positions in different organizations. The survey will contain questions about various motivational factors, as well as about productivity and job satisfaction. Analysis of the collected data will enable the identification of how internal and external motivation affect employee productivity. The results are expected to show that employees with internal motivational factors have greater creativity and innovation, while external motivation will be associated with the achievement of short-term goals and the satisfaction of business expectations. This paper contributes to the understanding of the complex relationship between intrinsic and extrinsic motivation and their role in employee productivity. Understanding how different motivational factors affect employees in senior positions can help management develop more effective motivation and engagement strategies. Based on the findings of the research, a holistic approach is recommended that will include a combination of internal and external motivation factors, taking into account individual needs and the specifics of organizational culture. This approach can contribute not only to increased productivity, but also to general employee satisfaction and loyalty to the organization.

Keywords: *Motivation; Hierarchical levels; Productivity; Intrinsic motivation; Extrinsic motivation.*

SUSTAINABLE PROJECT MANAGEMENT

CAN ARTIFICIAL INTELLIGENCE LEAD THE WHY IN SHAPING THE FUTURE OF SUSTAINABLE PROJECT MANAGEMENT PRACTICES?

Grebić B.[1], *Świętoniowska J.*[2], *Ćirić Lalić D.*[3]

[1] Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, Novi Sad, Serbia
(e-mail: grebic.b@gmail.com)

[2] University of Information Technology and Management, Sucharskiego 2, 35-225 Rzeszów, Poland

[3] Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, Novi Sad, Serbia

Abstract:

The recent surge in the application of artificial intelligence (AI) to project management has introduced new perspectives on managing projects more efficiently, prompting a reevaluation of existing practices and encouraging the integration of these promising technological innovations with sustainable approaches. Therefore, this paper explores the potential of AI to drive sustainable project management practices, focusing on its ability to enhance an organization's performance, predict outcomes, and support decision-making aligned with sustainability goals. AI-powered tools, such as predictive analytics, generative language models, automated resource optimization, or advanced risk assessment, are already transforming traditional approaches to project management; thereby, these technologies can streamline processes, reduce waste, and improve overall stakeholder engagement by enabling data-driven decisions, real-time monitoring, and comprehensive reporting. However, questions persist about the extent to which AI can independently shape sustainable practices, given the complex ethical, cultural, and human-centered dimensions of sustainability, as well as concerns over increased energy consumption, safety risks, and the massive hardware requirements for data processing and storage. Building on this, we present both supporting and critical perspectives on AI's role in shaping the future of sustainable project management practices, examining key areas where AI intersects with sustainability and highlighting challenges such as the carbon footprint of AI technologies, ultimately leading to the development of a comprehensive action plan for success in this promising yet challenging initiative. Furthermore, the authors conclude that AI can not only enhance existing sustainability efforts but also lead the way in creating innovative solutions for long-term impact – provided that ecological, social, and other relevant considerations are fully integrated.

Keywords: *Sustainable Project Management; Artificial Intelligence; AI-powered Transformation; ESG; Sustainability.*

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AGILE TOOLS FOR COMMUNICATION AND DISSEMINATION IN RESEARCH PROJECTS: STRENTEX CASE

Knežević I.[1], *Stavrakis A.*[1], *Stojanović G. M.*[1], *Ćirić Lalić D.*[1]

[1]Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, Novi Sad, Serbia
(e-mail: ivanak@uns.ac.rs)

Abstract:

Traditional approaches to managing research projects are predominantly linear and rigid, often overlooking the flexibility and adaptability required in communication and dissemination activities. This rigidity can result in inefficiencies and missed opportunities for effectively sharing project results. Agile tools, commonly used in software development and project management, offer a dynamic alternative by fostering continuous collaboration, feedback loops, and iterative improvements. This paper explores the practical application of Microsoft Teams as an agile tool for organizing and managing communication and dissemination activities within the STRENTEX project. By using Teams, the project established a centralized platform for coordinating tasks and ensuring accountability among researchers. Team members were required to regularly contribute content, such as textual descriptions, visual materials, and proposed platforms for publication, including social media channels and the project website. The experience highlights several advantages, including improved team collaboration, enhanced transparency in task management, and timely dissemination of project updates. Researchers noted that agile methods fostered a greater sense of ownership and engagement, particularly in ensuring that outputs aligned with the communication and dissemination strategy. While the adoption of agile tools in research projects remains limited due to traditional management paradigms, the STRENTEX experience suggests that these tools can address critical gaps in project visibility and outreach. This paper advocates for broader integration of agile methodologies, offering insights into how these tools can transform communication and dissemination processes in research contexts, ultimately driving greater impact and audience engagement.

Keywords: *Agile tools; Communication and dissemination; Research project management; Microsoft Teams; STRENTEX project.*

Acknowledgement

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THE ROLE OF SUSTAINABLE PROJECT MANAGEMENT IN INTRODUCING INNOVATIONS IN EDUCATIONAL INSTITUTIONS

Savic B.[1], *Savkovic M.*[1], *Bilic I.*[2]

[1] Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, Novi Sad, Serbia
(e-mail: bojanabsavic@gmail.com)

[2] University of Split. Faculty of Economics, Business and Tourism, Cvite Fiskovića 5, 21000, Split, Croatia

Abstract:

This research proposal explores the role of sustainable project management in driving innovations within educational institutions, with a particular focus on conducting a needs analysis to identify gaps and opportunities for integrating sustainability, innovation, and social responsibility into curricula. The study aims to assess the current state of sustainability-related education, including the availability of courses on topics such as renewable energy systems, circular economy practices, and sustainable project management. By addressing the specific needs of students, educators, and local communities, this research will provide actionable insights to enhance educational offerings and align them with global sustainability goals. A comprehensive needs analysis will evaluate institutional readiness, stakeholder expectations, and the demand for sustainability-focused programs. This includes gathering input from students, faculty, industry partners, and policymakers to ensure the development of educational initiatives that are both practical and impactful. The research will emphasize the importance of aligning new curricula with industry trends and labor market demands, thereby equipping graduates with skills relevant to emerging fields such as green construction, sustainable transportation, and renewable energy. The proposal further investigates how digital tools, such as online platforms and interactive learning resources, can be leveraged to overcome accessibility barriers and foster inclusivity in sustainability education. These tools are expected to reduce operational costs, minimize environmental impacts, and provide flexible learning pathways for diverse student populations. Partnerships with industry and local organizations will serve as key enablers, facilitating hands-on training and real-world problem-solving opportunities. Ultimately, this research aims to establish a framework for the systematic introduction of sustainable project management principles in educational innovation. By identifying and addressing critical needs, the study will provide a foundation for developing programs that contribute to both institutional growth and broader societal benefits. The findings will position educational institutions as pivotal actors in achieving sustainable development goals and fostering long-term environmental and social well-being.

Keywords: *Sustainable project management; educational innovations; sustainability; curriculum development; social responsibility.*

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

LEVERAGING ESG PRINCIPLES AND SUSTAINABLE PROJECT MANAGEMENT FOR THE TRANSITION TO FLEET ELECTRIFICATION

Savic B.[1], *Ciric Lalic.*[1]

[1] Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, Novi Sad, Serbia
(e-mail: bojanabsavic@gmail.com)

Abstract:

The transition from internal combustion engine (ICE) vehicles to electric vehicles (EVs) is a key step toward achieving environmental, social, and governance (ESG) objectives while enhancing operational efficiency and sustainability. This shift requires strategic planning, resource allocation, stakeholder engagement, and risk mitigation within the framework of sustainable project management. It represents both a technological and organizational transformation, demanding leadership, collaboration, and adherence to ESG principles. This research aims to explore how digital technologies and sustainable project management practices, aligned with ESG frameworks, enable fleet electrification. By conducting a comprehensive literature review, the study synthesizes existing knowledge on best practices, challenges, and emerging trends in fleet electrification projects. The review will address ESG-specific considerations such as carbon footprint reduction, equitable access to infrastructure, and compliance with governance standards. Key research components include assessing fleet readiness, conducting feasibility studies, and evaluating the role of IoT technologies for real-time monitoring and optimization. Feasibility studies emphasize local infrastructure readiness, renewable energy integration, and lifecycle cost analyses, ensuring that fleet electrification aligns with ecological, economic, and social goals. Digital technologies such as IoT and analytics support energy optimization, predictive maintenance, and route planning, further reinforcing ESG commitments. The environmental dimension of ESG is addressed by reducing greenhouse gas emissions, lowering energy consumption, and integrating renewable energy into charging solutions. Economic sustainability is explored through cost reductions in fuel and maintenance, access to green incentives, and job creation in EV-related infrastructure. Social benefits include improved air quality, enhanced public health, and increased urban safety, aligning fleet electrification with sustainable urban planning and social equity. The governance aspect is integrated by ensuring transparency, accountability, and alignment with regulatory frameworks and sustainability standards. By embedding ESG principles, leveraging digital technologies, and fostering sustainable practices, this research aims to provide a robust foundation for innovative fleet transformation strategies, advancing global sustainability goals and setting a benchmark for responsible transportation systems.

Keywords: *Fleet electrification; sustainable project management; ESG principles; digital technologies; renewable energy.*

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

TAILORING THE PMBOK® GUIDE FOR SUSTAINABLE PROJECT MANAGEMENT

Savković M.[1], *Ćiric Lalić D.*[2], *Konstantopoulos H.*[2]

[1, 2]University of Novi Sad, Faculty of Technical Sciences, 21000 Novi Sad, Serbia
(e-mail: milena.savkovic@uns.ac.rs)

[1, 2] PM² Alliance, Rdpt Robert Schuman 6, 1040 Bruxelles, Belgium

Abstract:

Projects are instrumental in driving sustainable business practices, with sustainability increasingly becoming a core component of project management. To guide project managers across industries, the Project Management Body of Knowledge (PMBOK®), developed by the Project Management Institute, provides a standardized framework of terminology, processes, and best practices. Widely recognized as a global standard, the PMBOK® Guide evolves over time to address emerging trends and challenges in project management. The most recent edition, released in 2021, shifts the focus from rigid processes to flexible principles, emphasizing project outcomes and the importance of tailoring methodologies to suit specific project needs. Despite its comprehensive approach, the PMBOK® Guide currently lacks sufficient integration of sustainability principles, which are critical for addressing the environmental, social, and economic challenges of modern projects. Incorporating sustainability requires a shift in the project manager's mindset—from merely delivering project results to actively promoting sustainable development within organizations and society. This study explores the potential for tailoring the PMBOK® Guide to incorporate sustainability, aligning its principles and domains with the goals of long-term impact and the triple bottom line. Key project domains such as stakeholder engagement, team collaboration, risk management, and lifecycle thinking are examined, along with the tailoring of processes to meet sustainability objectives. The study investigates how sustainability considerations can be integrated into various delivery approaches—predictive, adaptive, or hybrid—and evaluates the role of tailoring in customizing methodologies for sustainability-focused projects. The Seventh Edition's emphasis on project outcomes and its dedicated section on tailoring provide a strong foundation for these adaptations, which can be further enhanced through the adoption of recommended sustainable practices. The study further examines how one of the most widely used and recognized project management standards, the PMBOK® Guide, can be enhanced to support the delivery of projects with sustainability components.

Keywords: *PMBOK®; PMI; Sustainability; Project Management; Triple Bottom Line.*

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.

PROJECT PRESENTATIONS

Hydrology and non-point source pollution at the level of small agro-forestry basin

Coordinating institution: Polytechnic University of Castelo Branco, Portugal
Programme: Self-funded project
Duration: Project underway since 2005

Summary of Project

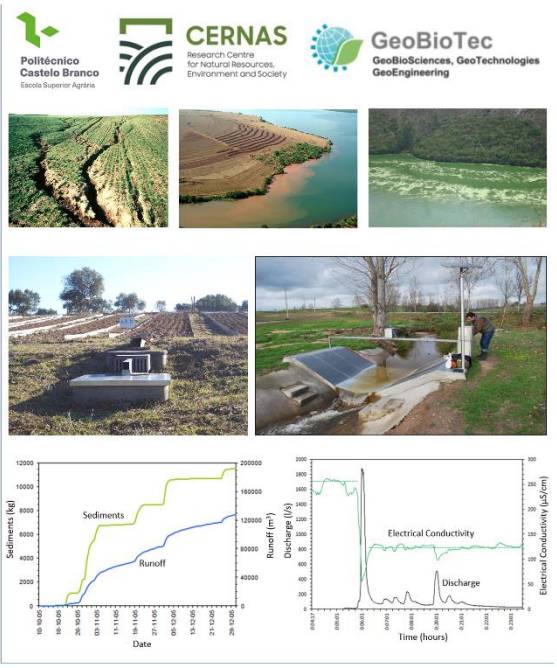
The intensification of agricultural activity, especially irrigated agriculture, implies the massive use of more fertilizers and other agrochemicals. Diffuse pollution from agricultural areas, and its consequence in the contamination of surface water resources, such as eutrophication, is currently a worrying problem. Knowledge of the hydrologic behavior of small watersheds, and an understanding of the dynamics of pollutants, are important to defining good agricultural practices.

Highlights

The production of sediments only reaches the natural drainage network when the runoff has enough energy to transport it.
The concentration of pollutants, mainly the most soluble, shows a large dependence on the runoff volume.

Objectives

The main objective is to understand the hydrologic behavior and the dynamics of pollutants in the study basin.



Jean Monnet ENROL Project

»Challenges and opportunities for implementation of regulations on environment, occupational health and safety and labour relations based on the best European practices«

Coordinating institution: University of Novi Sad
Coordinator at UNS: PhD Maja Petrović, Associate Professor
Programme: Jean Monnet Actions - Modules
Duration: 2022 – 2025

Elevate teaching quality through dynamic ENROL Summer Schools and interactive round tables.

Introduce innovative teaching approaches and fresh perspectives.

Advance education and research initiatives based on the best European practices.

Project objectives

CONTACT US

enrol@uns.ac.rs

Co-funded by the European Union

FOLLOW US

@ENROL_JEANMONNET

WWW.ENROL.UNS.AC.RS

Co-funded by the European Union

Official Webpage

www.smartwb-eu.com

SmartWB

Erasmus+ Capacity Building in Higher Education project

Curricula innovation in climate-smart urban development based on green and energy efficiency with the non-academic sector

Coordinating institution: University of Montenegro

Duration: 2023 - 2025

smartWB

General Objective

Improving the quality of higher education in the climate-smart urban development (CSUD) field,
strengthening its relevance for the labor market and society,
enhancing relations between HEIs in WB partner countries and the economic and social environment by
establishing a technological platform for cooperation, exchange of knowledge, experience and good practices,
modernising universities' courses in line with EU trends and
improving the level of competencies and skills of teaching staff.

Encouraging the urban transformation of the city of Novi Sad through the development of a model for evaluating the ecological footprint of wastewater treatment plants

Coordinating institution: Faculty of Technical Sciences Novi Sad
Coordinator at UNS: Prof.Dr Maja Petrović
Programme: Public competition for the allocation of funds for co-financing research and development projects and programs in the field of environmental protection in the territory of the City of Novi Sad for 2024
Duration: Sept 2024 - Sept 2025

Main goals:

✅ Development of a new validated environmental risk assessment in different construction stages of WWTP in Novi Sad
✅ Development of a model for future assessments of the ecological footprint of WWTP

Expectations:

1. Development of a new validated method for environmental risk assessment
2. Validation of the developed preliminary risk assessment method with a special focus on the involvement of experts in the field of environmental protection and technology
3. Identification and assessment of environmental risks for different phases of the construction project of the WWTPt for the city of Novi Sad
4. Prioritization of identified risks and development of measures to manage significant risks
5. Development of models for future assessments of the ecological footprint of WWTP
6. Organization of a one-day event "Creative Collaboration for a Sustainable Wastewater Treatment Plant"
7. Organization of a Roundtable for decision-makers at the city, provincial and republican levels, where the obtained results and potential possibilities for using risk assessment methods will be presented.

Prof.dr Maja Petrović, PI

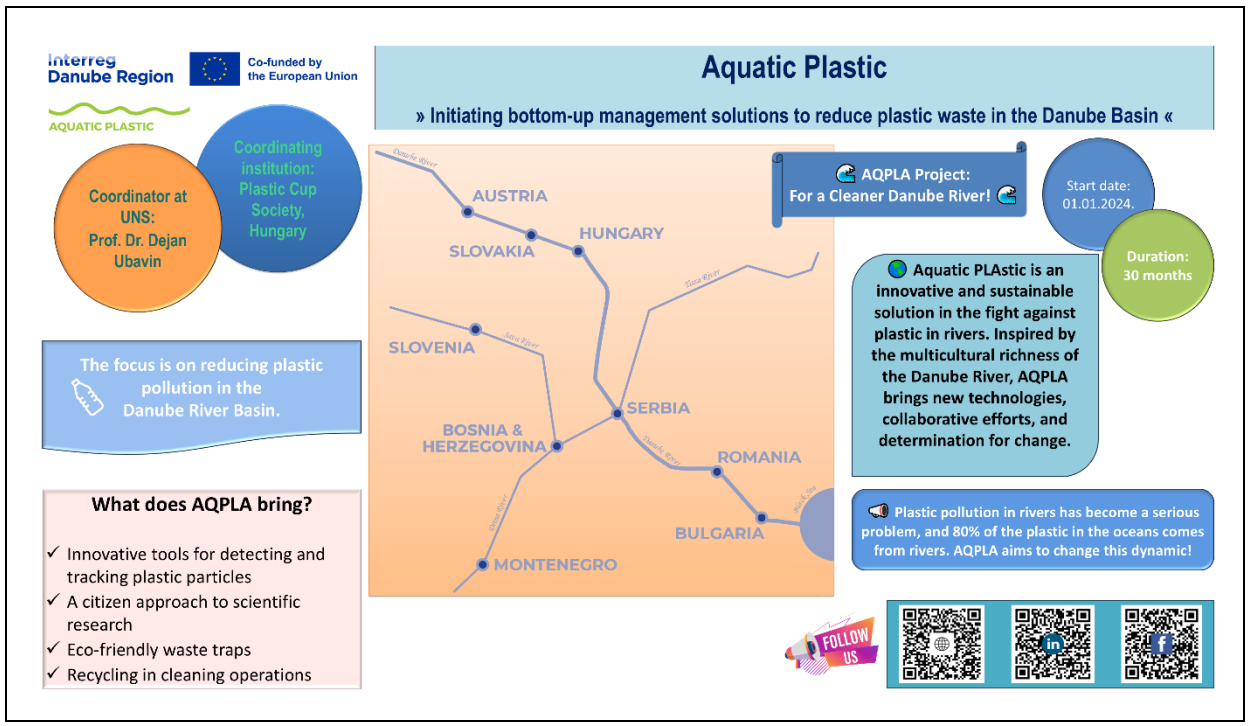
Ph.D Jovana Topalić, TM1

Milena Senjak Pejić, TM2

Prof.dr Vladimir Mučenski, TM3

Prof.dr Ivana Mihajlović, TM4

We will use:



COST DAEMON

» CA22154 - Data-driven Applications towards the Engineering of functional Materials: an Open Network (DAEMON)«

Coordinating institution: TECHNISCHE UNIVERSITEIT DELFT
MC at VINS: dr. Katarina Batalović
Programme: COST Action
Duration: 2023 - 2027

Working group 1. Community standards: data, workflows and codes for materials design. Data digitalisation guidelines, documents, resources for codes/repositories.
Working group 2. Representations and algorithms for materials design for "single-modality" use. Methods, software, and representations for heterogeneous data types.
Working group 3. Multi-modal machine learning methods for advanced materials design. Approaches to integrate alternative information channels into data-driven models
Working group 4. Process-structure-property relationships in materials. Novel insights and applications. Expected deliverables include theory and solutions for bio-derived materials and sustainable technologies.
Working group 5. Training, Dissemination, Exploitation, and Outreach Engagement, strengthening of network, build-up of collaborations with industry

https://cost-daemon.eu/
https://www.cost.eu/actions/CA22154/

VINČA INSTITUTE OF NUCLEAR SCIENCES
University of Belgrade
NATIONAL INSTITUTE OF THE REPUBLIC OF SERBIA

The DAEMON COST Action will grow a cross-disciplinary and pan-European network, which builds capacity and promotes education and research coordination, with the goal to accelerate materials discovery in Europe by means of cutting-edge computational techniques and data-driven methods. Discovery and commercialisation of innovative functional materials is needed to e.g. address energy production, storage and resilience, de-carbonise our economy to preserve ecosystems and climate, and switch current technologies to sustainable materials choices. The objective of this Action is to develop, harmonise, and promote the exploitation of ML methods for functional materials design. In the process, the Action will train a new generation of young European researchers in a multidisciplinary and transferable array of data science methods, and unite the non-ITC and ITC teams in cutting edge developments.

ESDG

» Project Title: European Sustainable Development Goals – Embracing ESG for Business Transformation «

Coordinating institution: University of Novi Sad
Coordinator at UNS: Prof. Dr. Bojan Lalić
Programme: Erasmus+ Jean Monnet Module
Duration: 2023 - 2026

1.Specific Objective 1. To integrate the ESDG Module into the MBA curriculum by incorporating EU'S ESG-related policies, initiatives, and directives into the existing "Business Strategies" course. This will be achieved through the development and annual delivery of a comprehensive course, establishing the ESDG module as a key component of the MBA curriculum.
2.Specific Objective 2. To establish the ESDG Training Academy at the University of Novi Sad as an annual training program aimed at promoting the integration of EU'S ESG-related policies, initiatives, and directives through the use of innovative training methodology and OER (Open Educational Resources).
3.Specific Objective 3. To improve the understanding and awareness of the challenges associated with implementing EU'S ESG-related policies, initiatives, and directives among academic, professional, public and media communities through targeted and effective communication and dissemination efforts.

Co-funded by the European Union

FTN Business School
Faculty of Technical Sciences
University of Novi Sad
Jean Monnet Module:
European Sustainable Development Goals - Embracing ESG for Business Transformation

The multidisciplinary Jean Monnet Module **"European Sustainable Development Goals - Embracing ESG for Business Transformation" / (ESDG)** hosted by the **International Postgraduate School of Engineering and Management, Faculty of Technical Sciences, University of Novi Sad** aim is to introduce and promote the EU'S ESG-related policies, initiatives, and directives through teaching, training, and outreach activities. The ESDG Module will target a wide range of audiences, including students, academics, the professional community, policymakers, and wider society. The focus will be on increasing awareness, knowledge, and skills for successful business transformation aligned with common EU values and Sustainable Development Goals. The aim is to inspire and motivate target groups to take action and become leaders in their respective fields, driving forward the EU's agenda for a more sustainable and prosperous future.

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

esg4PMChange
The ESG Imperative for the Project Management World: Alliance for Developing and Empowering Changemakers

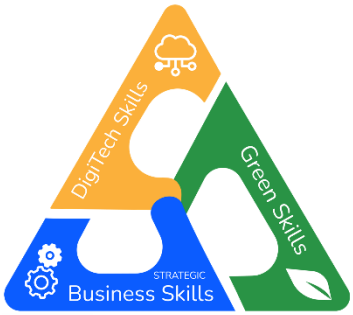
Co-funded by the European Union

The **ESG4PMChange project** stands at the forefront of integrating **Environmental, Social, and Governance (ESG)** principles into project management education and training. This initiative represents a collaborative effort among **HEIs, VET providers, PM2 Alliance, and Business actors** across 8 countries. At its core, the project conducts an exhaustive **education gap analysis** to align current offerings with the dynamic **job market demands for ESG - focused project management roles.** Building on this foundation, the initiative develops **standardized professional profiles** and a competency framework.
This project pioneers an **innovative ESG4PMChange learning framework**, incorporating practical, real-world application through **Living Labs**. In addition, the ESG4PMChange project introduces **a digital resource hub, integrating MOOCs and OER** to provide accessible, high-quality learning opportunities. Moreover, the project establishes a **micro-credential framework** to formally recognize and validate ESG project management competencies.

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



Co-funded by the European Union

1.The cornerstone of this learning ecosystem is the **competency-oriented curriculum model, built round the green & digital transition talent triangle** which will be applied to modernize and enhance existing curricula in eight higher education institutions across Azerbaijan, Kazakhstan, and Mongolia.
2.The project will establish **an eLearning ecosystem, incorporating courses aligned with the competency- oriented curriculum model.** These courses will integrate innovative instructional design approaches and Massive Open Online Courses to ensure accessibility and effectiveness.

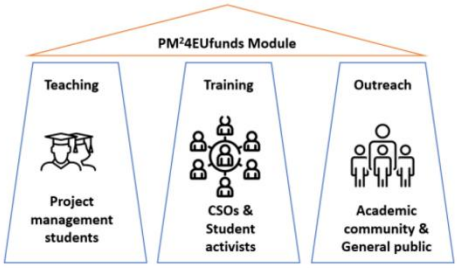
The **GreenTech Horizons** project establishes a **multi-country cross-regional partnership** comprising of 17 institution from 8 countries.
The primary aim of the **GreenTech Horizons** project is to facilitate a successful **dual green and digital transition in the Neighbourhood East, Central Asia, and Asia regions, with a specific focus on the contexts of Azerbaijan, Kazakhstan, and Mongolia.**
This is achieved through the comprehensive **development and adoption of twinning competencies in green, digital, and business skills** necessary for a modern workforce, contributing to sustainable economic growth and job creation.
Central to the project is the creation of an innovative competency-oriented learning ecosystem designed to equip future generations with the skills required to address the challenges and opportunities presented by the green and digital transition, thereby enhancing their positive societal impact.

PM24EUfunds

» Enhancing PM² Skills and Competencies for EU Funded Projects «

Coordinating institution: University of Novi Sad
Coordinator at UNS: Doc. Dr. Danijela Ćirić Lalić
Programme: Erasmus+ Jean Monnet Module
Duration: 2022 - 2025

The **PM²4EUfunds Module** is designed as an interdisciplinary set of lectures, practical classes, training and outreach activities aimed to bring the **European Commission's PM² Methodology** and its benefits closer to its broader stakeholders and potential user community.



Co-funded by the European Union

PM24EUfunds Training Academy

SedSubMat

» Evaluation of stabilized dredged sediment's potential for use in subgrade material with Life Cycle Assessment«

Coordinating institution:University of Novi Sad, Faculty of Sciences
Coordinator at UNS: Dr. Nataša Slijepčević, Research associate
Programme: Proof of Concept, Science Fund of R. Serbia
Duration:01.06.2024-31.05.2025.

- Remediation of the dredged contaminated sediment is a worldwide challenge.
- In order to have a sustainable future, developing countries are increasingly turning to ways of beneficial use of dredged sediment.
- Solidification/stabilization technology has been proved as one of the most efficient technique of remediation, during which the sediment can be transformed into a sustainable road construction material, fill material, road block construction material, etc.
- Life Cycle Assessment (LCA) is a tool for assessing the environmental impact of a product, process, or material from start to finish!

PROOF OF CONCEPT

Science Fund of the Republic of Serbia

SedSubMat team members

dr Nataša Slijepčević, PI

dr Dragana Tomašević Pilipović | dr Miloš Šešlija | dr Boris Agarski | dr Milana Ilić Mićunović

SPArrow

» Developing Sustainable Solutions for the Restoration of Local Ecosystems Through Pioneer Use of Discharged Thermal Waters «

Interreg Co-funded by the European Union
IPA Hungary - Serbia
SPArrow

Coordinating institution: Municipality Morahalom, Hungary

MÓRAHALOM

Coordinator at UNS: Dr. Ivana Mihajlovic, Associate Professor

Duration: 2024 - 2025

The **SPArrow Project** is on a mission to restore the rare soda lakes and pans of the Homokhátság region. These unique ecosystems have been severely impacted by pollution and drainage over the years, but we're working to bring them back to life using **sustainable practices** like filtered thermal water.

Supporting EU Conservation Goals
Aligned with the **Birds and Habitats Directives**, the SPArrow project contributes directly to **biodiversity conservation** across Europe.

Why It Matters
Soda lakes are biodiversity hotspots, home to rare species that depend on these habitats. By restoring them, we're not just protecting nature—we're helping the community thrive through long-term ecological benefits.

FOLLOW US

SPM²

» Project Title: Sustainable project management through 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

FROM PM² TO SUSTAINABLE PM²

Project results and other outcomes expected:

1. SPM² guide and digital hub accessible to all, featuring practical insights and interactive tools.
2. Standardized curriculum and professional profile for SPM² education, enhancing the quality and consistency of SPM2 training across Europe.
3. Modular micro-credential framework providing professionals with recognized qualifications in SPM² skills.
4. Endorsement and ISO 17024 certification of the SPM2 Methodology, ensuring its credibility, recognition and alignment with international standards.

The **SPM² project** is not just about advancing sustainable project management; it's about ensuring its widespread adoption and bolstering the European Commission's leadership in sustainability.

By **leveraging PM², the European Commission's official project management methodology**, accessible to all, this initiative will effectively disseminate sustainable practices across diverse sectors and regions. Why integrating sustainability into PM² through the SPM² initiative is crucial and why it is funded:

1. SPM² directly supports the EU's strategic priorities, particularly the EU Green Deal and UN SDGs.
2. SPM² addresses the growing demand for professionals skilled in SPM by offering a micro-credential framework.
3. SPM² addresses the pressing need for professionals capable of managing projects with a strong sustainability focus.

Funded by the European Union

UNIVERSITY of INFORMATION TECHNOLOGY and MANAGEMENT in Rzeszow, POLAND

EUROPEAN ACADEMY

advise institute by ENERGYNET

PM² ALLIANCE

PM² EU

Interreg Co-funded by the European Union
IPA Hungary - Serbia
ADAPTisa

Lead Partner:

Other Parners:

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ADAPTisa

»Joint adaptation and mitigation measures to climate change supporting integrated water management on the Tisa River«

Lead Partner: Faculty of Technical Sciences in Novi Sad
EU Programme: Interreg VI-A IPA Hungary Serbia
Duration: 1st September 2024 – 31st August 2026

- The main objective of ADAPTisa is to develop an Integrated Water Management Platform for the Tisa river using innovative tools and by enhancing communication and cooperation among water and disaster management stakeholders to aid adaptation to weather extremes and mitigation of hydrological risks.
- The project seeks for solutions which can be applied for future investments to tackle the consequences of climate change and to a quest for a greener and more sustainable region.

Expected Results:
To reduce climate change-related risks, such as floods and droughts, the project focuses on four key outcomes:

1. **Database and Hydraulic Model**: A foundation for flood and low water forecasting, early warning, and input for adaptation and mitigation measures.
2. **Improved Flood Risk Management:** Enhanced flood safety and planning of solutions for better risk reduction and management.
3. **Water Retention and Aquifer Recharge**: Nature-based solutions to boost water management's climate adaptation capacity.
4. **Integrated Water Management Platform**: Development of protocols for managing floods and low water, improving organizational coordination, and raising public awareness through joint campaigns targeting residents and agricultural producers.

µPlastChar

»Use of recycled microplastics and biochar to remove specific pollutants from the water matrix«
- the Provincial Secretariat for Higher Education and Scientific Research –

Coordinating institution: University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection
Coordinator at UNS: Dr. Maja Vujić; Duration: 2021 – 2024

Objectives

The project aims to investigate the mechanisms of removing specific pollutants from aquatic media using biochar and recycled microplastics (microplastic fibers), with the goal of assessing the risk of pollutant discharge into the environment.
Determination of adsorption affinity and kinetic parameters of selected organic pollutants on microplastic fibers and biochar

INDICATE LIFE Project

»National Building LCA Data Accelerator«

Coordinating institution: Smith Innovation
Coordinator at GBC Croatia: Franciska Erdelj
Programme: LIFE-2023-CET
Duration: 2024 - 2026

Why INDICATE?

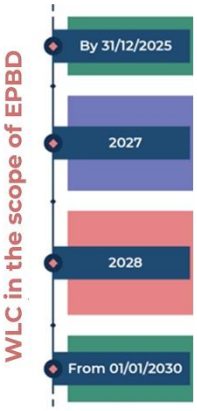
INDICATE is meeting one of the most fundamental challenges to decarbonise buildings – the lack of data to support policymaking and strategic business decision-making

INDICATE pushes for policy and industry to tackle both operational and embodied carbon **-'Whole Life Carbon' (WLC)** – since it is crucial to reduce the climate impact of new construction and renovation.

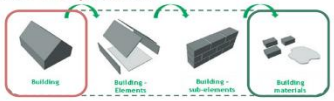
National implementation **in Croatia, Italy, Austria, Luxembourg**

Preparing the ground for the effective implementation of the EPBD recast provisions on WLC

Accelerating action on decarbonising buildings to be brought in line with the 1,5 °C target from the 2015 Paris COP21 agreement.



Advancing WLC reporting
From aggregated reporting to detailed, reusable life cycle data



This project has recieved funding from the European Union's LIFE-CET program under Grant Agreement No. 101167585

BPIE KU LEUVEN Smith WORLD GREEN BUILDING COUNCIL 15 years of Building The Transition GBC GREEN BUILDING COUNCIL CROATIA

MONALISA

MONITORING AND ASSESSING PREVENTION AND RESTORATION SOLUTIONS TO COMBAT DESERTIFICAION
no. 101157867

MAIN GOAL: Identification and promotion of innovative tailored solutions to combat **land degradation and desertification (LDD).**

APPROACH & MAIN OUTPUTS:

- **Co-design**, **co-implementation** & **co-assessment** processes.
- Learning & sharing via **Information Hub** & **Community of Knowledge**.
- User friendly multi-modular **Decision Support System**.

6 case studies in **5 countries** aimed at advancing **nature-based** and **high-tech LDD solutions**, from innovative grazing technics to water harvesting.

09/2024 - 08/2028
Duration: 48 months

22 partners & 1 affiliated entity
9 Countries
Coordinated by UNISS

Funded by the European Union

https://monalisa4land.eu/

UDENE

UDENE - **U**rban **D**evelopement **E**xplorations using **N**atural **E**xperiments
Project no. **101131190**

Funded under the **Horizon EUSPA Call**
Duration: 24 months (February 2026)

CORDIS

Project aim:
Support evidence-based decision making for urban development, by creating a **virtual laboratory** for urban planners and visionaries to test their development ideas.

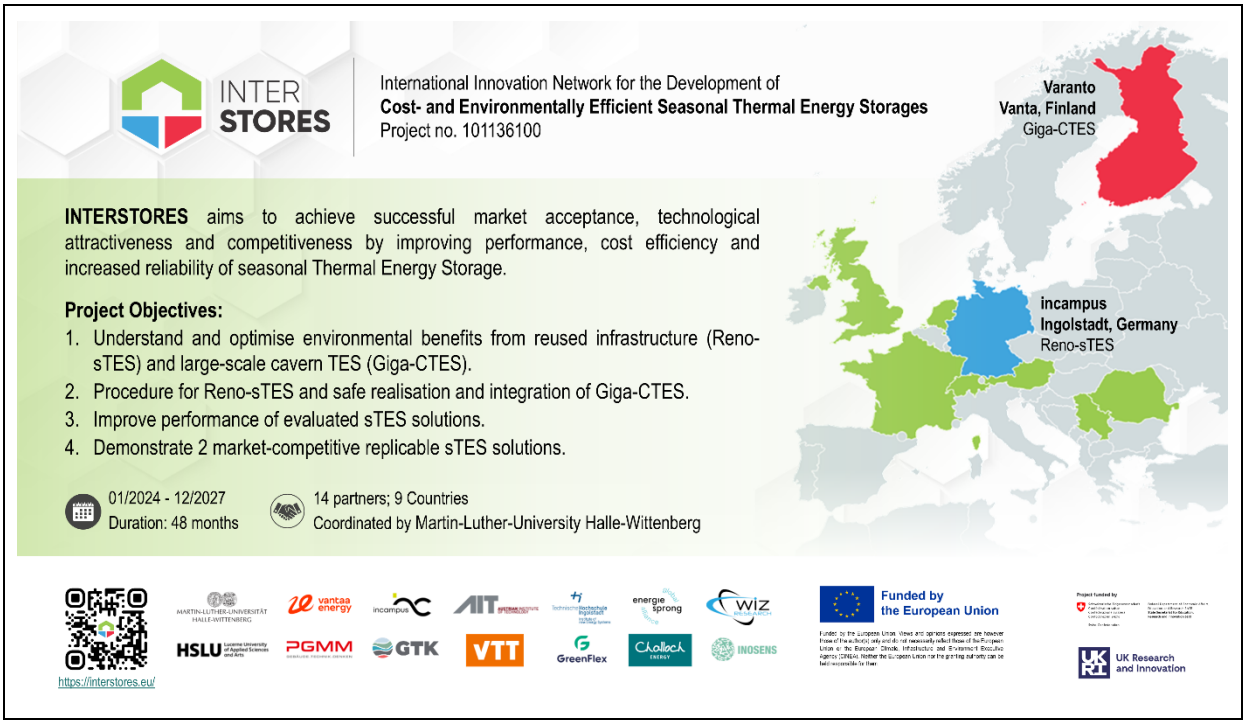
Project Objectives:
– Enable exploration of urban impacts by integration of local in-situ data into Copernicus data cubes.
– Assess urban development outcomes and environmental impact via advanced algorithms.
– Promote use of EO technologies through investments and efficient urban decision-making tools.

- 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)

9 Consortium Partners
6 countries: Italy, Tunisia, Turkey, France, Serbia, Slovenia
Coordinator: WEGLOBAL SRL

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.


INTER STORES
International Innovation Network for the Development of
Cost- and Environmentally Efficient Seasonal Thermal Energy Storages
Project no. 101136100
Varanto
Vanta, Finland
Giga-CTES
INTERSTORES aims to achieve successful market acceptance, technological attractiveness and competitiveness by improving performance, cost efficiency and increased reliability of seasonal Thermal Energy Storage.
Project Objectives:
1. Understand and optimise environmental benefits from reused infrastructure (Reno-sTES) and large-scale cavern TES (Giga-CTES).
2. Procedure for Reno-sTES and safe realisation and integration of Giga-CTES.
3. Improve performance of evaluated sTES solutions.
4. Demonstrate 2 market-competitive replicable sTES solutions.
incampus
Ingolstadt, Germany
Reno-sTES
01/2024 - 12/2027
Duration: 48 months
14 partners; 9 Countries
Coordinated by Martin-Luther-University Halle-Wittenberg
https://interstores.eu/
Funded by the European Union
UK Research and Innovation