Microplastics for Breakfast

The First Meeting of Micro- and Nanoplastics Researchers from Serbia, Montenegro & Bosnia and Herzegovina

Book of Abstracts

May 2025

Building bridges in science.

Microplastics for Breakfast -
The First Meeting of Micro- and Nanoplastics Researchers from Serbia, Montenegro & Bosnia and Herzegovina

Book of abstracts

This book compiles the abstracts of keynote, invited, workshop and pitching presentations given during Microplastics For Breakfast - The First Meeting of Micro- and Nanoplastics Researchers from Serbia, Montenegro & Bosnia and Herzegovina, conducted on 10th April 2025 at the Institute SUPERLAB in Vrčin, Serbia. The abstracts are reproduced as submitted by the authors.

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Contact List:
A list of participants and contributors, including institutional affiliations and contact information, is included at the end of this book to encourage networking and further collaboration.

Contact for More Information:
info@microplasticsforbreakfast.com

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WELCOME NOTE

Dear colleagues,

Welcome to *Microplastics for Breakfast* – the first meeting of micro- and nanoplastics researchers from Serbia, Montenegro, and Bosnia and Herzegovina. Beyond a scientific gathering, this event marks the beginning of a new regional research network.

Part of the broader Microplastics for Breakfast initiative — which began in Slovenia in 2023 and expanded to Croatia — this meeting continues the effort to connect researchers, institutions, industry, and the public in tackling the growing challenge of microplastics. Our goal is to foster ongoing collaboration, dialogue, and joint action across the region.

This abstract book features summaries of plenary lectures by Prof. Dr. Aleksandra Tubić and Prof. Dr. Tanja Ćirković Veličković, workshops by Dr. Robert Packer, Dr. Milica Velimirović, and Assist. Prof. Dr. Ula Putar, and research pitches from active teams. It also includes demonstrations of analytical methods and equipment by Perkin-Elmer, providing practical insights into modern microplastics analysis.

We believe that gatherings like this are essential for building trust, sharing knowledge, and creating partnerships that cross institutional and national boundaries. To support continued collaboration, we are pleased to provide a comprehensive contact list of all participants who have kindly given permission for their details to be shared.

This event was made possible thanks to the outstanding support of SUPERLAB, a cutting-edge laboratory center that bridges science and industry by providing state-of-the-art analytical services, advanced instrumentation, and expert support for research and development.

Thank you to all participants, contributors, and supporters. We look forward to growing this community — and to many more breakfasts together!

Andreja Palatinus
Founder, Microplastics for Breakfast

Dr. Vladan Kocić, CEO of the SUPERLAB Group, opened the event "Microplastics for Breakfast – The First Meeting of Micro- and Nanoplastics Researchers from Serbia, Montenegro, and Bosnia and Herzegovina.
The event was held at the premises of the SUPERLAB Institute, the main sponsor of the gathering.

MEET OUR SPEAKERS

The following pages feature the biographies of our keynote and invited speaker, and workshop presenters, whose presentations made an important contribution to the Microplastics for Breakfast – Serbia program. Their expertise, dedication, and diverse perspectives on microplastics added valuable depth and insight to the discussions throughout the event.

KEYNOTE & INVITED SPEAKER

Keynote Speaker

Prof. Dr. Aleksandra Tubić

Faculty of Sciences, University of Novi Sad

Prof. Dr. Aleksandra Tubić is a full professor at the Faculty of Sciences in Novi Sad. Her research focuses on environmental protection, particularly the impact of microplastics and organic pollutants on aquatic ecosystem quality and water treatment. She is an expert in the application of gas chromatography and has extensive experience in both laboratory and pilot-scale research.
She currently leads two Horizon Europe projects and serves as Vice Chair of the COST Action PRIORITY. Prof. Tubić is also an active member of the International Water Association (IWA), particularly within the Groundwater Management Group. She has co-authored over 200 publications, including 68 papers in internationally recognized scientific journals.

ORCID: https://orcid.org/0000-0001-7503-7754
Contact: https://www.dh.uns.ac.rs/dr-aleksandra-tubic-redovni-profesor/

Invited Speaker

Prof. Dr. Tanja Ćirković Veličković

Faculty of Chemistry, University of Belgrade

Prof. Dr. Tanja Ćirković Veličković is a full professor of biochemistry at the Faculty of Chemistry, University of Belgrade. She is Head of the Centre of Excellence for Molecular Food Sciences and leads the Proteomics Group at the same faculty. She graduated in biochemistry at UBFC and further specialized in molecular immunology during her postdoctoral studies at the Department of Medicine, Karolinska Institute in Stockholm, Sweden (2004).
She is a member of the Food and Nutrition Proteomics Group of the European Proteomics Association and President of the Serbian Proteomics Association. She served on the Council of the Human Proteome Organization (HUPO) from 2015 to 2017 and is currently a member of Steering group of the HUPO Food and Nutrition Initiative. Since 2018, she has been a member of the Serbian Academy of Sciences and Arts.
Her current research interests include: identification of allergenic food proteins; post-translational and chemical protein modifications during processing and due to environmental contamination; the impact of processing, food matrices, and contaminants on protein structure, digestion, and biological activity; protein-ligand interactions in food systems; and the use of high-resolution mass spectrometry in food, nutrition, and environmental sciences. She has published over 140 articles in international journals (Web of Science), one research monograph, and seven book chapters.

Citations: 5,700 | h-index: 42 | i10-index: 112
(Google Scholar, as of February 2, 2025)

Contact: https://www.chem.bg.ac.rs/osoblje/27-l.html

WORKSHOP SPEAKERS

Dr. Robert Packer

PerkinElmer, Inc.

Dr. Robert Packer is the Director of the Material Characterization and Food Quality Portfolio at PerkinElmer, where he has worked for the past 15 years. After earning his degree in chemistry, he completed a PhD in Materials Science at Imperial College London, specializing in analytical techniques.
Following his doctoral studies, he joined PerkinElmer as an application scientist in the thermal analysis division, later moving into product management roles for both thermal analysis and infrared spectroscopy. He eventually became Segment Strategy Leader for food and pharmaceutical testing markets across PerkinElmer's product lines, a role that led him to relocate from the UK to Connecticut, USA.
Five years ago, he returned to product management to lead the Materials Characterization and Food Quality businesses which includes IR, NIR, UV-VIS and FL Spectroscopy, Thermal analysis as well as Food Quality NIR and functional testing products focussed on Grain and Dairy.

Contact: https://www.linkedin.com/in/robert-packer-9169011b/

Dr. Milica Velimirović

VITO, Belgium

After earning a BSc and MSc in Chemistry from the University of Novi Sad , Dr. Milica Velimirović earned her PhD in Applied Biological Sciences in 2013 from the University of Antwerp, in collaboration with the Flemish Institute for Technological Research (VITO), Belgium. From 2013 to 2019, she held a post-doctoral position at the Department of Environmental Geosciences, University of Vienna (Austria), focusing on the development of validated and standardized methods using field-flow fractionation hyphenated with ICP-MS, in support of European Commission recommendations on nanomaterials.
From 2019 to 2022, she served as a senior postdoctoral researcher (FWO) in the »Atomic & Mass Spectrometry« research group at the Department of Chemistry, Ghent University and VITO. She is currently a Marie Curie postdoctoral fellow at VITO, a Management Committee member, and the leader of Working Group 7 (Developing new strategies to enhance synergies with society and education) within the COST Action CA20101 – PRIORITY. She also coordinates the EU-funded SSbD4CheM project.
Her primary research interests include the development of new analytical strategies and methods for assessing and predicting the health and environmental risks of nanomaterials, including nanoplastics.

ORCID: https://orcid.org/0000-0002-3233-8837
Contact: https://www.linkedin.com/in/milica-velimirovic/

Assist. Prof. Dr. Ula Putar

Faculty of Chemistry and Chemical Technology, University of Ljubljana

Dr. Ula Putar obtained her Master's degree in Chemical Engineering and completed her PhD in the interdisciplinary Environmental Protection program at the University of Ljubljana. She is currently an Assistant Professor and postdoctoral researcher at the Faculty of Chemistry and Chemical Technology at the University of Ljubljana, Slovenia.
She is a member of the Planterastics research team, focusing on the preparation and characterization of microplastics, their environmental aging, ecotoxicity, indirect effects, and the development of strategies to prevent microplastics from entering the environment. Since joining the Planterastics team, she has collaborated with several institutions in Slovenia and internationally, including the National Institute of Chemistry (Slovenia), Biotechnical Faculty (University of Ljubljana), Korea University (South Korea), RPTU (Germany), TU Wien (Austria), and CEITEC (Czech Republic).
Last year, she received a two-year national post-doctoral project grant to study the impact of microplastics on nutrient cycling and greenhouse gas emissions.

ORCID: https://orcid.org/0000-0001-5625-6767
Contact: https://www.linkedin.com/in/ula-rozman-putar-148970194/

ABSTRACTS (speakers & pitches)

Microplastics in the Environment: Challenges, Solutions, and Sustainable Approaches

Prof. Dr. Aleksandra Tubić
University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry, and Environmental Protection

aleksandra.tubic@dh.uns.ac.rs

Abstract:

Environmental pollution caused by microplastics is one of the most significant global issues, which has become the subject of intense research over the past decade. However, understanding the behavior of microplastics in the environment, as well as managing prevention, treatment, and reuse processes, remains a challenge for the scientific community, industry, and policymakers. This lecture will analyze key aspects of microplastic pollution prevention, with a particular focus on preventive measures that can reduce microplastic emissions into the environment. Additionally, monitoring techniques used to track concentrations and types of microplastics in various environmental matrices will be presented. The discussion will cover modern technologies for removing microplastics from wastewater. Finally, opportunities for recycling and reusing plastic and microplastic waste will be introduced, along with the potential for producing new environmentally friendly products from recycled materials, thereby contributing to reducing the ecological footprint and improving sustainability.

Challenges in micro- and nanoplastics determination in complex matrices

Prof. Dr. Tanja Ćirković Veličković
University of Belgrade – Faculty of Chemistry, Belgrade, Serbia

tanja.cirkovic16@gmail.com

Abstract:

Microplastics (MP), resulting from the degradation of plastics, represent an increasingly significant environmental and health issue. These small particles are widely distributed across ecological systems, found in food, and even in various organs and biological fluids of humans and animals. While the ecotoxicological effects of MPs on marine organisms are well-researched, their impact on human health remains insufficiently studied. MPs pose a threat not only due to their physical properties but also because of the leaching of monomers, additives, plastic oligomers, and sorbed contaminants. Moreover, MPs can carry microorganisms, toxins, and other hazardous substances, contributing to their spread in the environment and potential human exposure.

Here we provide an overview of current analytical methods for detecting and characterizing MPs from complex matrices. It is estimated that humans ingest several hundred thousand MP particles annually, indicating chronic exposure. Nanoplastics (NP), the smallest particles of microplastics, represent a particular challenge for quantitative analytical chemistry. Their physicochemical characterization currently exceeds the capabilities of available methods. Studies on cellular and animal models indicate that the harmful effects of NPs are significantly greater than those of larger MP particles. Further research in this area, especially on the smallest plastic particles, is urgently needed to better understand their impact on human health and ecosystems.

Optimising the Workflow for Microplastics Analysis using FTIR Microscopy

Dr. Robert Packer
Perkin Elmer, Shelton, CT, USA

robert.packer@perkinelmer.com

Abstract:

Analysis of environmental samples containing microplastics is essential to determine their prevalence and their impact. A range of analytical techniques have been applied to the analysis of microplastics. Of the techniques adopted, infrared (IR) spectroscopy, and more specifically IR microscopy, has established itself as a primary analytical technique for the detection and identification of microplastics.

The microplastics analysis workflow for IR microscopy consists of several steps involved in getting from the raw sample to answers, including the initial sampling through to data analysis. The steps involved may be different depending on the type of initial sample and the amount of sample cleanup required to prepare the sample for infrared (IR) analysis. This paper describes the different types of environmental samples, the sample collection methods, the range of different sample cleanup methods, and then deals more specifically with the best ways to optimise sample filtration for measurement by IR microscopy.

The principles of IR microscopy and the different sample measurement modes will be described, comparing and contrasting each type. IR microscopy and imaging experiments can generate significant quantities of data that need to be analysed to get the required information. The different methods for extracting data and information will be explained and suggestions made for best practice.

From Macro to Nanoplastics and Beyond: Advances in Analytical Techniques

Dr. Milica Velimirović
Flemish Institute for Technological Research – VITO, Belgium

milica.velimirovic@vito.be

Abstract:

Nanoplastics, released from the degradation of plastic materials, present unique challenges due to their heterogeneity in composition, morphology, and persistence. These tiny particles are ubiquitous, infiltrating water bodies, soils, and even biological systems, making their detection and analysis a complex task. Traditional methods often fall short in accurately identifying and characterizing nanoplastics, necessitating the development of innovative analytical techniques.

This workshop will explore the latest advances in techniques for identifying and characterizing nanoplastics in water, soil, or biological samples. Participants will gain insights into the development and application of state-of-the-art tools designed to tackle this analytical challenge. The workshop will feature case studies demonstrating the practical application of these techniques, providing attendees with actionable insights into their implementation.

Furthermore, the discussion will highlight the importance of precise and reliable detection methods as critical steps toward addressing the complex issue of nanoplastic pollution.

Preparation and characterization of microplastics for environmentally relevant research

Assist. Prof. Dr. Ula Putar
Faculty of Chemistry and Chemical Technology
University of Ljubljana, Slovenia

ula.putar@fkkt.uni-lj.si

Abstract:

In recent decades, microplastic pollution has emerged as a critical environmental issue. Beyond monitoring their presence across various ecosystems, researchers have increasingly focused on investigating the ecotoxicity, transport dynamics, aging processes, interactions with pollutants, and the development of remediation strategies in laboratory settings. Given the diverse nature of microplastics, stemming from variations in polymer composition, additive content, morphology, and size, careful consideration is required when selecting appropriate test materials. However, microplastics research often suffers from a lack of environmentally representative particles and insufficient characterization of the materials used. This presentation aims to explore the various methods available for producing environmentally relevant microplastics under laboratory conditions and to introduce simple laboratory techniques for simulating the environmental aging of these particles. In addition, proper preparation and characterization of microplastics in laboratory settings are essential for ensuring the reliable extrapolation of laboratory results to real-world environmental scenarios.

Institute of Physics Belgrade:

Microplastics Removal, Degradation, Implications

TEAM MEMBERS & CONTACTS:
Anđelija Ilić, PhD • *andjelijailic@ieee.org*
Predrag Kolarž, PhD • *kolarz@ipb.ac.rs*
Milica Ćurčić, PhD • *milicap@ipb.ac.rs*
Mira Aničić Urošević, PhD • *mira.anicic@ipb.ac.rs*
Milica Popović, MSc • *milica.popovic@ipb.ac.rs*
Branka Hadžić, PhD • *branka@ipb.ac.rs*
Jelena Trajković, MSc • *jelena.trajkovic.ff@gmail.com*

Institute of Physics Belgrade, Pregrevica 118, Serbia

TEAM INTRODUCTION: Our team comprises researchers of different backgrounds gathered around a topic of mutual interest – microplastics. Kolarž, Ilić, and Trajković, with a primary research focus on particles and fields, investigate possibilities of micro- and nanoparticle removal from indoor air [1], their transport, etc. Ćurčić, Hadžić, and Kolarž lead the investigation of polystyrene, polyethylene, polypropylene degradation under exposure to plasma, UVC light, ozone [2]. Aničić, an expert in biomonitoring [3], and Popović, plan to perform controlled microplastics exposures to ions, using the self-designed interaction chambers to assess removal efficiency, and biomonitoring of microplastics in the environment. Health implications will be studied in collaboration with the Faculty of Medicine.

RESEARCH AND EQUIPMENT: We use the Jobin Yvon T64000 Raman spectrometer (backscattering), equipped with nitrogen cooled CCD detector and 514.5 nm Ti:Sapphire laser (100mW), and via collaboration with the Vinča Institute, Thermo Scientific Nicolet iS35 FTIR spectrometer (Waltham, MA, USA), for optical characterization. We employ cold atmospheric plasma jet rich in reactive oxygen and nitrogen species (10 kV, 80 kHz). We use the GPS-FC48™-AC (GPS Ltd., USA), UL 2998 certified ion generator, the in-house developed BCDI instrument (IPB, Belgrade, Serbia), Optical Particle Sizer OPS3330 (TSI Inc, MN, USA), NanoScan SMPS™ Nanoparticle Sizer 3910 (TSI Inc, MN, USA), alongside the in-house developed interaction chambers.

KEY PROJECTS AND RESULTS: Current investigation is linked to the Project "Elimination of respirable airborne particles, microplastics, microorganisms, and VOCs by ionization of indoor air and filtration systems: comprehensive investigation for reliable technological answers," financed by the Science Fund of the Republic of Serbia, under the Green Program of Cooperation between Science and Industry (No: 5661, Acronym: IonCleanTech), 2023-2025. Within the Project we have patented chambers providing controlled aerosol-ion interaction (MP-2022/0050, 1776 U1, **https://www.zis.gov.rs/wp-content/uploads/glasnik-12-2022.pdf**, p.45/299; MP-2024/0019, 1834 U1, **https://www.zis.gov.rs/wp-content/uploads/glasnik-01-2025.pdf**, p.48/221). Team members also belong to the CEEPUS network SI-0905-11-2425: Training and research in environmental chemistry and toxicology.

PUBLICATIONS:

[1] Kolarž, P. et al. (2023) 'Estimating aerosol particle removal in indoor air by ion-enhanced deposition', Journal of Aerosol Sci, v.173, p.106199. doi: **https://doi.org/10.1016/j.jaerosci.2023.106199**.

[2] Ćurčić, M. et al. (2024) 'Plasma, UV radiation and ozone for microplastics degradation', manuscript under review. doi: **https://doi.org/10.2139/ssrn.4974167**.

[3] Aničić Urošević, M. et al. (2019), Air Quality, Atmosphere & Health, v.12, p.1081. doi: **https://doi.org/10.1007/s11869-019-00724-6**.

University of Montenegro:

Microplastics in the aquatic ecosystems of Montenegro

TEAM MEMBERS & CONTACTS:

Neda Bošković[1] • *nedaboskovic93@gmail.com*
Oliver Bajt[2] • *oliver.bajt@nib.si*
Željko Jaćimović[3] • *zeljkoj@ucg.ac.me*
Danijela Joksimović[4] • *danijela.j@ucg.ac.me*

1 Institute for Interdisciplinary and Multidisciplinary Studies, University of Montenegro, Cetinjski put b.b. 81000 **2** Podgorica, Montenegro; National Institute of Biology, Marine Biology Station, Fornače 41, 6330 Piran, Slovenia; **3** Faculty of Metallurgy and Technology, University of Montenegro, Cetinjski put b.b. 81000 Podgorica, Montenegro
4 Institute of Marine Biology, University of Montenegro, Put I Bokeljške brigade 68, Kotor 85330, Montenegro

TEAM INTRODUCTION: The joint work of the team members in the field of research into the presence of microplastics in Montenegro, for the first time, is based on conducting experiments and analyses necessary for the successful implementation of two doctoral dissertations and a couple of projects that have resulted in a large number of published scientific papers in highly ranked international journals.

RESEARCH AND EQUIPMENT: The presence of microplastics was analyzed in: sediment, fish and shellfish from the Montenegrin coast, sediments of rivers and lakes in Montenegro. The following equipment was used: lyophilizer (Alpha 2-4 LD plus, CHRIST, Hagen, Germany), oven (DRYSCN43), Olympus SZX16 imaging microscope (with DP-Soft software), professional STEBD optical microscope, micro Fourier-transformer infrared (μ-FTIR) spectroscopy (Perkin Elmer Spotlight 200i) with attenuated total reflectance (ATR) FTIR Spectrum.

KEY PROJECTS AND RESULTS: Research program of Slovenian Research Agency (P1–0237), PROMIS project by the Ministry of Education, Science, Culture and Sports of Montenegro (No 3173), UNESCO Man and the Biosphere (MAB) program (No. 101, 507712).

COLLABORATIONS AND PUBLICATIONS:

1. Bošković, N. et al. (2023) Microplastic pollution in rivers which belong to the Adriatic Sea basin in Montenegro: Impact on pollution of the Montenegrin coastline. Science of the Total Environment, 905: 167206. **https://doi.org/10.1016/j.scitotenv.2023.167206**
2. Bošković, N. et al. (2023) Microplastics in mussels from the Boka Kotorska Bay (Adriatic Sea) and impact on human health. Food and Chemical Toxicology, 173: 113641. **https://doi.org/10.1016/j.fct.2023.113641**
3. Bošković, N. et al. (2022) Microplastics in fish and sediments from the Montenegrin coast (Adriatic Sea): similarities in accumulation. Science of the Total Environment, 850: 158074. **http://dx.doi.org/10.1016/j.scitotenv.2022.158074**
4. Bošković, N. et al. (2022) Distribution and characterization of microplastics in marine sediments from the Montenegrin coast. Journal of Soils and Sediments. 22(11): 2958–2967. doi: **https://doi.org/10.1007/s11368-022-03166-3**
5. Bošković, N. et al. (2021) Microplastics in Surface Sediments along the Montenegrin Coast, Adriatic Sea: Types, Occurrence, and Distribution. Journal of Marine Science and Engineering, 9: 841. **https://doi.org/10.3390/jmse9080841**

Department for Biology and Ecology, Faculty of Science, University of Kragujevac:

Microplastics in living organisms and in food chains

TEAM MEMBERS & CONTACTS:
Rastko Ajtić • *rastko.ajtic@pmf.kg.ac.rs* / **https://www.pmf.kg.ac.rs/?id=972**
Tanja Trakić • *tanja.trakic@pmf.kg.ac.rs* / **https://www.pmf.kg.ac.rs/?id=287**
Filip Popović • *filip.popovic@pmf.kg.ac.rs* / **https://www.pmf.kg.ac.rs/?id=1492**
Glorija Ćirković • *glorija.cirkovic@pmf.kg.ac.rs* / **https://www.pmf.kg.ac.rs/?id=1510**

Department for Biology and Ecology, Faculty of Science, University of Kragujevac
Radoja Domanovića 12, 34000 Kragujevac Republic of Serbia

TEAM INTRODUCTION: Team members are employees at the Department of Biology and Ecology, at Faculty of Science University of Kragujevac. All team members have been engaged in taxonomic, ecological and physiological research of various groups of invertebrates and vertebrates for many years, and in the last few years, they also started research in the field of micro and nanoplastics and their impact on living organisms. The aim is to address the importance and presence of this global problem.

RESEARCH AND EQUIPMENT: We conduct research on microplastics in the digestive system of earthworms, tadpoles and adult frogs, as well as the presence of microplastic particles in various tissues of these organisms. Our research is focused on monitoring the impact of microplastic particles on the embryonic development of earthworms; influence on the diet, development and metamorphosis of amphibians; monitoring the fate of these organisms through the food chain, as well as the impact on the morphological and physiological characteristics of the mentioned organisms. We use stereomicroscopes, light microscopes, and FTIR for analysis.

KEY PROJECTS AND RESULTS: Until now we didn't have founded projects, the research and results are just part of doctoral and master thesis. We plan to apply for the projects connected with this topic.

COLLABORATIONS AND PUBLICATIONS: So far, we have mostly cooperated with colleagues from the Institute for Nuclear Sciences "Vinča" (Institute of national importance for the Republic of Serbia) and Department of Biology, Josip Juraj Strossmayer University of Osijek, Croatia. The three major publications until now:

1. Ćirković, G., Rakonjac, A., Ajtić, R. (2023). 'Results of the first analysis of tadpoles' diet and determination of microplastics presence of *Rana, Bufo* and *Bufotes* species from different localities in Serbia', Biologica Nyssana, Vol. 14, No. 1, p. 31-38. doi: **https://doi.org/10.5281/zenodo.8027114**
2. Ćirković, G., Ajtić, R. (2023). 'Preliminary results of geometric and traditional morphometric analysis of *Rana dalmatina* and *Rana temporaria* tadpoles exposed to polyethylene microplastics. 22nd European Congress of Herpetology, Wolverhampton, UK.
3. Trakić, T., Popović, F., Sekulić, J., Hackenberger, D.K. (2024). 'Ecotoxicological effects of commercial microplastics on earthworm *Eisenia fetida* (Savigny, 1826) (Clitellata; Lumbricidae)'. Agriculture, Vol. 14, No. 2, p. 267. doi: **https://doi.org/10.3390/agriculture14020267**.

**University of Belgrade – Faculty of Pharmacy,
Department of Toxicology:**

TOX Lab: Understanding the Toxicological Risks of Microplastics

TEAM MEMBERS & CONTACTS:
Prof. dr Danijela Đukić-Ćosić • *danijela.djukic.cosic@pharmacy.bg.ac.rs* /
tel: +381638472709
Prof. dr Aleksandra Buha Đorđević • *aleksandra.buha@pharmacy.bg.ac.rs*
Prof. dr Biljana Antonijević • *biljana.antonijevic@pharmacy.bg.ac.rs*
Prof. dr Zorica Bulat • *zorica.bulat@pharmacy.bg.ac.rs*
Prof. dr Marijana Ćurčić • *marijana.curcic@pharmacy.bg.ac.rs*
Doc. dr Evica Antonijević Miljaković • *evica.antonijevic@pharmacy.bg.ac.rs*
Asist. dr Katraina Baralić • *katarina.baralic@pharmacy.bg.ac.rs*
Asist. Đurđica Marić • *djurdjica.maric@pharmacy.bg.ac.rs*
Spec. farm. Jovana Živanović • *jovana.zivanovic@pharmacy.bg.ac.rs*

University of Belgrade – Faculty of Pharmacy, Department of Toxicology,
Centre for Toxicological Risk Assessment, Vojvode Stepe 450, 11221 Belgrade, Serbia

TEAM INTRODUCTION: The team consists of university professors and associates, many of whom are European Registered Toxicologists and serve as experts for various ministries. Their primary research focus is to discover how daily exposure to low doses of various substances affects human health, using a multi-disciplinary approach to advance toxicology research, including in silico, toxicogenomic data analysis, and in vivo studies on laboratory animals. They also assess the health risks posed by these substances, aiming to provide a comprehensive understanding of the mechanisms that affect health and contribute to the development of safer public health

RESEARCH AND EQUIPMENT: The team specializes in investigating the toxic effects of microplastic components and their mixtures, such as phthalates, bisphenols, toxic metals, and other substances using LC-MS/MS and AAS. These methods allow for detailed analysis of the toxicological impact and the interaction of microplastics with various chemicals, providing crucial data for assessing their health risks. The team also develops educational materials for the general public, focusing on reducing exposure to toxic substances, especially among pregnant women and young children. These efforts aim to raise awareness and promote safer environmental practices, complementing their research on microplastics and harmful chemicals (**https://www.setox.rs/wp-content/uploads/2022/11/Informator-B5-2022-WEB-22112022.pdf**, **https://www.setox.rs/meetox/**).

KEY PROJECTS AND RESULTS: The team is involved in both international and national projects, including collaborations with partners from China, the First Affiliated Hospital of Zhengzhou University, the National Institute of Environmental Health Sciences, USA, and the Science and Innovation Fund, Serbia. Key outcomes include understanding the impact of toxic substances on human health, risk assessment, exposure reduction measures, and the identification of preventive substances to mitigate the toxic effects of various chemicals and their mixtures.

COLLABORATIONS AND PUBLICATIONS: The team collaborates scientifically with numerous institutions both nationally and internationally, enhancing research efforts and knowledge exchange in the field of toxicology and environmental health. The team publishes around 20 scientific papers annually, many of which are published in prestigious international journals and are often awarded. The research results are available on platforms such as PubMed, SCOPUS, Google Scholar, and other academic databases.

1 Đukić-Ćosić, D. et al. (2022) 'Exploring the relationship between blood toxic metal(oid)s and serum insulin levels through benchmark modelling of human data: Possible role of arsenic as a metabolic disruptor', Environmental Research, 1;215-114283. doi: **https://doi.org/10.1016/j.envres.2022.114283** .

2 Baralić, K. et al. (2023) 'Comprehensive investigation of hepatotoxicity of the mixture containing phthalates and bisphenol A', Journal of Hazardous Materials, 5;445-130404. **https://doi.org/10.1016/j.jhazmat.2022.130404**.

3 Živančević, K. et al. (2024) 'Integrative investigation of hematotoxic effects induced by low doses of lead, cadmium, mercury and arsenic mixture: In vivo and in silico approach', Science of The Total Environment, 930, 172608. **https://doi.org/10.1016/j.scitotenv.2024.172608**.

University of Belgrade, Institute for biological research "Siniša Stanković" – National Institute of the Republic of Serbia:

Interreg VI-B IPA Adriatic Ionian 140 – Adriatic Sea and plastic and microplastic pollution from freshwaters – an Adrion territorial challenge – ADRIPLAST

TEAM MEMBERS & CONTACTS:

Vesna Djikanović • *djiki@ibiss.bg.ac.rs*
Maja Raković • *maja@ibiss.bg.ac.rs*
Stoimir Kolarević • *stoimir.kolarevic@ibiss.bg.ac.rs*
Margareta Kračun Kolarević • *margareta.kracun@ibiss.bg.ac.rs*
Jelena Tomović • *jelena.tomovic@ibiss.bg.ac.rs*
Katarina Jovičić • *katarina.jovicic@ibiss.bg.ac.rs*
Jelena Stanković • *jelena.stankovic@ibiss.bg.ac.rs*

Institute for biological research "Siniša Stanković" – National Institute of the Republic of Serbia, Department of hydroecology and water protection, University of Belgrade, Bulevar despota Stefana 142, 11108 Belgrade

https://www.ibiss.bg.ac.rs/

TEAM INTRODUCTION: The project's objective is to address the growing issue of plastic pollution in aquatic ecosystems, and its detrimental impacts on biodiversity, ecosystems, and human health. The project will concentrate on the identification of significant challenges, including the improper disposal of waste and the use of single-use plastics. The project's principal objectives are: (1). to facilitate cross-border collaboration with a view to sharing best practices and reinforcing regional efforts to combat plastic pollution; (2). to conduct research and monitoring activities to gain a deeper understanding of plastic pollution in aquatic environments and develop strategies to mitigate its impact.

RESEARCH AND EQUIPMENT: The project aims to improve transnational cooperation to understand and address plastic and microplastic pollution (PmPP) in aquatic ecosystems, from rivers to the sea, including water, sediment and biota samples (molluscs, fish). PmPP will be analysed with the stereomicroscope and the polymer type will be determined with microFTIR.

KEY PROJECTS AND RESULTS: With aims to develop a comprehensive roadmap for pollution reduction, increase citizen involvement, and propose a standardized operational protocol (SOP) for monitoring, key themes and ideas are: (1) Source-to-Sea Approach; (2) Standardized Monitoring Protocols (SOPs); (3) Pilot Sites; (4) Citizen Science and Public Awareness; (5) Bio-indicators; (6) Plastic Reduction Roadmap.
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COLLABORATIONS AND PUBLICATIONS: Universitary Consortium for Socioeconomical Research and for the Environment (CURSA), Italija – leading partner, University of Ferrara. Ferrara, Ruđer Bošković Institute, Zagreb, National institute of biology, Ljubljana, Institute of Public Health of Montenegro, Podgorica, National Center of Environmental Movement, Tirana

SEHA Sharjah Environmental Hazards Assessment Research Group, American University of Sharjah

Microplastics investigation in marine stranded species across the United Arab Emirate coastline

TEAM MEMBERS & CONTACTS:

Dr. Lara Dronjak[1,2] • *ldronjak@aus.edu*
Prof. Fatin Samara[1,2] • *fsamara@aus.edu*
Prof. Sofian Kanan[1,2] • *skanan@aus.edu*
Dr. Sandra Knuteson[1,2] • *sknuteson@aus.edu*
Fadi Yaghmour[2,3] • *fadiepaa@gmail.com*

1 Department of Biology, Chemistry and Environmental Sciences, American University of Sharjah, Sharjah, UAE **2** SEHA- Sharjah Environmental Hazards Assessment Research Group, American University of Sharjah, Sharjah, UAE **3** Sharjah Environment and Protected Areas Authority (EPAA), Sharjah, UAE

TEAM INTRODUCTION: The SEHA team specializes in investigating microplastic contamination in marine stranded species, providing critical baseline data on their presence in both organisms and the environment. The research focuses on assessing the extent of microplastic pollution, understanding ingestion and bioaccumulation patterns in different species, and evaluating potential ecological and health risks.

RESEARCH AND EQUIPMENT: SEHA team specializes in identifying microplastic particles using advanced pretreatment methods, including alkaline digestion and density separation, to remove organic and inorganic matter. High-resolution microscopes facilitate visual sorting and identification of suspected particles. The lab is equipped with FTIR spectroscopy for precise polymer characterization, ensuring accurate differentiation of synthetic materials in environmental samples.

KEY PROJECTS AND RESULTS:

1. PDFA25 Stranded but Not Silent: Toxicological Assessment of Marine Organisms along UAE Coasts
2. FRG24-C: Toxicological Assessment of Stranded Marine Organisms from UAE Coasts for Environmental Monitoring

These projects provide the first comprehensive assessment of microplastic contamination in seabirds and sea snakes along the UAE coast. MPs were detected in 100% of examined seabirds (n=20) and 95.24% of sea snakes (n=63). Fibers were the dominant morphology in both taxa, with FTIR analysis confirming polypropylene (PP) and polyamide (PA) as the most common polymers. The high prevalence of MPs ingestion highlights synthetic clothing and wastewater effluent as major sources. These findings emphasize the need for stricter pollution controls to mitigate the impact of MPs on marine biodiversity in the region.

COLLABORATIONS AND PUBLICATIONS:

1 Al Hammadi, M.; Knuteson, S.; Kanan, S.; Samara, F. (2022). Microplastic pollution in oyster bed ecosystems: An assessment of the northern shores of the United Arab Emirates. Environmental Advances, 8, 100214. doi: **https://doi.org/10.1016/J.ENVADV.2022.100214**

2 Dronjak, L., Exposito, N., Rovira, J., Florencio, K., Emiliano, P., Corzo, B., ... & Sierra, J. (2022). Screening of microplastics in water and sludge lines of a drinking water treatment plant in Catalonia, Spain. *Water Research*, 225, 119185. doi: **https://doi.org/10.1016/j.watres.2022.119185**

3 Dronjak, L., Exposito, N., Sierra, J., Schuhmacher, M., Florencio, K., Corzo, B., & Rovira, J. (2023). Tracing the fate of microplastic in wastewater treatment plant: a multi-stage analysis of treatment units and sludge. *Environmental Pollution*, 333, 122072. doi: **https://doi.org/10.1016/j.envpol.2023.122072**

„VINČA" Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia:

Exploring the Biochemical, Physiological, and Behavioural Consequences of Microplastic Consumption in Rats

TEAM MEMBERS & CONTACTS:

Ivana Guševac Stojanović[1] • *igusevac@vin.bg.ac.rs*
Zoran Stojanović[2] • *zoran.stojanovic@itn.sanu.ac.rs*
Jelena Martinović[1] • *jelenazlatkovic@vin.bg.ac.rs*
Dunja Drakulić[1] • *drakulic@vin.bg.ac.rs*
Ana Todorović[1] • *anato@vin.bg.ac.rs*
Nenad Filipović[2] • *nenad.filipovic@itn.sanu.ac.rs*

1 Department of Molecular Biology and Endocrinology, „VINČA" Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia
2 Group for Biomaterials and Biomedical Applications, Institute of Technical Sciences of SASA

https://www.ibiss.bg.ac.rs/

TEAM INTRODUCTION: Our research team is composed of molecular biologists, biochemists, and material scientists working together to investigate the impact of microplastic ingestion. Ivana Guševac Stojanović, Jelena Martinović, Dunja Drakulić, and Ana Todorović are leading experimental studies focusing on microplastic toxicity in young male Wistar rats. Zoran Stojanović and Nenad Filipović bring their expertise in microplastic particle detection and analysis. The team's primary objective is to evaluate the health impacts of polyethylene terephthalate (PET)-derived microplastics, exploring both molecular and physiological effects in rats to better understand their potential risks to humans.

RESEARCH AND EQUIPMENT: The team is investigating the toxicity of PET-derived microplastics in rats. Key equipment includes Fourier-transform infrared (FTIR) spectroscopy for polymer identification, laser diffraction for particle size analysis, and optical microscopy for examining morphology. Following exposure, rats are sacrificed, and key organs (brain, kidneys, heart, liver, lungs, testes, adrenal glands, eyes, and intestines) along with serum, urine and faeces are collected for further analysis. To assess the molecular and physiological effects of microplastic exposure, we employ a variety of techniques, including behavioural and toxicity tests, biochemical assays and Western blot analysis.

KEY PROJECTS AND RESULTS: We successfully generated and characterized PET-derived microplastics and administered them to rats to study their effects on organs such as the kidneys, heart, and liver. Notable changes were observed in food and water intake, together with alterations in specific biochemical markers and oxidative stress indicators. These findings suggest potential dysfunction in the examined organs. Ongoing research will extend this investigation to additional organs and assess the impact of varying doses and particle sizes of microplastics to better understand their systemic effects.

COLLABORATIONS AND PUBLICATIONS:

1 Guševac Stojanović, I. et al. (2024) 'Acute Toxicity Assessment of Orally Administered Microplastic Particles in Adult Male Wistar Rats', Toxics, 12, 167. doi: **https://doi.org/10.3390/toxics12030167**

COST action CA23131 - ISO compatible, efficient and reproducible protocols/equipment for mICro-nanoPLASTIC detection through machine-learning (ICPLASTIC) **https://www.cost.eu/actions/CA23131/**

Agricultural and Food Sciences Faculty – Sarajevo, Pharmaceutical Faculty of Sarajevo and Sarajevo School of Science:

Collection and detection of micro and nano plastic with FTIR and Electromicroscopy

TEAM MEMBERS & CONTACTS:

Enver Karahmet[1] • *enverkarahmet@yahoo.com, e.karahmet@ppf.unsa.ba*
Senita Isaković[2], **Enisa Omanović-Mikličanin**[1], **Fahir Bečić**[3], **Semira Galijašević**[4]

1 University of Sarajevo, Faculty of Agriculture and Food Sciences, Zmaja od Bosne 8, 71000 Sarajevo, Bosnia and Herzegovina **2** PZU GRAL Dejzina Bikića bb, 71000 Sarajevo, Bosnia and Herzegovina **3** University of Sarajevo, Farmaceutical Faculty, Zmaja od Bosne 10, 71000 Sarajevo, Bosnia and Herzegovina. **4** Sarajevo School of Science and Technology. 71000 Sarajevo, Bosnia and Herzegovina

TEAM INTRODUCTION: Dr Enver Karahmet is a full Professor at the University of Sarajevo at the Faculty of Agriculture and Food Science, at Department of Standardization, Special Technologies and Nutrition. Dr Fahir Bečić is a dean of the Faculty of Pharmacy. He is a lecturer on the courses: "Pharmacology", "Methodology of scientific work", "Pharmacotherapy of pain", "Fixed combinations of drugs". Senita Isaković MA is working on Food Controlling and Technology. She was involved in few Projects activities at the local and international level. Dr Enisa Omanović-Mikličanin, is a Full Professor at the Institute of Pedology and Agrochemistry. Department of Applied Chemistry and Biochemistry in Agriculture and Food Technology.
Dr Semira Galijašević is a professor at Sarajevo School of Science and Technology.

RESEARCH AND EQUIPMENT: For the activities in this project, guided primarily by the idea of detecting macroplastics and microplastics, we are using various methods to record the river flow and its surroundings with a drone and sampling (Manta ray) and for differentiation of collected microplastics (FTIR - Furier Infrared Spectroscopy). After that, the collection of plastic would be started, primarily from the banks of the watercourse – it will be physical removal. In the second part of the project, the installation and activation of the collection with adequate booms and the Clean Trash collection cage and its removal in an adequate manner.

KEY PROJECTS AND RESULTS: INSPIRE project's main idea is to integrate the "Innovative Solution for Plastic free European Rivers« into the areas of Bosnia and Herzegovina in its basic idea of reducing micro, meso and macroplastic pollution in waterways. The activities in this project would be guided primarily by the idea of detecting macroplastics and microplastics using various methods, physically, recording the river flow and its surroundings with a drone, sampling (Manta ray) and differentiation of collected microplastics (FTIR - Furier Infrared Spectroscopy) or some other method.

COLLABORATIONS AND PUBLICATIONS:

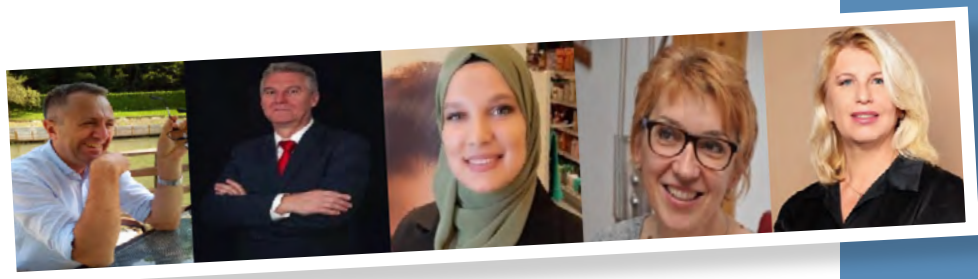
1 E Omanović-Mikličanin, A Badnjević, A Kazlagić, M Hajlovac Nanocomposites: a brief review, Health and Technology 10 (1), 51-59.

2 A Tahirović, A Čopra, E Omanović-Mikličanin, K Kalcher A chemiluminescence sensor for the determination of hydrogen peroxide., Talanta 72 (4), 1378-1385.

3 Karahmet Enver, Senita Isaković, Almir Toroman, Samir Muhamedagić (2024). Shellfish Meat Safety on the Montenegro Coast. Global Research in Environment and Sustainability. Vol 2, Issue 8, October 2024. pp: 33-41. doi: **https://doi.org/10.63002/gres.28.2024**

4 Karahmet, E., Senita Isaković., Toroman, A., Marković, Z., Bezdrob, M., Rakita, N., Alejna Krilić (2024). Characterization of Waste Water from Slaughterhouses and Optimization of Its Final Treatment. Global Research in Environment and Sustainability. Vol 1, Issue 9, December 2024. Pp: 01-08, doi: **https://doi:/1063002/gres.29.2024**.

5 Senita ISAKOVIĆ, Enver KARAHMET, Almir TOROMAN, Lerina SMAJIĆ (2021). Level of pollution of the Miljacka river. 10th Central European Congress on Food (CEFood), Sarajevo. Proceedings of CE-Food 2020, pp: 280-287. Springer, doi: **10.1007/978-3-031-04797-8**



Vinča Institute of nuclear sciences- National Institute of the Republic of Serbia, University of Belgrade:

Detection of microplastic in biological tissue

TEAM MEMBERS & CONTACTS:
Jelena Martinović[1] • *jelenazlatkovic@vinca.rs*
Ivana Guševac Stojanović[1] • *igusevac@vinca.rs*
Zoran Stojanović[2] • *zoran.stojanovic@itn.sanu.ac.rs*
Nenad Filipović[2] • *nenad.filipovic@itn.sanu.ac.rs*

1 Laboratory of molecular biology and endocrinology, Vinča Institute of nuclear sciences- National Institute of the Republic of Serbia, University of Belgrade
2 Group for Biomaterials and Biomedical Applications, Institute of Technical Sciences of SASA

TEAM INTRODUCTION: Our research team, consisting of molecular biologists and material scientists, has recently focused on the investigation of microplastics. Our main goal is to investigate the presence of microplastics in human tissue and explore potential correlations with confirmed pathologies in patients. Zoran and Nenad are responsible for detecting and analyzing microplastics, using their expertise in this field. Ivana and Jelena, as molecular biologists, provide the link between our research and cellular and tissue processes. We also have medical doctors, a pathologist and a surgeon, as associated members who play a crucial role in the planned study.

RESEARCH AND EQUIPMENT: We aim to detect microplastic particles in human biological samples, including histopathological slides previously reviewed by pathologists, and other biological samples using optical microscopy, electron microscopy, FTIR, and Raman spectroscopy. The goal is to develop a method for identifying microplastics in human tissue and fluids, assessing their presence, concentration, and potential effects. Optical microscopy and FTIR spectroscopy, already established in our labs, will be the initial approach. If ineffective, we will explore alternative methods and potential collaborations to advance the investigation

KEY PROJECTS AND RESULTS: We recently initiated our research and are currently refining our methodological approach to effectively detect microplastics in human samples. Additionally, our group has recently published a study on the effects of acute microplastic ingestion on serum biochemical parameters, including markers of organ/tissue function and oxidative stress indicators, in Wistar rats [1].

COLLABORATIONS AND PUBLICATIONS:

1 Guševac Stojanović, I. et al. (2024) 'Acute Toxicity Assessment of Orally Administered Microplastic Particles in Adult Male Wistar Rats', Toxics, 12, 167. doi: **https://doi.org/10.3390/toxics12030167**

COST action CA23131 - ISO compatible, efficient and reproducible protocols/equipment for mICro-nanoPLASTIC detection through machine-learning (ICPLASTIC) **https://www.cost.eu/actions/CA23131/**

Faculty of Chemistry, University of Belgrade: Fundamental and applied research in chemistry Jelena Mutić Lab:

Heavy metals interaction with Microplastics

TEAM MEMBERS & CONTACTS:
Jelena Martinović • *jelenazlatkovic@vinca.rs*
Prof. Jelena Mutić, PhD • *jmutic@chem.bg.ac.rs*
Miloš Ilić, MSc • *ilicm@chem.bg.ac.rs*
Ivana Mikavica, MSc • *i.mikavica@itnms.ac.rs*

Faculty of Chemistry, University of Belgrade, Studentski trg 12-16, 11158 Belgrade

TEAM INTRODUCTION: Prof. Jelena Mutić is a full university professor leading a research group focused on the development and application of analytical methods for isolation of microplastics (MPs); current investigations with team members (students Miloš and Ivana) involve MPs extraction from soil and exploring its interconnection with heavy metals and environmental behavior in ecosystems.

RESEARCH AND EQUIPMENT: The main objectives of our research were to assess the prevalence of MPs in Serbia's (sub)urban soils and reveal potential impacts on metal mobility in the soil-plant system. The concentrations of toxic metals in soil and plant samples were determined by inductively coupled plasma optical emission spectroscopy (ICP-OES). The MPs were identified by Fourier-transform infrared (FTIR) spectroscopy and quantified by the polarizing microscope.

KEY PROJECTS AND RESULTS: Method for MPs isolation from soil samples was developed and validated. Prevalence and potential sources in (sub)urban soils of four cities in Serbia for the first time were assessed. A significant positive correlation between MPs and the phytoavailable content of toxic metals in soil suggests that MPs play a role in the mobility of toxic elements in soil-plant systems. Results demonstrate that MPs in the soil might promote metals availability, improve their migration to plants, and intensify the risks to human health safety and the environment.

COLLABORATIONS AND PUBLICATIONS: This research was conducted in collaboration with the Institute for Technology of Nuclear and Other Mineral Raw Materials and resulted in the publication of the following articles:

1 Mikavica, I. et al. (2024) 'Distribution of microplastics in (sub)urban soils of Serbia and Cd, As, and Pb uptake by Capsella bursa-pastoris (L.) Medik', Chemosphere, Issue 363, 142891, doi: **https://doi.org/10.1016/j.chemosphere.2024.142891**

2 Mikavica, I. et al. (2024) 'Microplastic Sources, Reduction and Remediation: Current State and Future Trends', Metallurgical and Materials Data, Issue 1, No 4, doi: **https://doi.org/10.30544/MMD15**

University of Niš, Faculty of Sciences and Mathematics, Department of Biology and Ecology

Passive and active monitoring of Microplastics

TEAM MEMBERS & CONTACTS:
Đurađ Milošević • *djuradj.milosevic@pmf.edu.rs*
Milica Nikolić • *milica.nikolic@pmf.edu.rs*
Dimitrija Savić Zdravković • *DIMITRIJA.SAVIC@PMF.EDU.RS*
Jelena Stojanović • *jelena.conic@pmf.edu.rs*
Nikola Stanković • *nikola.stankovic@pmf.edu.rs*

Faculty of Sciences and mathematics, University of Niš, Višegradska 33, 18000 Niš, Serbia

TEAM INTRODUCTION: Our team from the University of Niš—comprising Dimitrija Savić Zdravković (ecotoxicology and aquatic toxicology), Đurađ Milošević (freshwater ecology, ecotoxicology, and bioassessment), Milica Nikolić (polymer chemistry and spectroscopic analysis), Jelena Stojanović (histopathology and biomarker development), Nikola Stanković (microbial ecology and cyanotoxin research), and a dedicated group of trained students—brings extensive and interdisciplinary expertise in plastic pollution research. Together, we cover key domains including ecotoxicology, microbiology, polymer chemistry, and freshwater monitoring. As participants in several EU-funded initiatives—including Plastic Underground —we benefit from advanced infrastructure for microplastic aging, analysis, and microbiome studies, supported by our collaboration with Polymateria Ltd. (UK) and other international partners.

RESEARCH AND EQUIPMENT: As part of the consortium, the University of Niš focuses on bioturbation as a key driver of micro- and nanoplastic (MnP) transport through sediment and soil into groundwater. Plastics will be weathered in a natural karst lake, followed by in situ experiments tracking MnP movement influenced by aquatic and soil fauna. In parallel, laboratory models simulating karst ecosystems will provide controlled insights into biotic and abiotic transport mechanisms. This dual approach enhances understanding of MnP behaviour in vulnerable karst environments, supporting improved risk assessment and informing mitigation strategies for subsurface plastic pollution.

KEY PROJECTS AND RESULTS: The PlasticUnderground Doctoral Network addresses this challenge by creating a supra-disciplinary, intersectoral capacity for analysing the fate, transport, and impacts of MnP in soils and groundwater, in support of the European Commission's circular plastic economy strategy. The central aim of the PlasticUnderground network is to deliver international scientific excellence through a holistic research and training programme, integrating expertise across environmental and social sciences, ecotoxicology, soil science, aquatic ecology, analytical chemistry, agronomy, data science, numerical modelling, responsible innovation, method standardisation, regulatory science, and risk assessment. A cohort of 10 Doctoral Candidates (DCs) will benefit from unique interdisciplinary training, with additional Associated Partners supporting extended research and capacity building.

COLLABORATIONS AND PUBLICATIONS:

Sebteoui, K., Milošević, D., Stanković, J., Baranov, V., Jovanović, B., Krause, S., & Csabai, Z. (2024). Beneath the surface: Decoding the impact of Chironomus riparius bioturbation on microplastic dispersion in sedimentary matrix. Science of The Total Environment, 919, 170844.

Sebteoui, K., Csabai, Z., Stanković, J., Baranov, V., Jovanović, B., & Milošević, D. (2025). Downsizing Plastics, Upsizing Impact: How Microplastic Particle Size Affects Chironomus riparius bioturbation activity. Environmental Research, 121055.

Yıldız, D., Yalçın, G., Jovanović, B., Boukal, D. S., Vebrová, L., Riha, D., ... & Beklioğlu, M. (2022). Effects of a microplastic mixture differ across trophic levels and taxa in a freshwater food web: In situ mesocosm experiment. Science of the Total Environment, 836, 155407.

University of Belgrade, Institute for Application of Nuclear Energy (INEP), Department for Reproductive Biology:

Human reproduction with a focus on the biology of the placenta and trophoblast function in physiological and pathological pregnancy

TEAM MEMBERS & CONTACTS:

Milica Jovanović Krivokuća, PhD, Principal Research Fellow • *milicaj@inep.co.rs*
Mirjana Nacka-Aleksić, PhD, Senior Research Associate • *mnacka@inep.co.rs*
Andrea Pirković, PhD, Senior Research Associate • *andrea.pirkovic@inep.co.rs*
Aleksandra Vilotić, PhD, Senior Research Associate

University of Belgrade, Institute for Application of Nuclear Energy (INEP), Department for Reproductive Biology; Banatska 31b; 11080 Zemun; Serbia

TEAM INTRODUCTION: The selected team members bring expertise in cell and tissue culture, molecular biology, immunology, toxicology and pharmacology. With backgrounds spanning biologists, a molecular biologist and a medical doctor, we focus on exploring factors impacting embryo implantation and pregnancy conditions such as pre-eclampsia and early pregnancy loss, while also investigating regenerative medicine and immunomodulatory properties of placental cells. Overall, the members of our department are dedicated to investigating the modulatory potential of endogenous factors, environmental pollutants and food-derived bioactive components on early pregnancy processes, trophoblast-derived extracellular vesicle biology, and are currently acquiring expertise on advanced tissue modeling using a 3D bioprinter.

RESEARCH AND EQUIPMENT: HTR-8/SVneo cells were used to model human trophoblast invasion and investigate the effects of 40 nm and 200 nm carboxylated polystyrene particles on early-pregnancy trophoblast function and the putative mechanisms. We found that exposure to high concentrations of 40 nm particles disrupted extravillous trophoblast phenotype and invasive behavior. Our research was performed in collaboration with the University of Kragujevac, Institute of Information Technologies, Laboratory for Bioengineering and Faculty of Medical Sciences, Department of Genetics. We used standard equipment for cell culture, mRNA and protein expression analysis, DNA damage analysis, epifluorescence microscopes Olympus IX73, Zeiss Axio Imager A1, ZetaView (multiparameter NTA sizing, counting and zeta potential determination).

KEY PROJECTS AND RESULTS: Institutionally founded research topics: "Factors regulating physiological and pathological processes in early pregnancy" (Ministry of Science, Technological development and Innovation),"Trophoblast and extra-embryonic fetal cells: plasticity, differentiation factors and in vitro modulation of functional characteristics" (Ministry of Science and Technological development), "Cellular interactions and molecular mechanisms in differentiation of cells at the fetal-maternal interface" (Ministry of science and technological development), European Network for Skin Engineering and Modeling (NETSKINMODELS) – COST action CA21108, Targeting Cell Senescence to Prevent Age-Related Diseases (SENESCENCE2030) – COST action 23119.

COLLABORATIONS AND PUBLICATIONS:

1 Nacka-Aleksić M, Vilotić A, Pirković A, et al. (2025). Nano-scale dangers: Unravelling the impact of nanoplastics on human trophoblast invasion. *Chemico-biological interactions*, 405, 111317. doi: **https://doi.org/10.1016/j.cbi.2024.111317**

2 Legner J, Jovanović Krivokuća M, Vilotić A, et al. (2024). Galectin-8 Contributes to Human Trophoblast Cell Invasion. International journal of molecular sciences, 25(18), 10096. doi: **https://doi.org/10.3390/ijms251810096**

3 Kostić S, Vilotić A, Pirković A, et al. (2022). Caffeic acid protects human trophoblast HTR-8/SVneo cells from H2O2-induced oxidative stress and genotoxicity. Food and chemical toxicology : an international journal published for the British Industrial Biological Research Association, 163, 112993. doi: **https://doi.org/10.1016/j.fct.2022.112993**

University of Belgrade, Institute of Molecular Genetics and Genetic Engineering (IMGGE):

Group for Eco-biotechnology and drug development

TEAM MEMBERS & CONTACTS:

Dr. Jasmina Nikodinović-Runić • *jasmina.nikodinovic@imgge.bg.ac.rs*
Dr Sandra Vojnović • *sandra.vojnovic@imgee.bg.ac.rs*
Dr Tatjana Ilić-Tomić • *tatjana.ilic-tomic@imgge.bg.ac.rs*
Dr Marijana Ponjavić • *marijuana.ponjavic@imgge.bg.ac.rs*
Dr Jelena Milovanović • *jelena.milovanovic@imgge.bg.ac.rs*
Dr Ivana Aleksic • *ivana.aleksic@imgge.bg.ac.rs*
Dr Dusan Milivojević • *dusan.milivojevic@imgge.bg.ac.rs*
Dr Milica Ćirić • *milica.ciric@imgge.bg.ac.rs*
Dr Vuk Filipović • *vuk.filipovic@imgge.bg.ac.rs*
Dr Sanja Skaro-Bogojević • *sanja.bogojevic@imgee.bg.ac.rs*
Dr Jelena Simić • *jelena.simic@imgge.bg.ac.rs*
Dr Brana Pantelić • *brana.pantelic@imgge.bg.ac.rs*
Vukasin Janković • *vukasin.jankovic@imgge.bg.ac.rs*
Marija Kokić • *marija.nenadovic@imgge.bg.ac.rs*
Lena Pantelić • *lena.pantelic@imgge.bg.ac.rs*
Nikola Radivojević • *nikola.radivojevic@imgge.bg.ac.rs*

Institute of Molecular genetics and genetic engineering, University of Belgrade, Vojvode Stepe 444a, Belgrade Serbia

TEAM INTRODUCTION: We are a group of 16 researchers at various stages of scientific careers and different backgrounds, including molecular biology, biochemistry, organic chemistry, polymer science, veterinary science and microbiology. Our work merges biology and chemistry, focusing on eco-sustainable solutions for mitigating plastic pollution and other global concerns. Through the study of microbial metabolism, we drive advancements in biocatalysis, synthetic biology, and eco-friendly technologies. Our research addresses critical issues like plastic waste management, antibiotic resistance, and eco-friendly biopharmaceuticals, contributing to a greener future.

RESEARCH AND EQUIPMENT: We use microorganisms and enzymes to upcycle plastic waste into valuable compounds and biomaterials, offering sustainable alternatives to petrochemical plastics. Through microbial depolymerization, we capture monomers from various plastics and convert them into biopolymers and other useful byproducts, reducing micro- and nano-plastic pollution. Within the Centre for Industrial Biotechnology equipment includes: BioSan multi-channel bioreactor RTS-8, Biotehniskais centres 5 and 20 L fermenters, GNGQ076 high-speed tubular centrifuge, Pilotech YC-015A inert loop spray dryer, UltiMate 3000 UHPLC, TSQ Fortis™ Plus LC-MS/MS and ÄKTA go™ FPLC system. Our Microscopy unit consists of Phase contrast microscopes, Olympus fluorescence microscope BX51, Leica TCS SP8 confocal scanning microscope and Leica Thunder.

KEY PROJECTS AND RESULTS:

BioPEs (2025-2028) HORIZON-EIC-2024-Pathfinder– Development of Bio-based and biodegradable polyethylene and polyesters for packaging and agricultural applications

EcoPlastiC (2022-2025) Horizon-EIC, Pathfinder - Eco-conversion of lower-grade PET and mixed recalcitrant PET plastic waste into high-performing biopolymers

BioECOLogics (2021-2024) Science Fund RS IDEAS- Value-added biologics through eco-sustainable routes

Twinn4MicroUP (2024-2027) EC, HORIZON-WIDERA Twinning -Twinning Innovation Hub for Microbial Platforms in Plastic Upcycling

BioPolyCycle (2023-2025) ANSO - Bioplastics upcycling loop

PHOBioDepolyIMPROVE (2024-2026) Bilateral project Serbia- Turkey- Polyhydroxyalkanoate bioplastics depolymerizing enzyme improvement for more robust biotechnological applications

COLLABORATIONS AND PUBLICATIONS:

1 Djapovic M. et. al. (2021) Synthesis and characterization of polyethylene terephthalate (PET) precursors and potential degradation products: Toxicity study and application in discovery of novel PETases, Chemosphere, 275, p.130005 doi: **https://doi.org/10.1016/j.chemosphere.2021.130005**

2 Pantelic B. et. al. (2024) Proteomic examination of polyester-polyurethane degradation by *Streptomyces* sp. PU10: Diverting polyurethane intermediates to secondary metabolite production. Microb Biotechnol. 17, p.14445. doi: **https://doi.org/10.1111/1751-7915.14445**

Faculty of Mining and Geology, University of Belgrade
Department of Hydrogeology:

Project: MicroDrink - Capacity building for management and governance of MICROplastics in DRINKing water resources of Danube Region

TEAM MEMBERS & CONTACTS:
Dr Saša Milanović, associate professor • *sasa.milanovic@rgf.bg.ac.rs*
Dr Ljiljana Vasić, assistant professor • *ljiljana.vasic@rgf.bg.ac.rs*
Dr Branislav Petrović, research associate • *branislav.petrovic@rgf.bg.ac.rs*
Dr Veljko Marinović, research associate • *veljko.marinovic@rgf.bg.ac.rs*
Dr Dušan Polomčić, full professor • *dusan.polomcic@rgf.bg.ac.rs*
Petar Vojnović, research intern • *petar.vojnovic@rgf.bg.ac.rs*
Jelena Ratković, researcher • *jelena.mocevic@rgf.rs*
Mirjana Petronijević, dipl. ecc

Faculty of Mining and Geology, Đušina 7, 11000 Belgrade, Serbia

TEAM INTRODUCTION: The Faculty of Mining and Geology, is one of 11 participants in the project "MicroDrink - Capacity building for management and governance of MICROplastics in DRINKing water resources of Danube Region" co-funded by the European Union, approved in the first call of the The Interreg Danube Region Programme (DRP) 2021-2027. The implementation of the project began on 1.1.2024, and the Croatian Geological Institute (HGI) has the role of project leader. During the planned duration of 30 months, 11 project partners (https://interreg-danube.eu/projects/microdrink/about-us) will be engaged in researching the growing and ubiquitous problem of microplastics in water resources used for water supply.

Fig. 1 MicroDrink team

RESEARCH AND EQUIPMENT: Techniques such as FTIR and Raman spectroscopy are among the most commonly used due to their ability to provide detailed analysis and identification of plastic polymers. However, these methods come with drawbacks, including high costs, the need for specialized training, and their time-intensive nature. Other techniques, such as Py-GCMS and SEM, are also utilized, but their availability and use largely depend on the resources and priorities of each country. The MicroDrink project will contribute to the standardization of sampling and analysis methods, as well as to the strengthening of cooperation between public administrations, water supply companies and the scientific community, as well as to the improvement of relations between the countries of the Danube region.

KEY PROJECTS AND RESULTS: Among the several issues, one of the critical ones is a lack of standardization across the region, with some countries having modern and state-of-the-art equipment while the others are still in the process of building their capacity. The research on the presence of microplastics in drinking water resources will be carried out in 9 pilot areas in all 8 countries. The project partnership created an online database with a comprehensive overview of sampling methods, laboratory instruments and analytical procedures, and will create a tool to assist in decision-making in case of risk of increased microplastic content in water supply systems.

Foodscale Hub, FSH

TEAM MEMBERS & CONTACTS:
Mladen Radišić • *mladen@foodscalehub.com* / **+381 64 144 70 48** /
https://foodscalehub.com/team/prof-mladen-radisic/
Olivera Stojilović Trivunić • *olivera@foodscalehub.com* /
https://foodscalehub.com/team/olivera-stojilovic/
Gordana Racić • *gordana@foodscalehub.com* /
https://foodscalehub.com/team/gordana-racic/

Foodscale Hub, Trg Dositeja Obradovića 8, Serbia

TEAM INTRODUCTION: FSH is a dynamic hub for innovation, collaboration, and impact, positioned at the heart of the Water, Energy, Food, and Ecosystem (WEFE) Nexus, employing over 30 people across offices in Novi Sad, Serbia, and Osijek, Croatia. FSH blends excellence in research and innovation with a hands-on approach to empowering ecosystems, driving progress, and fostering inclusivity. Our team's expertise advances the agricultural sector, food sustainability, climate neutrality, the circular economy, bio-based value chains, energy efficiency, rural development, and sustainable land use. We drive practical outcomes by bridging academia and industry, supporting startups, and scaling ventures.

RESEARCH AND EQUIPMENT: FSH expertise fosters collaboration and sustainable growth across diverse areas: dissemination, communication, ecosystem building, intellectual property management, business modeling, cascade funding, piloting, training, and life cycle assessment for sustainability analytics. FSH is partner in InPlasTwin [1] project whose main objective is to strengthen the research and innovation capacity in the analysis of micro and nanoplastic (MNPs) in the environment and food through networking, knowledge sharing, and research activities between Jožef Stefan Institute and Agricultural University of Athens and leading research institutions in Europe, and to advance the understanding of MNPs' environmental and food-related impacts with a focus on agriculture.

KEY PROJECTS AND RESULTS: FSH leads in capacity building and business support, internationalization and access to finance, communication, go-to-market strategies and business model innovation, and the design and development of international R+D projects, such as Horizon Europe projects [1, 2, 3]. FSH is leader of the InPlasTwin work packages dedicated to enlarging the impact of project results and research through strategic dissemination, communication, exploitation, and sustainability strategies. Collaboration with FSH is envisaged to increase partner research profiles and social impact and help raise awareness of plastics pollution in the agri-food sector among the wider population at regional, national, EU, and global levels.

COLLABORATIONS AND PUBLICATIONS: Foodscale Hub is part of influential networks that amplify our impact and extend our reach. Through our memberships in renowned organizations like: Smart Sensors 4 Agri-food, Bio4Circularity and Bio-Based Industries Consortium, we gain access to cutting-edge knowledge, resources, and global partnerships.

1 Increasing expertise in micro- and nanoplastics analysis through twinning action – InPlasTwin, Grant agreement ID: 101160289, doi: **https://doi.org/10.3030/101160289**
2 Multi-Actor Research and Innovation Approaches for Functional Food – RIA4FOOD, Grant agreement ID: 101131479, doi: **https://doi.org/10.3030/101131479**
3 Advanced Sustainable Biofuels Production from Purified Microalgae and Oleaginous Yeasts via Integrated Solar Hydrothermal Liquefaction - SUNFUSION, Grant agreement ID: 101172945, doi: **https://doi.org/10.3030/101172945**

Ministry of Environmental Protection:

Regulatory Competent Authority for Risk Management of Microplastics (MPs) and MPs - added Products

TEAM MEMBERS & CONTACTS:

Sonja Roglic, MSc. Chem. Head of Depart. for Chemicals

• *sonja.roglic@eko.gov.rs* / +381 11 7155 203

Ivan Djurickovic, MSc. Chem. Eng., Senior adviser for systematic monitoring of chemicals, Depart. for Chemicals

•*ivan.djurickvoic@eko.gov.rs* / +381 11 7155 203

Ministry of Environmental Protection of the Republic of Serbia,
Omladinskih Brigada 1, Belgrade, Serbia

TEAM INTRODUCTION:

Ms. Roglic graduated from the Faculty of Chemistry at the University of Belgrade.
She has been director of many international projects related to chemicals management on behalf of the MEP including ongoing UNDP project "Further strengthening of national capacity and risk management of hazardous substances throughout their life cycle" funded by UNEP SP related to regulatory affairs on restriction of MPs added products.

Mr. Djurickovic graduated from the Faculty of Technology and Metallurgy in Belgrade. He has been involved in the realization of many international projects related to chemicals and waste management. Currently, he is the Project board member of the UNDP project "Further strengthening of national capacity and risk management of hazardous substances throughout their life cycle" funded by UNEP SP related to risk assessment of MPs. His PhD research is related to biodegradability of polymers by different types of microorganisms.

RESEARCH AND EQUIPMENT: Project team from the MEP is dealing with regulatory affairs related to chemicals safety management including restrictions on MPs and nanomaterials and development of the Inventory of these MPs and NMs added products from the Serbian market.

KEY PROJECTS AND RESULTS: The project is intended to further strengthen the national capacity of the Government of Serbia and risk management of hazardous substances throughout their lifecycle. There are three substantive proposed goals:

- Strengthening the policy framework and implementation of regulatory framework for chemicals and waste sound management in accordance with the BRS-M Conventions
- Building capacity of industry and raising awareness of the general public on chemicals and waste management;
- Identifying products containing nanomaterials and intentionally added microplastics that represent unacceptable health and environmental risk in the country.

COLLABORATIONS AND PUBLICATIONS:

Project link: **https://www.unep.org/serbia**

Institute of Technical Sciences of SASA:

Leveraging LLMs for Knowledge Extraction in Microplastics Research: Practical Approaches and Tools

TEAM MEMBERS & CONTACTS:

Zoran Stojanović[1] • *zoran.stojanovic@itn.sanu.ac.rs*
Ivana Guševac Stojanović[2] • *igusevac@vin.bg.ac.rs*
Jelena Martinović[2] • *jelenazlatkovic@vin.bg.ac.rs*
Nenad Filipović[1] • *nenad.filipovic@itn.sanu.ac.rs*

1 Group for Biomaterials and Biomedical Applications, Institute of Technical Sciences of SASA
2 Department of Molecular Biology and Endocrinology, „VINČA" Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, Belgrade, Serbia

TEAM INTRODUCTION: Our research team combines expertise in materials science and molecular biology to investigate the biological impacts of microplastics. Zoran Stojanović and Nenad Filipović specialize in the detection and characterization of microplastics, focusing on size, morphology and chemical composition. Ivana Guševac Stojanović and Jelena Martinović bring expertise in molecular biology, working with animal and human cell and tissue samples. We study varying sizes and doses of these particles in rats, while also developing methods to identify microplastics in human tissues, exploring the potential health implications.

RESEARCH AND EQUIPMENT: In our investigation, we utilize different technologies to detect and analyze microplastics from biological tissues, such as optical microscopy for morphological examination, along with Fourier Transform Infrared (FTIR) spectroscopy for chemical composition analysis, and laser diffraction for assessing the size distribution of microplastic particles. Along with experimental work in laboratories, we have leveraged recent state-of-the-art tools for text processing and LLMs such as GPT, Claude, Mistral, DeepSeek to aid our research. We are using these tools to extract knowledge from original research articles and get valuable insights on protocols for microplastic isolation, characteristics and toxicity.

KEY PROJECTS AND RESULTS: By integrating advanced tools to parse scientific PDFs, classify and extract from text, we have easily automated the retrieval of key information, identifying trends and data points in the field. Our findings illustrate that LLMs can significantly boost the efficiency and accuracy of knowledge extraction, providing researchers with powerful means to automatically review extensive literature data. The approach successfully identifies emerging trends and mitigation strategies, underscoring the potential of AI-driven methods in advancing research on microplastics.

COLLABORATIONS AND PUBLICATIONS:

1 Guševac Stojanović, I. et al. (2024) 'Acute Toxicity Assessment of Orally Administered Microplastic Particles in Adult Male Wistar Rats', Toxics, 12, 167. doi: **https://doi.org/10.3390/toxics12030167**

COST action CA23131 - ISO compatible, efficient and reproducible protocols/equipment for mICro-nanoPLASTIC detection through machine-learning (ICPLASTIC) **https://www.cost.eu/actions/CA23131/**

Educons University, Faculty of Environmental Protection Centre for microplastics

TEAM MEMBERS & CONTACTS:
Prof. Dr Nataša Stojić • *natasa.stojic@educons.edu.rs*
Prof. Dr Dunja Prokić • *dunja.prokic@educons.edu.rs*
Prof. Dr Ljiljana Milošević • *ljilana.curcic@educons.edu.rs*
MSc Galina Ćurčić • *galina.curcic@educons.edu.rs*
Prof. Dr Mira Pucarević • *mira.pucarevic@educons.edu.rs*

1 Educons University, Faculty of environmental protection, SremskaKamenica, Vojvode Putnika 87, Serbia

https://educons.edu.rs/

TEAM INTRODUCTION: Team introduction: The team at the Centre for Microplastics, Faculty of Environmental Protection, Educons University, is dedicated to advancing research on microplastic contamination and its environmental impact. With expertise in environmental science, analytical chemistry, and pollution assessment, the team focuses on identifying, monitoring, and developing strategies for mitigating microplastic pollution. Their collaborative approach combines cutting-edge laboratory techniques with interdisciplinary research to contribute to sustainable environmental solutions.

Prof. Dr Mira Pucarević | Prof. Dr Dunja Prokić | Prof. Dr Nataša Stojić | Prof. Dr Ljiljana Milošević | MSc Galina Ćurčić

RESEARCH AND EQUIPMENT: The team specializes in the analysis of microplastics in environmental samples, with a focus on soil and water. Using advanced spectroscopy techniques, we have developed a reliable method for microplastic identification and quantification. Our research is supported by the µFTIR LUMOS II, enabling precise chemical characterization of synthetic polymers. By integrating innovative analytical approaches, the team contributes to a deeper understanding of microplastic distribution and its impact on ecosystems.

KEY PROJECTS AND RESULTS: We are deeply engaged in international research on microplastic pollution, particularly through our involvement in the Horizon project "Greenland – Microplastics Free Environment," in collaboration with Alfred Wegener Institute (Germany) and the University of Galway (Ireland). In this project, we lead efforts to analyze microplastics in soil and water, aiming to assess and understand environmental contamination. As part of the "Greenland" project, we have developed a highly precise method for microplastic analysis. Additionally, through the IPA project "ECO(RE)ACT," in partnership with Croatian institutions, we explore the impact of agricultural activities on microplastic pollution. Through these project, we have established the Centre for Microplastics and fully equipped its laboratory.

University of Novi Sad, Faculty of Technology Novi Sad, Department of Materials Engineering Group for Study of Microplastics

TEAM MEMBERS & CONTACTS:

Vesna Teofilović • *vesnateofilovic@uns.ac.rs* / +381-21-485-3760 /
https://www.tf.uns.ac.rs/katedra-08/535-dr-vesna-teofilovic.html
Tamara Erceg • *tamara.erceg@uns.ac.rs* / +381-21-485-3760 /
https://www.tf.uns.ac.rs/katedra-08/536-dr-tamara-erceg.html
Jelena Tanasić • *jelenatanasic@uns.ac.rs* / +381-21-485-3760 /
https://www.tf.uns.ac.rs/katedra-08/546-jelena-tanasic.html

University of Novi Sad, Faculty of Technology Novi Sad, bul. Cara Lazara 1, Novi Sad, Serbia

TEAM INTRODUCTION: Team is consisted of three doctors in the field of Polymer Science: one Research Assistant and two Senior Research Associates. Area of scientific interest are synthesis of novel materials (polymers, biopolymers, functionalization of biopolymers with a special emphasis on green chemistry and edible coatings); contemporary technological processes (conversion of waste into valuable molecules and biomaterials, bioremediation, recycling); ecology (microplastics, pesticides in water and soil); circular economy (use of natural, biorenewable and biodegradable raw materials, waste as a resource).

RESEARCH AND EQUIPMENT: Fourier transformative infra-red spectroscopy (FT-IR), Differential scanning calorimetry (DSC), Dynamico-mechanical analysis (DMA), Accelerated aging chamber (UV, temperature,humidity).

KEY PROJECTS AND RESULTS:

1. Bilateral cooperation Turkiye – Serbia: „Advanced biodegradable hydrogels development for controlled delivery of fertilizer in sustainable vegetable production“
2. Bilateral cooperation France – Serbia: „Influence of aging on microplastics Identification
3. NATO Science for Peace and Security (SPS) Programme: „Wearable smart patches for multimodal wound healing“;
4. Horizon Europe: Twinning microplastic free environment;
5. COST Action: Plastics monitoring detectiOn RemedIaTion recoverY – PRIORITY

COLLABORATIONS AND PUBLICATIONS:

Balla, A.; Teofilovic, V.; Kiss, T. Microplastic Contamination of Fine-Grained Sediments and Its Environmental Driving Factors along a Lowland River: Three-Year Monitoring of the Tisza River and Central Europe. Hydrology 2024, 11, 11. doi: **https://doi.org/10.3390/hydrology11010011**

Erceg, T., Vukić, N., Šovljanski, O., Teofilović V., Porobić S., Baloš S., Kojić S., Terek P., Banjanin B, Rakić S; Preparation and characterization of biodegradable cellulose acetate-based films with novel plasticizer obtained by polyethylene terephthalate glycolysis intended for active packaging. Cellulose 30, 5825–5844 (2023). doi: **https://doi.org/10.1007/s10570-023-05240-6**

Ristić, I.; Nikolić, L.; Cakić, S.; Nikolić, V.; Tanasić, J.; Zvezdanović, J.; Krstić, M. Eco-Friendly Microwave Synthesis of Sodium Alginate-Chitosan Hydrogels for Effective Curcumin Delivery and Controlled Release. Gels 2024, 10, 637. doi: **https://doi.org/10.3390/gels10100637**

EQUIPMENT DEMONSTRATION

PerkinElmer
TECHNOLOGIES FOR MICROPLASTICS ANALYSIS

As part of Microplastics for Breakfast – Serbia, participants had the opportunity to attend live demonstrations of cutting-edge techniques for detecting and characterizing microplastics, presented by PerkinElmer. Two key technologies — FT-IR Microscopy and SP-ICP-MS — were showcased through real-world applications and expert discussions, providing valuable insights into how these methods can be integrated into research workflows.

FT-IR MICROSCOPY FOR MICROPLASTICS IDENTIFICATION

FT-IR (Fourier Transform Infrared) microscopy is a powerful technique for detecting and identifying microplastic particles in environmental samples. It allows analysis of even the smallest plastic fragments by combining the spectroscopic capabilities of the PerkinElmer Spectrum Two FT-IR system with the Spotlight 200i microscope. This method enables fast and reliable polymer type identification — essential for the analysis of water, soil, and complex sample matrices.

Presented by: Roberto Ferrero Guerra
Application Specialist, PerkinElmer
Contact: LinkedIn

Mr. Ferrero Guerra is an electronics engineer with over 20 years of experience at PerkinElmer. For the past 18 years, he has worked as a technical support specialist in spectroscopy and microscopy, including infrared and confocal techniques. In the last three years, his focus has shifted toward customer applications and support. Before joining PerkinElmer, he worked for eight years as a service and application technician in elemental analysis.

SP-ICP-MS FOR QUANTITATIVE ANALYSIS OF MICRO- AND NANOPLASTICS

Single Particle Inductively Coupled Plasma Mass Spectrometry (SP-ICP-MS) is an advanced technique designed for the detection and quantification of micro- and nanoplastics in complex samples. Using the 13C isotope for particle identification and equipped with a sophisticated sample introduction system (Asperon™ chamber and High Efficiency Nebulizer), this method ensures high transport efficiency of particles to the plasma and enables reliable quantification — even at the nanoscale. Low dwell times help reduce background noise, making SP-ICP-MS ideal for screening applications and for use in combination with FT-IR analysis.

Presented by: Dr. Helmut Ernstberger
Application Specialist, PerkinElmer
Contact: LinkedIn

Dr. Ernstberger is an analytical chemist with extensive experience in both academia and industry. For the past eight years, he has supported emerging markets from PerkinElmer's Milan office, specializing in inorganic analytical techniques. Prior to that, he held application scientist positions in the US and UK and began his career as a project engineer, university lecturer, and laboratory manager.

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Founded in 1993 as a privately owned company with 100% domestic capital, SUPERLAB is today one of the leading providers of laboratory equipment in Serbia. Through an extensive network of partnerships, SUPERLAB distributes products from over 100 renowned global manufacturers of laboratory and analytical equipment, chemicals, and consumables.

The company is dedicated to delivering comprehensive support — from equipment selection and application consulting, to technical assistance, servicing, and consistent supply of consumables. With a strong commitment to quality, expertise, and open collaboration, SUPERLAB has become a reliable partner to the scientific and educational community.

At Microplastics for Breakfast – Serbia, SUPERLAB played a key role as the initiator, main sponsor, and host of the event. Their contribution — from organizing equipment demonstrations to creating an open and inspiring environment — was instrumental in making the event valuable and memorable for all participants.

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PARTNERS

Faculty of Sciences, University of Novi Sad

The Department of Chemistry, Biochemistry, and Environmental Protection has extensive experience in chemical analysis, pollutant monitoring, and waste management. Through participation in international projects, the faculty actively contributes to the development of methodologies for microplastics detection and the education of young researchers in this field.

https://www.pmf.uns.ac.rs/en/

COST Action PRIORITY (CA20101)
This initiative is part of the COST (European Cooperation in Science and Technology) program, which funds research and innovation networks. The goal of COST Actions is to connect researchers across Europe, strengthening collaboration, knowledge exchange, and the development of new scientific directions.

www.cost.eu
https://ca-priority.eu

Educons University, Sremska Kamenica

Educons University focuses on modern approaches to sustainable development and ecology, with a strong emphasis on interdisciplinary education and the practical application of scientific knowledge. Through research and educational initiatives, the university contributes to understanding the impacts of microplastics and finding solutions for a cleaner environment.

https://educons.edu.rs

GREENLand – Horizon Europe (Grant Agreement No. 101079267)
This project is part of the Horizon Europe program and aims to strengthen scientific excellence through partnerships and knowledge development in the field of microplastics. The project focuses on developing strategies and approaches for a microplastics-free environment through networking and capacity-building among researchers.

https://project-greenland.com

MICROPLASTICS FOR BREAKFAST

Our Goal

The Microplastics for Breakfast initiative aims to strengthen collaboration and knowledge exchange on micro- and nanoplastics over the coming year in the Adriatic region. Through a series of events, cross-border networking, and joint initiatives involving at least three Western Balkan countries, we seek to bring this critical topic to the forefront of public awareness.

Our objectives are to make scientific data accessible, dispel common misconceptions, and foster meaningful dialogue between researchers, policymakers, industry, commerce, the public sector, and civil society. Above all, we strive to create a community where scientists can meet, learn, collaborate — and enjoy the process.

Our founder

Andreja Palatinus

Andreja Palatinus is a pioneering microplastics researcher in the Adriatic Sea and a specialist with over 15 years of experience in marine litter and microplastics management. After many years in academic research, she transitioned into leadership roles and later entered the private sector. In 2023, she founded the Slovenian Microplastics Researchers Community and launched the Microplastics for Breakfast initiative with the goal of uniting and empowering micro- and nanoplastics researchers across the Adriatic region. As an independent entrepreneur, she leads this initiative with a focus on enhancing cooperation between researchers and the private sector.

POSLOVNO SVETOVANJE
Andreja Palatinus s.p.

Contact: https://www.linkedin.com/in/andreja-palatinus-35612758/

CONTACT LIST

A

Aleksandar Šmit
Public Utility Company Drugi Oktobar Vršac
aleksandar.smit@oktobar.rs

Aleksandra Ivanoska-Dacik
Macedonian Academy of Sciences and Arts
aivanoska@manu.edu.mk

Aleksandra Tubić
University of Novi Sad, Faculty of Sciences
aleksandra.tubic@dh.uns.ac.rs

Amel Salihagić
Public Utility Company "Water Supply and Sewerage" Ltd. Sarajevo
amel.salihagic@viksa.ba

Ana Hrabar
SUPERLAB
ahrabar@superlab.rs

Ana Stanisavljev
City Institute for Public Health Belgrade
anakomanovic@gmail.com

Andrea Pirković
Institute for the Application of Nuclear Energy – INEP
andrea.pirkovic@inep.co.rs

Andreja Palatinus
Microplastics for Breakfast
info@microplasticsforbreakfast.com

Anđelija Ilić
Institute of Physics Belgrade, Pregrevica 118, Belgrade-Zemun
andjelijailic@ieee.org

Angelina Mitrović
Ministry of Environmental Protection
angelina.mitrovic@eko.gov.rs

Anja Babić
Center for Ecotoxicological Research Podgorica
anja.babic@ceti.me

B

Biljana Bumbić
Institute for Occupational Safety
biljana.bumbic@institut.co.rs

Biljana Ljubenović
Institute for Public Health Niš
hemijaizjznis@gmail.com

Bisa Amidžić
IHTM Lab
bisa.amidzic@ihtm.rs

Bojana Knežević
Center for Ecotoxicological Research Podgorica
bojana.knezevic@ceti.me

Bojana Petrović
Sanitary Medical School of Applied Sciences "Visan",Belgrade
bojanapetrovich@yahoo.com

Branislav Petrović
University of Belgrade, Faculty of Mining and Geology
branislav.petrovic@rgf.bg.ac.rs

Branka Hadžić
Institute of Physics Belgrade
branka@ipb.ac.rs

Brankica Kartalović
BioSens Institute
brankica.kartalovic@biosense.rs

D

Danica Bogdanović
Faculty of Sciences Niš
dannica.milojkovic@gmail.com

Danijela Đukić-Ćosić
University of Belgrade - Faculty of Pharmacy
danijela.djukic.cosic@pharmacy.bg.ac.rs

Danijela Lukić
Institute for Public Health of Vojvodina
danijela.lukic@izjzv.org.rs

Danijela Ridjić
SUPERLAB
dridjic@superlab.rs

Dario Jovišić
Institute for Public Health Sombor
hemija@zzjzsombor.org

Dijana Mihajlović
Faculty of Agriculture, University of Banja Luka
dijana.mihajlovic@agro.unibl.org

Dimitrija Savić Zdravković
Faculty of Sciences, University of Niš
dimitrija.savic@pmf.edu.rs

Dina Tenji
Faculty of Sciences, University of Novi Sad
dinatenji@gmail.com

Dragana Micović
SUPERLAB
dmicovic@superlab.rs

Dragana Plakalović
Faculty of Technology
draganaplakalovic217@gmail.com

Dragana Ujsasi
Institute for Occupational Safety
dragana.ujsasi@institut.co.rs

Dragana Vidojević
Environmental Protection Agency
dragana.vidojevic1@gmail.com

Dragan Marinović
Institute for Public Health
Kraljevo
dragan.marinovic@zjzkv.org.rs

Dragan Stevanović
Institute for Public Health
Kruševac
draganstevanovic877@gmail.com

Dragica Pulja
Institute for Public Health
Sombor
dadapulja@gmail.com

Dušan Rakić
University of Novi Sad,
Faculty of Technology
dusan.rakic.1995@gmail.com

Đ

Đorđe Dejanović
SUPERLAB
djdejanovic@superlab.rs

Đorđe Kocić
SUPERLAB
djkocic@superlab.rs

Đorđe Radojičić
SUPERLAB
djradjoicic@superlab.rs

Đurađ Milošević
Faculty of Sciences,
University of Niš
djuradj.milosevic@pmf.edu.rs

E

Emil Živadinović
Institute for Public Health
of Vojvodina
emil.zivadinovic@gmail.com

Enver Karahmet
Faculty of Agricultural and Food
Sciences - University of Sarajevo
e.karahmet@ppf.unsa.ba

G

Galina Ćurčić
Educons University
galina.curcic@educons.edu.rs

Gjoshe Stefkov
Ss. Cyril and Methodius
University in Skopje
gstefkov@yahoo.com

Glorija Ćirković
Institute for Biology and Ecology,
Faculty of Science Kragujevac
glorija.cirkovic@pmf.kg.ac.rs

Gordana Racič
Foodscale Hub
gordana@foodscalehub.com

H

Hakim El Khiar
HYPER FILTER
hakim@microplastic.io

Hasena Košarić
Public Utility Company "
Water Supply and Sewerage" Ltd.
Sarajevo
hasena.kosaric@viksa.ba

Hazrat Amin
Wroclaw University of
Environmental and Life Sciences
hazratamin92@gmail.com

I

Igor Majkić
Institute of Public Health of
the Republic of Srpska
igor.majkic@phi.rs.ba

Igor Savanović
SUPERLAB
isavanovic@superlab.rs

Ilinka Đurić
Institute for Public Health
Kraljevo
ilinka.djuric@zjzkv.org.rs

Iva Ljumović
Faculty of Dentistry in Pančevo
ljumovic.iva@hotmail.com

Ivan Đuričković
Ministry of Environmental
Protection of the Republic of
Serbia
ivan.djurickovic@eko.gov.rs

Ivana Delić
JP KOMUNALNO BRĆKO
kosticivana@gmail.com

Ivana Gašić
City Institute for Public Health
Belgrade
ivana.gasic@zdravlje.org.rs

Ivana Guševac Stojanović
VINČA Institute of nuclear
sciences- National Institute of the
Republic of Serbia, University of
Belgrade
igusevac@vin.bg.ac.rs

Ivana Mikavica
Institute for Technology of
Nuclear and Other Mineral Raw
Materials
i.mikavica@itnms.ac.rs

Ivana Perković
SUPERLAB
iperkovic@superlab.rs

Ivanka Kaut
PUC WATER SUPPLY AND
SEWERAGE PANČEVO
ivanka.kaut@vodovodpa.rs

Ivica Janković
Military Medical Academy
ivica.jankovic@vma.mod.gov.rs

J

Jasmin Šutković
International University
Sarajevo
jsutkovic@ius.edu.ba

Jasmina Đuretić
University of Belgrade - Faculty of
Pharmacy
jasmina@pharmacy.bg.ac.rs

Jasmina Jevremović Public
Utility Company Drugi Oktobar
Vršac
jasmina.jevremovic@oktobar.rs

Jasmina Nikodinović-Runić
Institute of Molecular Genetics
and Genetic Engineering
jasmina.nikodinovic@imgge.bg.ac.rs

Jasna Simonović Radosavljević
University of Belgrade - Institute
for Multidisciplinary Research
jasna@imsi.rs

Jelena Đorđević Aleksić
University of Belgrade - Institute
for Multidisciplinary Research
jelenadjo@imsi.rs

Jelena Martinović
VINČA Institute of nuclear
sciences- National Institute of the
Republic of Serbia, University of
Belgrade
jelenazlatkovic@vinca.rs

Jelena Milovanović
Institute of Molecular Genetics
and Genetic Engineering
jelena.milovanovic@imgge.bg.ac.rs

Jelena Stojić
PUC WATER SUPPLY AND
SEWERAGE PANČEVO
jelena.stojic@vodovodpa.rs

Jelena Tosić
MMA
jelenatosicdr@gmail.com

Jelena Videnović
Institute for Public Health Niš
hemijaizjznis@gmail.com

Jelena Vidojević
Institute for Public Health Čačak
jelena.v.vidojevic@gmail.com

K

Karolina Sunjog
Institute for Multidisciplinary
Research
sunjogkarolina@imsi.rs

Katarina Bobić
Vinča Institute of Nuclear
Sciences - Institute of National
Importance for Serbia
katarina.bobic@vinca.rs

Katarina Jovanović
Institute of Public Health of
Serbia Dr Milan Jovanović Batut
katarina_jovanovic@batut.org.rs

Katarina Jovičić
Institute for Biological Research
"Siniša Stanković"
katarina.jovicic@ibiss.bg.ac.rs

Katerina Bačeva Andonovska
Macedonian Academy of Sciences
and Arts - MANU
kbaceva@manu.edu.mk

Kristina Kalkan
Biosens Institute
kristina.kalkan@biosense.rs

Ksenija Bugarinović
Institute for Public Health Užice
ksenija.ela@gmail.com

L

Lara Dronjak
American University of Sharjah
ldronjak@aus.edu

Ljiljana Tolić Stojadinović
Innovation Center of the Faculty
of Technology and Metallurgy
ljtolic@tmf.bg.ac.rs

Ljiljana Vujašanin
Institute for Public Health
Kraljevo
ljiljana.vujasanin@zjzkv.org.rs

M

Maja Milanović
Faculty of Medicine, University of
Novi Sad
maja.milanovic@mf.uns.ac.rs

Maja Vujić
University of Novi Sad, Faculty
of Sciences, Department of
Chemistry, Biochemistry and
Environmental Protection
maja.loncarski@dh.uns.ac.rs

Maida Šljivić Husejnović
Faculty of Pharmacy, University
of Tuzla
maida.sljivic-husejnovic@untz.ba

Majda Nikezić
Jožef Stefan Institute, Ljubljana,
Slovenia
majda.nikezic@ijs.si

Marija Joksimović
Institute for Public Health of
Vojvodina
marija.joksimovic77@gmail.com

Marijana Nikolić
Faculty of Sciences Kragujevac
marijana.nikolic@pmf.kg.ac.rs

Marijana Ponjavić
Institute of Molecular Genetics and Genetic Engineering
marijana.ponjavic@imgge.bg.ac.rs

Marina Peruničić Lučić
Institute of Hygiene, Military Medical Academy
marina.perunicic.lucic@vma.mod.gov.rs

Marko Baroš
Food Testing Center
marko@cin.co.rs

Meliha Malagić
Public Utility Company "Water Supply and Sewerage" Ltd. Sarajevo
hasena.kosaric@viksa.ba

Merima Ibišević
University of Tuzla
merima.ibisevic@untz.ba

Merima Pinjo
Public Utility Company "Water Supply and Sewerage" Ltd. Sarajevo
merima.sakovic@viksa.ba

Milan Jovanović
Institute for Public Health of Vojvodina
milanjovanovic31@gmail.com

Milena Radojević
Institute for Chemistry, Technology and Microbiology
milena.radojevic@ihtm.rs

Milica Baloš
Agrounik
cucuzm@yahoo.com

Milica Ćurčić
Institute of Physics Belgrade
milicap@ipb.ac.rs

Milica Janković
Institut for Public Health of Belgrade
milica.jankovic@zdravlje.org.rs

Milica Nikolić
Faculty of Sciences, University of Niš
milica.nikolic@pmf.edu.rs

Milica Popović
Institute of Physics Belgrade
milicap@ipb.ac.rs

Milica Velimirović Fanfani
VITO
milica.velimirovic@vito.be

Miloš Ilić University of
Belgrade - Faculty of Chemistry
ilicm@chem.bg.ac.rs

Mina Radovanović
Faculty of Chemistry
mina@chem.bg.ac.rs

Mirjana Anđelković Stojanović
SUPERLAB
mastojanovic@super-lab.com

Mira Aničić Urošević
Institute of Physics Belgrade
mira.anicic@ipb.ac.rs

Mirjana Nacka-Aleksić
Institute for the Application of Nuclear Energy (INEP), University of Belgrade
mnacka@inep.ac.rs

Mohamed Abd-Elnaby Aly-Eldeen
National Institute of Oceanography and Fisheries, NIOF, Egypt
m_niof@yahoo.com

N

Nataša Stojić
Educons University
natasa.stojic@educons.edu.rs

Nataša Vuković
Institute for Occupational Safety
natasa.vukovic@institut.co.rs

Neda Bošković
University of Montenegro
nedaboskovic93@gmail.com

Nevena Preradovic
Institute for Multidisciplinary Research
nevena449@yahoo.com

Nikola Geskovski
Ss. Cyril and Methodius University in Skopje
ngeskovski@ff.ukim.edu.mk

Nikolina Antić
Customs Laboratory
svinid@gmail.com

O

Olga Gigopulu
Faculty of Pharmacy, University "Ss. Cyril and Methodius", Skopje
olga.gigopulu@ff.ukim.edu.mk

Olivera Stojilović Trivunić
Foodscale Hub
olivera@foodscalehub.com

P

Petar Trajčeski
SUPERLAB
ptrajceski@super-lab.com

Petar Vojnović
University of Belgrade, Faculty of Mining and Geology
petarpodosoje@gmail.com

Petre Makreski
Ss. Cyril and Methodius University in Skopje
petremak@pmf.ukim.mk

Predrag Kolarz
Institute of Physics
kolarz@ipb.ac.rs

R

Rastko Ajtić
Institute for Biology and Ecology, Faculty of Science Kragujevac
rastko.ajtic@pmf.kg.ac.rs

S

Sanja Bijelović
Institute for Public Health of Vojvodina
sanja.bijelovic@gmail.com

Sanja Trifunčević
NTC NIS-Naftagas LLC Novi Sad
sanja.trifuncevic@nis.rs

Sanja Vasiljević
Faculty of Sciences, Novi Sad
sanjav@dh.uns.ac.rs

Senad Tafro
Eurolab/SUPERLAB
stafro@eurolab.ba

Slaven Dolić
Faculty of Sciences Sarajevo (PMF Sarajevo)
slaven.dolic@cito.ba

Snežana Đorđević
Military Medical Academy
ivezicnela@yahoo.com

Snežana Joksimović
Ministry of Environmental Protection
snezana.joksimovic@eko.gov.rs

Sonja Roglić
Ministry of Environmental Protection
sonja.roglic@eko.gov.rs

Stanka Bobić
Institute for Public Health of Vojvodina
stanka.bobic@izjzv.org.rs

Stevan Miletić
NTC NIS-Naftagas LLC Novi Sad
stevan.miletic@nis.rs

Suzana Andrejević Stefanović
Ministry of Environmental Protection
suzana.a.stefanovic@eko.gov.rs

Suzana Marković
Institute for Forensic Medicine
suzana.a.stefanovic@eko.gov.rs

Svetlana Petrović
Institute for Public Health Niš
hemijaizjznis@gmail.com

T

Tamara Mutić
Faculty of Chemistry - University of Belgrade
tmutic@chem.bg.ac.rs

Tanja Anić
City Institute for Public Health Belgrade
tanja.anic@zdravlje.org.rs

Tanja Ćirković Veličković
Faculty of Chemistry - University of Belgrade
tanja.cirkovic16@gmail.com

Tanja Trakić
Faculty of Sciences, University of Kragujevac
tanja.trakic@pmf.kg.ac.rs

Tatjana Anđelković
Faculty of Sciences in Niš
tatjana.andjelkovic@outlook.com

Tatjana Radosavljević
Institute of Pathophysiology, Faculty of Medicine, University of Belgrade
tatjana.radosavljevic@med.bg.ac.rs

Teja Pelko
University of Ljubljana, Biotechnical Faculty
teja.pelko@bf.uni-lj.si

Tijana Mitrović
Field Test LLC
tijana.mitrovic@fieldtest.rs

U

Ula Putar
Faculty of Chemistry and Chemical Technology, University of Ljubljana
ula.putar@fkkt.uni-lj.si

Uroš Natević
SUPERLAB
unatevic@superlab.rs

V

Vanja Jocić
Institute for Public Health Niš
hemijaizjznis@gmail.com

Velibor Kocić
SUPERLAB
velibor.kocic@gmail.com

Vesna Đikanović
Institute for Biological Research "Siniša Stanković"
djiki@ibiss.bg.ac.rs

Vesna Teofilović
Faculty of Technology Novi Sad
vesnavele@gmail.com

Vladan Kocić
CEO, SUPERLAB Grupa
info@super-lab.com

X

Xhevdet Elezi
xhelezi@hotmail.com

Z

Zoran Dondić
JP KOMUNALNO BRĆKO
zoran.dondic@komunalno.ba

Zoran Stojanović
Institute of Technical Sciences of the Serbian Academy of Sciences and Arts (SANU)
zoran.stojanovic@itn.sanu.ac.rs

Zorica Blagojević
Institute of Public Health of Serbia "Dr Milan Jovanović Batut"
zorica_blagojevic@batut.org.rs

Zorica Bulat
University of Belgrade - Faculty of Pharmacy
zorica.bulat@pharmacy.bg.ac.rs

Zvonko Ilić
PUC "Water Supply" Vlasotince
vodvlas@gmail.com

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