ASSOCIATION OF CHEMISTRY AND THE ENVIRONMENT

Newsletter 2024

edited by Branimir Jovančićević

Contents of this issue:

1) Malgorzata Iwona Szynkowska-Jozwik, new elected ACE president: **Environmental chemistry at universities in Poland**

Environmental chemistry is an important field of study and research at Polish universities due to the fact that it is seen as a key discipline for understanding and solving environmental problems and challenges, such as pollution, climate change and sustainable development. Twenty-five universities in Poland currently offer high-quality undergraduate and graduate programs in environmental chemistry (at the Bachelor's and Master's levels). Environmental

chemistry is considered as a relevant science at the societal level because it is related to environmental impact, pollution and pollution reduction, environmental management, and it also indicates the role of chemistry in understanding and solving environmental problems. Poland as the country has a strong reputation for its environmental research and commitment to sustainability. Study programs, as well as the research in the field of environmental chemistry generally focuses on the interactions of chemical species in the environment, chemical processes that affect the sources, composition, reactions, transport and fate of chemical species in natural environments (air, water, soil and biological tissues), the impact of human activities on these environments, and the chemical aspects of pollution prevention and remediation of pollution. Important aspects and areas of relevance in environmental chemistry include climate change and its impact on the environment, pollution and its impact on air, water and soil quality, environmental monitoring, toxicology, sustainability and green technologies, renewable energy sources and their potential to reduce e.g. carbon emissions, waste management and recycling initiatives, environmental policies and regulations. One can find different versions of the study programs of Environmental Chemistry offered at universities. As an example, Lodz University of Technology in Poland, offers study in Computer Science in Environmental Protection. The program combines the principles of environmental chemistry with the use of IT tools and techniques. It focuses on the analysis and interpretation of environmental data using methods such as data mining, digital data processing and geographic information systems (GIS). Students gain knowledge addressed to complex environmental challenges as they learn how to collect, manage, and analyze data related to environmental issues. They also have skills in programming, data visualization and statistical analysis, and are introduced to the legal and technical tools of environmental protection. Due to the fact that environmental chemistry is an interdisciplinary field, it combines aspects of chemistry, biology, geology, IT and environmental science. Polish researchers and students, as well as researchers around the world, are attracted to the field because it allows them to collaborate with experts from different disciplines to solve complex environmental issues and make a positive impact on the environment. There are several key research areas of environmental chemistry at Polish universities, which include the following:

- Atmospheric Chemistry: Researchers in this field focus on the chemical processes that occur in the Earth's atmosphere, including the formation and breakdown of pollutants as well as the studies of natural processes and human activities that contribute to air pollution;
- Water Chemistry: Environmental chemists study water contamination from industrial, agricultural, and urban sources, the chemical properties of water, the sources and impacts of pollutants such as heavy metals, pesticides, pharmaceuticals and microplastics in aquatic environments;
- Soil Chemistry: Environmental chemists study how chemicals move through and contaminate soils, affect plants and ecosystems. They also study strategies for remediating contaminated soils and restoring them to proper condition;
- Green Chemistry: Scientists work to minimizes the generation of hazardous substances and wastes, to develop eco-friendly materials, processes, technologies and analytical methodologies to reduce the environmental impact of chemical production, use and consumption;

– Environmental Toxicology: Environmental toxicologists, among others, study the toxicity of chemicals in the environment, as well as factors that influence their bioavailability, bioaccumulation, and biomagnification.

Research in environmental chemistry at Polish universities contributes to the development of scientific knowledge and innovative solutions to environmental challenges. By conducting scientific projects and collaborating with industry and authorities, scientists make valuable contributions to the field and participate in developing solutions for the future of the environment and sustainable development. Overall, the popularity of environmental chemistry at Polish universities is likely to continue to grow in the coming years, as the need for professionals with expertise in environmental chemistry grows with the increasing importance of environmental protection, biodiversity conservation, public health and sustainable development in our lives, society and all around the world, in order to protect and improve our planet for future generations.

2) Željko Jaćimović:
Budva- Montenegro 2023 – EMEC23 that lies behind us

We're thrilled to share the highlights from the 23rd European Meeting on Environmental Chemistry (EMEC 23), held from December 3rd to 6th 2023, at the stunning Hotel Avala in Budva, Montenegro. This year's conference was a resounding success, bringing together researchers, scholars, and professionals from around the globe to explore the latest advancements in environmental chemistry, with over 100 participants.

Participants at EMEC23, Budva, December 3rd-6th 2023.

EMEC 23 was honored to host three distinguished plenary speakers who shared their insights and expertise with attendees, renowned for his groundbreaking research in environmental chemistry **Prof. George P. Cobb**, with his vast experience in environmental toxicology and

chemistry **John P. Giesy, Ph.D., FRSC** enriched our conference program, and last but not least **Prof. Ioannis A. Katsoyiannis** gave us insight into the innovative research that highlighted the essential nature of cross-disciplinary teamwork in addressing complex environmental issues.

Prof. George P. Cobb and Prof. Željko Jaćimović

EMEC 23 was proud to receive sponsorship from "The Prince Sultan Bin Abdulaziz International Prize for Water." This esteemed partnership highlights the conference's global significance in advancing research and innovation in water science and environmental sustainability. In recognition of outstanding contributions by young scientists, thanks to the sponsorship the Association of Chemistry and the Environment (ACE) awarded eight prizes during EMEC 23. These accolades celebrate the dedication, ingenuity, and impactful research endeavors of emerging scholars, inspiring future generations to push the boundaries of scientific discovery. We extend our sincere gratitude to the sponsors for their generous support and commitment to promoting excellence in the field and the participants who have enriched our event with great scientific contribution.

One of the highlights of EMEC 23 was the special event dedicated to early-career researchers. This initiative provided a platform for budding scientists to network, exchange ideas, and forge invaluable connections within the scientific community. The EMEC team is committed to nurturing the next generation of researchers, and this event exemplified our dedication to fostering talent and innovation.

As we reflect on the success of EMEC 23, we extend our heartfelt appreciation to all participants, speakers, sponsors, and organizers who contributed to making this conference a memorable and enriching experience. We look forward to continued collaboration and innovation as we advance our shared mission of addressing environmental challenges and safeguarding the health of our planet.

Declaring winners of The Prince Sultan Bin Abdulaziz International Prize for Water

The gala dinner

Stay tuned for updates on future events, initiatives, and opportunities within the EMEC community.

Warm regards,

EMEC23 Organising Committee.

3) Lorena Vidal and Antonio Canals:
Alicante, Spain 2024 – EMEC24 is in front of us

The Department of Analytical Chemistry, Nutrition and Food Science and the University Institute of Materials of the University of Alicante are pleased to host the **24th European Meeting on Environmental Chemistry**, which will be held in Alicante (Spain) from 26th to 29th November 2024.

The symposium will take place at the University of Alicante in Spain. The University of Alicante is a public university located on the Mediterranean coast. Because of our historical influences, excellent location and magnificent connections, the University of Alicante is a diverse-oriented and welcoming university with one of the best campuses in Spain, not only in terms of infrastructure, but also in terms of landscaping, sustainability and gender equality.

The city of Alicante on the Mediterranean cost was known by the Romans as *Lucentum*, or "City of Light", and offers an unparalleled combination of liveliness and generosity. It is a

carefully planned city, both hospitable and full of surprises as one walks down its streets, with parks and emblematic buildings wherever you go. Alicante has a gentle climate, with mild temperatures and many hours or sunlight.

Alicante can be easily reached either by airplane or by speed train from main cities as Madrid or Barcelona. Alicante is well connected with the whole Europe by low-cost airlines offering direct flights from across Europe. The airport of Alicante also hosts domestic flights to and from the Airport of Madrid or Barcelona, which can be used as connecting flights from and to major European gateway cities. Travelers from outside Europe can break up their journey in a European city of their choice or elect to keep connection time to a minimum. Popular gateways include London, Lisbon, Paris, Amsterdam, Berlin, Frankfurt, Zurich, Helsinki, Rome, etc.

Our main objective is to attain the level of excellence seen at the previous EMEC meetings. We are therefore preparing for this important scientific event with great effort and dedication to ensure a first-class scientific programme presenting the latest research and trends in Environmental Chemistry. The official programme will include plenary sessions, keynote lectures, oral presentations, poster sessions, workshops and an industrial exhibition that will bring us up to date with the latest advances and trends in the field; as well as poster and oral presentations by young researchers who represent the future of this scientific discipline.
We are confident that the EMEC meeting will provide a broad forum for people from academia, research and industry to exchange ideas on the latest advances in research and development in environmental chemistry and technology.

We sincerely hope that you will be able to attend and participate, and we trust that this event will be of the highest scientific and human value, full of content, vibrancy and participation, fulfilling your every expectation. We look forward to seeing you all in Alicante.
Abstract submission is open from 1st of March until the 15th of September 2024. Early bird registration closes the 15th of October 2024.

All information about EMEC24 is available on the conference website https://emec24.es/. All questions and doubts can be answered by e-mail: emec24@ua.es and emec24@transviabusiness.com

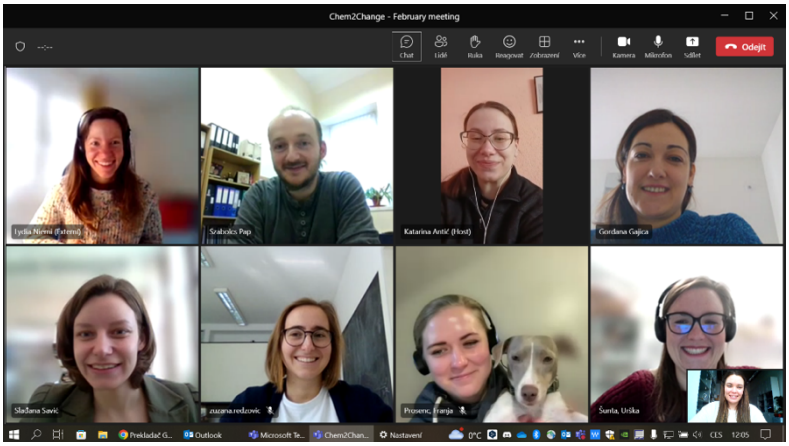
4) Gordana Gajica:

Activities of early-career researcher network of ACE, »Chem2Change« in 2023

Chem2Change is a pan-European early-career researcher (ECR) branch of the Association of Chemistry and the Environment (ACE). The Chem2Change network aims to support high-level knowledge exchange, collaboration and discussion between early-career scientists (MSc, PhD, and postdoc-level) across Europe and internationally, in the fields of environmental chemistry and the applications in addressing current global sustainability challenges. The board members of Chem2Change are researchers from the University of Belgrade (SRB), the University of Ljubljana (SI), the University of Pardubice (CZ), the Environmental Research Institute of the University of Highlands and Islands (UK), the University of Leeds (UK), and the University of Zagreb (CRO). The chair of the board is Dr. Lydia Niemi.

Board members of Chem2Change: Lydia Niemi, Environmental Research Institute, University of the Highlands and Islands, UK; Szabolcs Pap, Environmental Research Institute, University of the Highlands and Islands, UK; Franja Prosenc, University of Leeds, UK; Urška Šunta, Faculty of Health Sciences, University of Ljubljana, SLO; Frederika Mišíková, Institute of Environmental and Chemical Engineering, University of Pardubice, CZ; Gordana Gajica, Institute of Chemistry, Technology and Metallurgy, University of Belgrade, SRB; Slađana Savić, Faculty of Chemistry, University of Belgrade, SRB; Katarina Antić, Institute of Chemistry, Technology and Metallurgy, University of Belgrade, SRB; Zuzana Redžović, Faculty of Science, University of Zagreb, CRO; Iva Kokotović, Faculty of Science, University of Zagreb, CRO

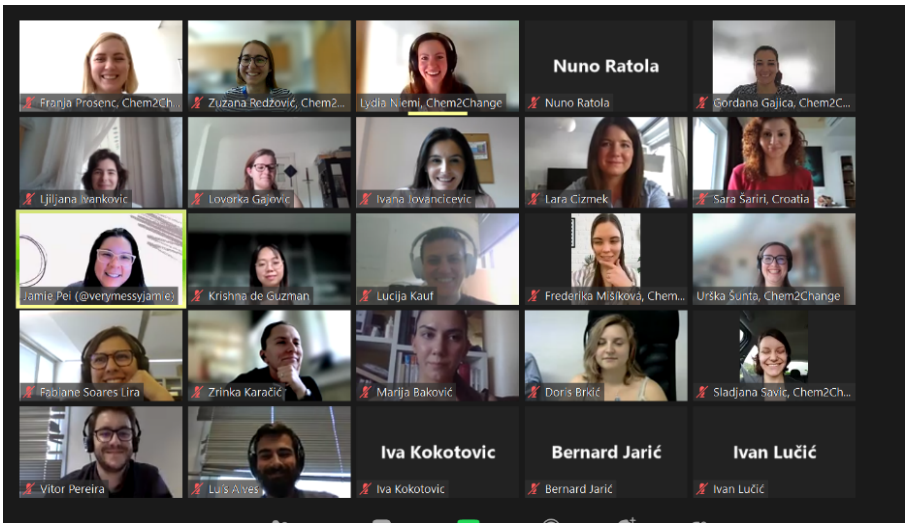
In 2023, Chem2Change continued its growth and activities. The Chem2Change board meets online every month to plan activities and topics of interest for early career researchers.



Some of the monthly meetings of Board members of Chem Change.

In previous years, two main activities were:

- Online career development workshop “Working less but accomplishing more – Alternative practices for productivity”, May 26th, 2023



Workshop “Working less but accomplishing more – Alternative practices for productivity”.

- In-person career development workshop “Alternative careers in research and working with stakeholders” and networking session, December 4th, 2023, at EMEC23, Budva, Montenegro

Career development workshop “Alternative careers in research and working with stakeholders”.

The online career development workshop “***Working less but accomplishing more – Alternative practices for productivity***”, was organised on May 26th, 2023. The workshop was led by the ’’messy coach’’ Dr. Jamie Pei, and encouraged participants to set aside

common “productivity” guidelines, find their own optimal working practices, and be accepting of and at ease with them. The workshop was attended by 42 participants, from a wide range of research institutes and universities across Europe. Together we participated in a series of interactive digital whiteboard Jamboards to encourage discussion and exchange ideas on how we procrastinate and how best to deal with demotivation – all in a fun and relaxed environment.

At EMEC24, we hosted the second in-person career development workshop, “Alternative careers in research and working with stakeholders”, and a social session, on December 4th, 2023, at EMEC23 in Budva, Montenegro. We are very happy that we could meet and connect and get to know 23 young scientists from all over the world (Bosnia and Herzegovina, Croatia, France, Germany, Ireland, Poland, Serbia, Slovakia, Slovenia, Spain and the United Kingdom). We had three very interesting speakers:

- Dr. Nevena Mihailović (Founder of HerbaLab cosmetics and Research Associate at the Department of Chemistry, Faculty of Science, University of Kragujevac, Serbia)
- Dr. Szabolcs Pap (Research Fellow at the Environmental Research Institute, University of the Highlands and Islands, UK)
- Dr. Luka Mihajlović (Chromatography and Mass Spectrometry Specialist at Analysis laboratory equipment, Serbia)

We found their presentations on alternative careers with a research background very insightful, interesting, and motivating. We have learned that it is possible to be Clark Kent and Superwoman at the same time and that you don’t have to be a billionaire to found your own company; that it is very useful and fruitful when you can bounce between academia and industry, especially in transferring the knowledge through pilot projects, that the path to innovation is through research and following the regulation; and that the skills you gained during your PhD can help you to stand out in the industry. We are very happy about the participants’ engagement and fruitful discussion. After the workshop, we continued our social at the Prince English Pub, located in the Budva old town. We are very grateful to our sponsors, the Royal Society of Chemistry (UK), KEFO (SRB), Analysis (SRB) and the PFAS twin project (SRB) for their support in making this event happen.

Our next event will be a free online workshop for early career researchers at the end of May or the beginning of Jun, so please invite your early career colleagues to join. We are also planning an in-person event for early career researchers at the next EMEC24 in Alicante, Spain. For more details and updates follow us on Chem2Change social media on Instagram (@Chem2Change) or LinkedIn.

5) Szabolcs Pap
Research Fellow and Water Technologist,
Environmental Research Institute, University of the Highlands and Islands, Thurso KW14 7JD, Scotland, UK;
szabolcs.pap@uhi.ac.uk
- awarded oral presentation at EMEC 23:

Biochar Produced from Sewage Sludge as an Adsorbent and Soil Conditioner: A Scottish Case Study

Water eutrophication is a widespread problem often caused by excess nutrient inputs. Reducing phosphorus (P) inputs (i.e., to lakes/rivers) can prevent eutrophication and at the same time, P can be recovered as a 'resource'. Adsorption (of P) using filtration material (here biochar) is one possible approach – and ideally, this would be a low-cost process that would create a P-rich material for use on land as a soil improver/fertiliser.

Production of biochar from sewage sludge (SS) is consistent with sustainable bioresource recovery and promotes a wastewater-based circular economy. Biochar is a pyrogenic carbon-rich material produced from different feedstocks through pyrolysis under oxygen-limited conditions. Pyrolysis of SS to biochar resolves two issues - it minimises the cost of SS disposal and creates a 'new' resource that can be used to eliminate (through adsorption) P from wastewater. SS is produced in hundreds of millions of tonnes globally each year. ~130,000 tons of SS are disposed of annually just in Scotland – at an estimated cost of ~£6m/yr to Scottish Water alone. Historically, SS has often been applied to agricultural land to recycle nutrients and carbon. However, untreated sludge contains pathogens and a myriad of potentially harmful organic and inorganic compounds, many of which are unregulated, e.g., flame retardants, microplastics and pharmaceuticals (Figure 1). As these may be taken up by plants and enter food chains, such practices are becoming unfavourable. Treatment of SS by pyrolysis to biochar offers great potential for the destruction of many pollutants, and the concurrent generation of highly valuable adsorbent material and fertiliser that may be rich in nutrients such as P. At present, such biochars are under lab/pilot scale development and their utility has not been exploited, in part due to restrictive regulatory frameworks (i.e., in the UK).

To address this issue in Scotland, this research adopts a holistic approach – addressing challenges related to the need for 'P recovery', the need to better manage SS, it's links into an emerging 'biochar market' and its potential benefit within the water/agricultural sectors (in Scotland and the UK). In line with Scotland's proposed Circular Economy Bill and SR21-27 Ministerial Objectives to Scottish Water, the development of technologies such as in this is a key enabling step for the water industry to play its critical role as a pillar of the Circular Economy. This research is supported by Scottish Water, who understands that unlocking the inherent value within wastewater and biosolids is paramount to ensuring the Water Industry meets its net zero targets, promotes a green economy, and contributes towards Scotland's

self-sufficiency agenda. Through the project the following results (Figure 2) and conclusions have been achieved:

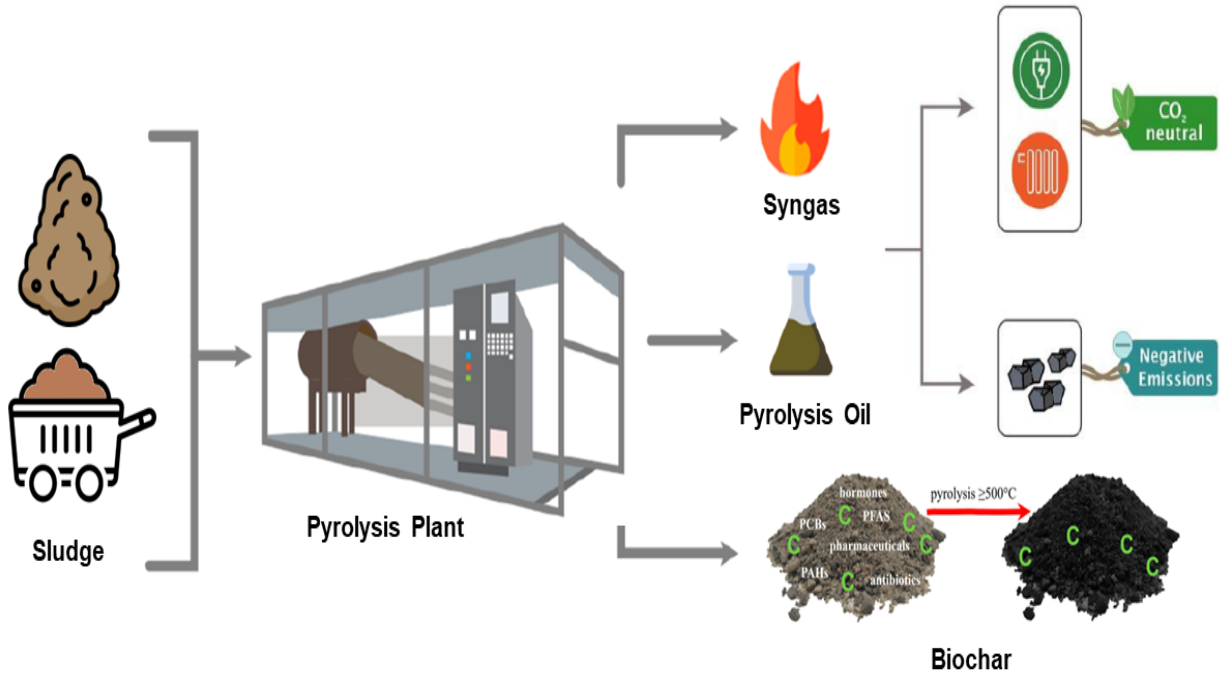


Figure 1: The concept of sewage sludge biochar and its benefits

- Optimal conditions to produce SS biochar were 550-600 °C for 80-120 min with ≈40% yield (by dry solids) and the P adsorption capacity was 10.5 mg/g (with 100% removal efficiency using environmentally relevant P concentrations);
- The SS biochar also showed a high affinity towards UK CIP3 (The Chemical Investigations Programme) pollutants – with a 60 mg/g adsorption capacity for lead and 20 mg/g capacity for nickel;
- The key achievement of the project was that we successfully showed that the SS biochar could be used at larger scale for P removal/recovery at wastewater treatmeant plants;
- Limited leaching potential was noted from the SS biochar which indicates no major environmental impact on treated water;
- With ~8% of P_2O_5, low heavy metal (i.e., Pb, Cd, Ni, Cr, As, Zn) and organic pollutant (i.e., PAH's and PFAS/PFOS) content (well below legislative limits) the SS biochar was 'clean' compared to raw SS;

The next phase for the project is expected to focus on transfer of the nutrient loaded biochar from an aqueous to a soil environment. Characterisation (using chemical extraction) of 'plant available' P in the biochar and plant-based pot trials to consider its potential uptake/benefit if used in a soil environment. This will also explore the factors relating to trophic transfer, providing comprehensive analysis to support biochar's environmental safety and quantify its soil benefits.

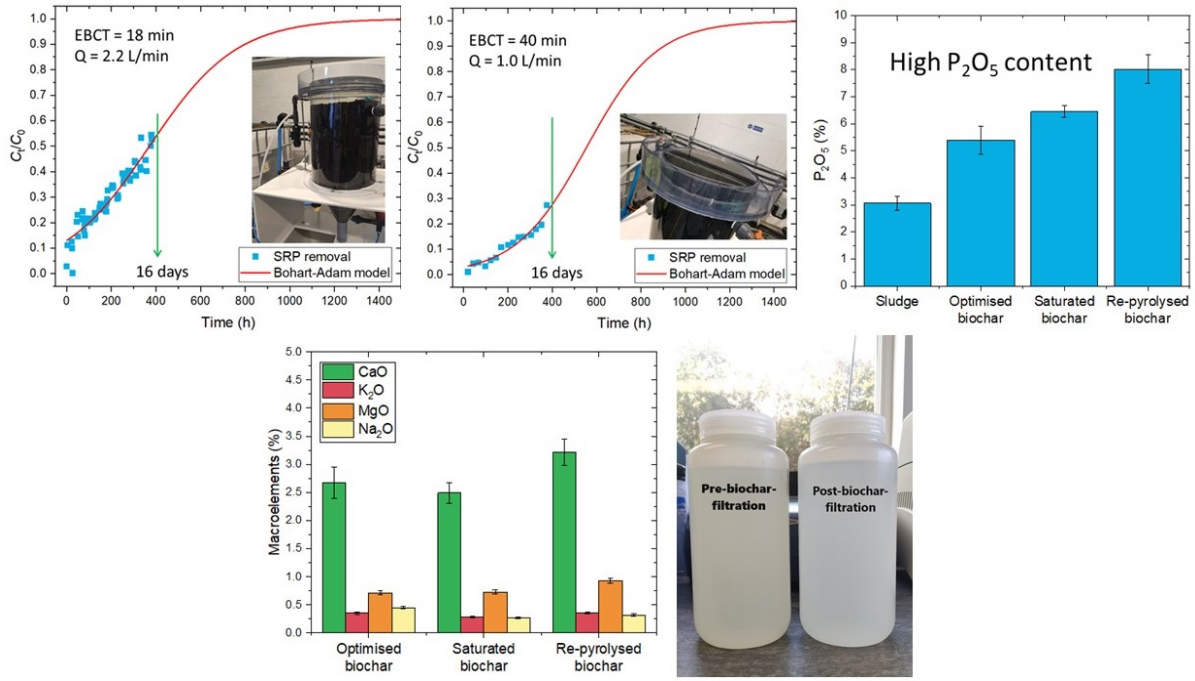


Figure 2: Filtration breakthrough curves, P_2O_5/macroelement content for SS biochar and water samples before and after the pilot-scale filtration trials

6) Emilija Vukićević

Doctoral student at the University of Belgrade, Faculty of Chemistry,

emilija@chem.bg.ac.rs

- awarded poster presentation at EMEC 23:

Potential of Biochar as Fuel Obtained by Pyrolysis of Agricultural Waste

and Isailović J., Savić D., Jovančićević I., Gajica G., Antić M., Jovančićević B., Schwarzbauer J. and Antić V.

The European Meeting on Environmental Chemistry (EMEC) conference has a long tradition and is recognized in the world of science, chemistry and environmental chemistry. Current and important topics in the field of environmental chemistry are always discussed at this event, with the participation of scientists and researchers from different parts of the world.

In December 2023, I had the honor to participate in the EMEC23 conference, which was held in Budva, Montenegro. At this event, we presented our research with a poster presentation under the title “Potential of Biochar as Fuel Obtained by Pyrolysis of Agricultural Waste”.

This work is supported by the project “Agricultural residues and plastic waste materials as a sustainable source of alternative fuels and valuable chemicals” (AGRIPLAST), grant BMBFNo. 01DS21008.

The stalks that remain after harvesting crops of corn, tomato and tobacco do not have further use and this waste is usually burned on the field. A possible reduction of waste is through pyrolysis processes. This study aimed to analyze solid residues obtained by pyrolysis of different agricultural residues and compare their fuel characteristics with widely used solid fuels such as wood, coal, coke, and charcoal. Thermogravimetric analysis showed the degradation process of analyzed samples. Regarding obtained results temperature chosen for pyrolysis was 400 ℃ (Fig 1).

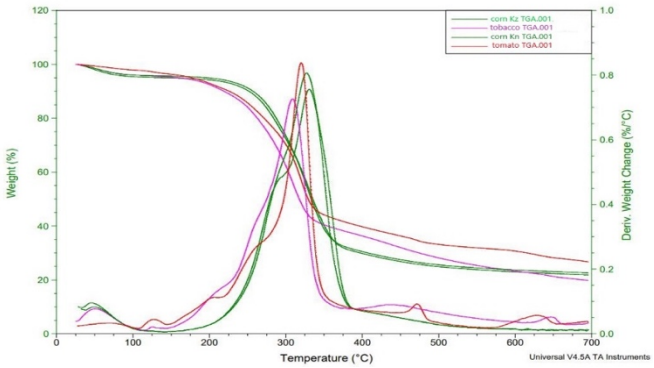


Figure 1: TGA curve of tobacco, tomato and corn stalks.

Pyrolysis took place at 400 ℃ and at a nitrogen flow of 150 ml/min in Carbolite, UK furnace, model MTF 10/15/130. Analyses performed on biochar were determination of ash content (ASTM D2584, ASTM D5630), calorific value (IKA C400, SRPS CEN/TS 16023:2014), and Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) analysis (Spectroblue TI; methods EPA M 200.7, sample preparation EPA M 3052/ISO 2598-1). Calorific value is one of the most important fuel characteristics. The calorific value of biochars from tomato, tobacco, corn ZP6263, and corn BC398 is 24.12 MJ/kg, 23.09 MJ/kg, 26.24 MJ/kg, and 25.78 MJ/kg, respectively. Regarding solid fuels, the calorific value of wood is 12.5 MJ/kg; for different types of coal, it can be from 13 MJ/kg to 36 MJ/kg; for coke, 32.6 MJ/kg and for charcoal, it is 25.7 MJ/kg (Fig. 2).

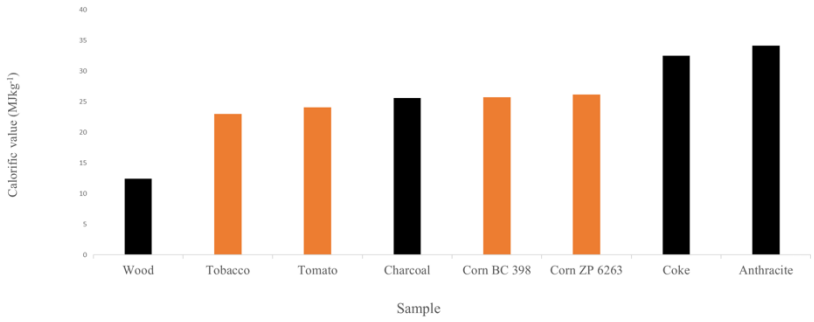


Figure 2: Calorific values of solid fuels: wood, coal, coke, charcoal, biochars.

Analysis performed on obtained samples of biochar showed results which are in alignment with characteristics of widely used solid fuels. The ash content of biochar is 12-20%, which corresponds to the ash content of solid fuels. ICP-OES analysis of biochars showed the absence of heavy metals and high concentrations of Ca, K, Na, and Mg, which remain in ash. Results obtained in this research lead to the conclusion that biochar produced by pyrolysis of tomato, tobacco, and corn stalks shows good potential for use as a solid fuel.

Our research on this topic and the results we got were awarded for one of the best poster presentations. Me and our research group are delighted and honored by this award! For me personally, this achievement is a confirmation of my previous work and research, as well as a great motivation to continue it. Also, the award is a confirmation that the research topic is interesting, important and current. EMEC23 was an amazing and important experience for me and I am looking forward to the next EMEC in Spain in 2024!

7) Nuno Ratola:
ACE and early-career researchers - scholars at EMEC23 in Budva- Montenegro

If for the EMEC22 meeeting in Ljubljana we had had an excellent response to the Association of Chemistry and the Environment Scholarships call, this year for EMEC23 in Budva (Montenegro), the number of candidates was even higher. Moreover, the quality of the M.Sc. and Ph.D. students and early career researchers who applied was outstanding, making the task of the evaluating committee a very hard one and demonatrating the interest of the younger generations of scientists in the EMEC conferences. This year ACE announced on the EMEC23 web page and by e-mail from the conference Organization that 3 young scientists would be awarded, in line with the most common practice of the last years. The conference fee and travel and accommodation expenses were financed up to €500.

The evaluation committee was again comprised of 5 members of the ACE Board with no conflict of interests (i.e., supervisors or co-workers), in a procedure supervised by Dr. Nuno Ratola, the ACE Scholarship Officer. The following candidates were awarded the support to their presence at EMEC23 (in alphabetical order): Ana Torres (University of Barcelona, Spain), Neda Boskovic (University of Montenegro) and Tijana Milicevic (University of Belgrade, Serbia). Congratulations to all!

Professors Albert Lebedev and Nuno Ratola (ACE) with awarded Neda Bošković, Tijana Milićevič and Ana Torres