

# EMEC21

21<sup>st</sup> European Meeting on Environmental Chemistry  
November 30 – December 3, 2021, Novi Sad, Serbia

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Association of Chemistry  
and the Environment



Serbian Chemical Society



Matica Srpska

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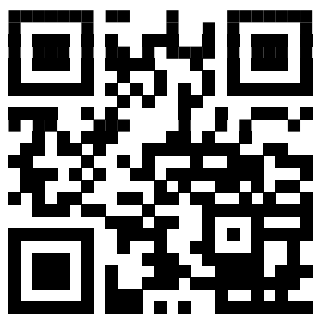
*Branimir Jovančičević, president*

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## BOOK OF ABSTRACTS



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on Environmental Chemistry

EMEC 21





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**21<sup>st</sup> European Meeting on Environmental Chemistry**

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*Dear guests and colleagues,*

*This, already traditional, international meeting of researchers from all over the world in the field of environmental chemistry has been attracted together by 200 participants.*

*We will work both, live in a unique conference venue of Matica Srpska that is one of the most important academic institutions in Serbia, and, on-line, in new, challenging conditions created by the Covid-19 pandemic.*

*Researchers from Austria, Bosnia and Herzegovina, Croatia, Czech Republic, France, Germany, Greece, Italy, Japan, Montenegro, Poland, Portugal, Russia, Serbia, Slovenia, South Korea, Spain, and United Kingdom will have a chance to present and share new research results. Broad range of topics and interdisciplinary presentations will be discussed at the conference with main objectives to report the most advanced research progresses and to pave the way for future research and challenges.*

*I wish you fruitful work and safe stay in Serbia. Welcome to the City of Novi Sad, the European Capital of Culture 2022!*

*Branimir Jovančičević  
President of the EMEC21 Organizing Committee*



# Association of Chemistry and the Environment - ACE



The Association of Chemistry and the Environment (ACE) is a non-profit-making scientific association founded in October 2000 by a group of European scientists. We aim to promote global contact between scientists in academia and research institutes, the commercial sector and social representatives within governmental and regulatory bodies to address environmental problems and to promote education in this area.

We strongly welcome scientists from diverse fields such as atmosphere science, biology, geology, industrial chemistry, medicine, sociology, soil science, toxicology and water science to play an active role within the organisation.





## Serbian Chemical Society

The Serbian Chemical Society (SHD) is a voluntary, non-governmental and non-profit association established to pursue goals in the fields of chemistry, chemical technology, and related disciplines. The Society is one of the oldest chemical societies in the world, the ninth ever established. It was founded on the initiative of professor Marko Leko (who was also the first president of the Society) in 1897. Despite many difficulties, interruptions in work during both world wars, the Society has successfully achieved its goals and currently has about 800 members, dozen divisions and affiliates. The Society actively contributes to development of education in chemistry and chemistry related disciplines and for 89 years cultivates scientific publishing activity by publishing the Journal of the Serbian Chemical Society-JSCS (one volume of 12 month issues per year). It is an openly accessed journal (IF 1.24 in June 2021).

Environmental Chemistry Division was founded in 1982 by professor Petar Pfendt who was a first president of a Division. A professor Dragan Veselinović, professor Branimir Jovančičević and professor Bojan Radak, succeeded him. The current president of the Environmental Chemistry Division is a professor Vladimir P. Beškoski. Alongside the EMEC2021, the Division has been the organizer of the Symposium CHEMISTRY AND ENVIRONMENTAL PROTECTION since 1985. During all these years, facing various challenges, the Symposium has changed its names but managed to preserve quality, and enhance its significance to the scientific community and society as a whole. Researchers, scientists, and experts dealing with various aspects of environmental chemistry have recognized the opportunities that the Symposium provides as a unique platform for sharing ideas, the latest scientific achievements and technological innovations. This resulted in an increasing number of participants over the years. Furthermore, members of the Division are dedicated to promotion of science and they are responsible editors of the Environmental Chemistry Section of the JSCS issues. To this day, the Division has organized several roundtable discussions including internationally recognized scientists across the globe, many lectures and workshops. With great enthusiasm, honour and pleasure we are expecting the year 2025 when EuChemS DCE will, together with us, organise the 19th International Conference on Chemistry and the Environment (ICCE) in Belgrade.



## Matica Srpska

Matica Srpska is the oldest Serbian literary, cultural and scientific society. Matica Srpska was founded in 1826 in Pest, during the liberation of Serbia from centuries of Ottoman occupation and the strengthening of awareness of the need to fully incorporate Serbian people in modern European trends at the same time maintaining their cultural identity. The activities of Matica were, from the very beginning, aimed at presenting Serbian culture to Europe and at enlightening the people. In order to achieve this, a rich publishing activity has been developed. The basis of this activity was the famous Letopis (Chronicle), first published in 1824. Later on, numerous other editions were published, among them one edition with a particular educational role, appropriately named Books for the People.

Matica Srpska has almost 2.000 associates today. Associates prepare articles for fifteen periodical publications of Matica and work on the preparation of publications of great significance for Serbian culture and science, such as the Serbian Encyclopedia, Serbian Biographic Dictionary, the Dictionary of Serbian Language, Orthography... The Library of Matica Srpska has over 3,500,000 books, and the Gallery of Matica Srpska houses a rich collection of Serbian eighteenth and nineteenth century paintings. The Publishing Center continues the tradition of the former Matica Srpska Publishing Company, whose editions were, for decades, recognizable throughout Southeastern Europe by the emblem MS, which signified high-quality and carefully selected literature from various fields. Every year Matica Srpska awards worthy accomplishments in various fields of culture and science.

Matica Srpska has been an example to many Slavic nations. Based on this model the following institutions were established: Czech Matica in 1831, Illyrian Matica in 1842 (in 1874 renamed to Matica Hrvatska); Matica Lužičkosrpska in 1847, Halych-Russian Matica in Lviv in 1848; Moravian Matica in 1849; Matica Dalmatinska in Zadar in 1861; Slovak Matica in 1863; Slovenian Matica in 1864; Matica Opava in 1877; Matica in the Teschen Principedom in 1898. (from which Silesian Matica was created in 1968); Polish Matica in Lvov (1882); Educational Matica in the Teschen Principedom in 1885; Educational Matica in Warsaw in 1905; Bulgarian Matica in Constantinople in 1909 and the new Bulgarian Matica in 1989. In the meantime, Matica Srpska has developed cooperation with many institutions and individuals worldwide.

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# PROGRAMME

## Tuesday, November 30<sup>th</sup>, 2021

18:00-20:00	Welcome cocktail	Restaurant “Veliki”, Nikole Pašića 24, Novi Sad
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## Wednesday, December 1<sup>st</sup>, 2021

Time	Presenter	Title	Page
08:00-	<b>Registration</b>		
09:00-09:30	<b>OPENING CEREMONY</b> (Matica Srpska, Main Hall)		
Moderators	Branimir Jovančičević/Jasmina Nikodinović-Runić		
09:30-10:00	Plenary lecture Anne-Marie Delort	The Cloud Microbiota - Microorganisms-H <sub>2</sub> O <sub>2</sub> Interactions	22
10:00-10:20	Section lecture Jasmina Nikodinović-Runić	Progressing Plastics Circularity: Mechano-Biocatalytic Approaches for Waste Plastic (Re)valorization (BioICEP Project Overview)	28
10:20-10:35	Huiyi Zhang	Removing Copper and Lead Ions from Water by a Dopamine Modified Marine Plastic Adsorbent	38
10:35-10:50	Malcolm Watson	Effect of Ozonation on the Speciation of Arsenic in Groundwater During Drinking Water Preparation	39
10:50-11:20	<b>Coffee break</b>		
11:20-11:35	Gilles Mailhot	New Sustainable Process for Wastewater Treatment Using Recycled and Recoverable Magnetite with Natural Iron Complexing Agent: an Example of Photochemical AOP	40
11:35-11:50	Nuno Ratola	Presence and Challenges of Volatile Methylsiloxanes in WWTPs	41
11:50-12:05	Marija Stevanović	The Embryotoxic Potential and Photocatalytic Degradation of Thiophanate-Methyl	42
12:05-12:20	Sladana Savić	The Effect of Power on the Degradation of Propranolol by Nonthermal Plasma Reactor	43
12:20-12:50	<b>Sponsor presentation – Analysis d.o.o.</b> Luka Mihajlović Trends in Analytical Approaches for Environmental Chemistry - a Review		
12:50-14:20	<b>Lunch break</b>		
Moderators	Polonca Trebše/Vesna Antić		
14:20-14:35	Minja Bogunović	Revisiting Humic Acid Adsorption onto Activated Carbon	44
14:35-14:50	Szabolcs Pap	Circular Economy-Based Phosphorus Recovery Technology Development to Create a Soil Conditioner: an Integrated Approach	45
14:50-15:05	Ana Fernandes	Uptake of Synthetic Musks and Volatile Methylsiloxanes by Pea Crops Grown in Sewage Sludge-Amended Soils	46
15:05-15:20	Vera Homem	Environmental and Agricultural Impacts of Using Sewage Sludge as a Fertilizer – Emerging Contaminants as a Case Study	47
15:20-15:40	Section lecture Vesna Antić	Migration of Toxic and Essential Trace Elements from Tinplate Cans to Meat Products - Possible Impact on Human Health	29

15:40-15:55	Suzana Gotovac Atlagić	Introduction of Innovative Green Material Chemistry Demonstrations in Early Education: Case Study Bosnia and Herzegovina	48
16:00-18:30	<b>City tour and visit of the City Hall</b> (Meeting point: in front of Matica Srpska)		

## Thursday, December 2<sup>nd</sup>, 2021

Time	Presenter	Title	Page
08:00-	<b>Registration</b>		
Moderators	Jan Schwarzbauer/Maja Turk Sekulić		
08:30-09:00	Plenary lecture Tatjana Ćirković- Veličković	Emerging Food Contaminants	23
09:00-09:20	Section lecture Pierro Bellanova	Impact Of Tsunamis On Pollutants' Distribution	30
09:20-09:35	Patricia Tarín-Carrasco	Study of the Impacts of Large Wildfires on PM10 and Human Mortality in Portugal	49
09:35-09:50	Jan Schwarzbauer	Emission and Dispersion of Organic Pollutants by the 2021 Extreme Flood in Germany	50
09:50-10:05	Emira Hukić	Do Freezing and Heating Cycles Influence Differently on Soil Elements Leaching?	51
10:05-10:35	<b>Coffee break</b>		
10:35-10:50	Milica Stefanović	The Response of Badland Materials from Spain with Different Mineralogical Content on Seasonal Changes	52
10:50-11:05	Luisa Bellanova	Chemostratigraphic Distribution of Harmful Organic Contaminants in Flood Affected (Sub-)tropical Urban River Sediments (Chennai, India)	53
11:05-11:20	Filipe Rocha	Studying the Behaviour and Fate of Volatile Methylsiloxanes and Synthetic Musk Compounds in Soil	54
11:20-11:35	Dragana Vidojević	Inadequate Municipal Solid Waste Management and Soil Pollution in Serbia	55
11:35-11:50	Ioanna Pantelaki	Occurrence and Fate of Organophosphate Esters in a Municipal Wastewater Treatment Plant	56
11:50-12:05	Maria Krishna de Guzman	Comparative Profiling of Microplastics in Differently sized Manila Clams from South Korea by Nile Red Staining and $\mu$ FTIR	57
12:05-12:35	<b>Sponsor presentation – ANNAFER d.o.o. (LECO)</b> Pavel Jiros MS Technology Diversity to Provide Enhanced GC Separation, Detection and Identification Solutions		
12:35-14:00	<b>Lunch break</b>		
Moderators	Malgorzata Iwona Szykowska-Jóźwik/Vladimir Beškoski		
14:00-14:30	Plenary lecture Albert Lebedev	Mechanisms of Formation of Disinfection By-Products in Water Treatment	24
14:30-14:50	Section lecture Lydia Niemi	Pharmaceuticals in the Aquatic Environment: A Rural Perspective and Cross-Sector Partnership Addressing the Issue in Scotland	31

14:50-15:05	Taja Verovšek	Wastewater Analysis Assessment: Prevalence of Drugs of Abuse in Educational Institutions	58
15:05-15:20	Christina Alina Schwanen	Structural Diversity of Organic Contaminants in a Meso-Scaled River System	59
15:20-15:35	Fábio Bernardo	Monitoring Volatile Methylsiloxanes Levels in Wastewater Collected from a Portuguese Wastewater Treatment Plant	60
15:35-15:50	Aleksandra Tubić	Presence of Arsenic and Microplastics in the Groundwater in the Vicinity of a LandfillTubić1	61
15:50-16:20	<b>Coffee break</b>		
16:20-16:35	Urška Šunta	Adsorption of Three Pesticides onto Different Polymer Types of Microplastic Particles in Alluvial Soil	62
16:35-16:50	Mojca Bavcon Kralj	Determination of Microplastics in Environmental Samples by Simply Applicable Method	63
16:50-17:05	Franja Prosenc	Method for Extraction, Quantification, and Identification of Microplastics from Soil and Compost	64
17:05-17:25	Section lecture Sonja Kaišarević	Neuroactive Compounds in the Aquatic Environment: Biomarkers of Effect and Their Integration into Adverse Outcome Pathways (AOPs)	32
17:25-17:40	Karla Jagić	Exposure to Polybrominated Diphenyl Ethers Associated with Car Dust	65
19:00-23:00	<b>Conference dinner at Restaurant “Wine House Kovačević“</b> (Kralja Petra 221, Irig) Transfer at 18:00h (the corner of Temerinska Street and Marija Trandafil Square,   5 min. walk from Matica Srpska)		

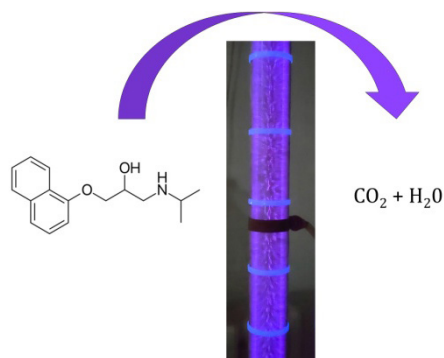
## Friday, December 3<sup>rd</sup>, 2021

Time	Presenter	Title	Page
08:00-08:30	<b>Registration</b>		
Moderators	Núria Fiol/Ivana Ivančev-Tumbas		
08:30-09:00	Plenary lecture Walter Gössler	A Closer Look at the Elemental Composition of Macrofungi, with a Focus on Arsenic	25
09:00-09:20	Section lecture Hideyuki Inui	Plants, An Attractive Partner for Phytoremediation and Phytomonitoring of Environmental Pollutants	33
09:20-09:35	Anna Irto	3-Hydroxy-4-pyridinone as Potential Chelating Agent for the Remediation of Ecotoxic Metals From Environmental Matrices	66
09:35-09:55	Section lecture Tatjana Anđelković	Phthalate Migration from Food and Medical Plastic Materials	34
09:55-10:10	Pascal Renard	Free Amino Acids Quantification in Cloud Water at the Puy de Dôme Station (France)	67
10:10-10:25	Roberto Di Pietro	Cd(II) Sorption by Novel Polymer Inclusion Membranes Based on L-Glutamic N,N-Diacetic Acid or Citric Acid from Aqueous Solution	68
10:25-10:55	<b>Coffee break / ACE General Assembly</b>		
10:55-11:10	Dmitrii Mazur	Estimation of Environmental Pollution Using Precipitation Analysis	69



## The Effect of Power on the Degradation of Propranolol by Nonthermal Plasma Reactor

S. Savić<sup>1,\*</sup>, V. Kovačević<sup>2</sup>, G. Sretenović<sup>2</sup>, B. Obradović<sup>2</sup>, G. Roglič<sup>1</sup>. (1) University of Belgrade, Faculty of Chemistry, Studentski trg 12-16, 11000 Belgrade, Serbia, (2) University of Belgrade, Faculty of Physics, Studentski trg 12, 11000 Belgrade, Serbia; \*sladjana@chem.bg.ac.rs.



Propranolol (PRO) is a beta-blocker that is readily detected in surface water and hospital wastewater [1]. This pharmaceutical poses a danger for aquatic animals because it is commonly prescribed for heart diseases and anxiety issues [2]. Advanced oxidation processes are commonly tested for the decomposition of pharmaceuticals because they produce various reactive species at room conditions [3].

A liquid-falling film dielectric barrier discharge (DBD) reactor was used for the treatment of a PRO solution, with no catalysts added. A coaxial construction, accompanied by a peristaltic pump, enables the recirculation of the treated liquid. Ambient air was selected as a feed-gas for nonthermal plasma generation under three levels of power dissipated in plasma. Direct contact of liquid film with plasma in this coaxial reactor enables the efficient transfer of reactive oxygen and nitrogen species generated in plasma to the liquid phase.

The degradation rate of PRO, pH value, and conductivity were monitored after every cycle of treatment of PRO solution (100 mg/dm<sup>3</sup>), and in the presence of scavengers (t-butanol and p-benzoquinone). The PRO concentration was monitored by HPLC-DAD, at 213 nm.

As expected, the highest applied power (60 W) contributed to the highest degradation rate (100%). At the same time, in these extreme conditions, pH values dropped from 6 to 2.5 and conductivity increased from 20 μS/cm to almost 1450 μS/cm in the tenth cycle of plasma treatment. Moreover, a high power yielded an

excessive decontamination level, but also in the grand production of nitric acid.

On the other hand, lower values of power lead to less successful endpoints, over 85% and less than 60% of degraded PRO when 35 W and 15 W were applied, respectively. Accordingly, under these conditions, the total production of ions was less intensive. The maximum conductivity value was less than 500 μS/cm for PRO treated with plasma generated by 35 W of power, and under 130 μS/cm for 15 W.

To elude the exact role of reactive species, a pair of scavengers were added to a PRO solution. Both t-butanol and p-benzoquinone cut down the degradation efficiency to roughly 50%, which is 35% less than without scavengers. This result indicates an important role of hydroxyl radicals and superoxide anion radicals in air-generated nonthermal plasma.

Advanced oxidation using this type of nonthermal plasma reactor enables the production of active species *in situ* while working in ambient conditions [4]. The effectiveness of plasma treatment was confirmed with the degradation of propranolol, as a model compound for common waterborne pharmaceuticals.

### Acknowledgements

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### References

- [1] M. Yi, Q. Sheng, Q. Sui, H. Lu, *Environmental Pollution*, 266 (2020) 115269.
- [2] T.-Y. Jeong, H.Y. Kim, S.D. Kim, *Environmental Pollution*, 206 (2015) 188–194.
- [3] M. Hijosa-Valsero, R. Molina, A. Monràs, M. Müller, J.M. Bayona, *Environmental Technology Reviews*, 3 (2014) 71–91.
- [4] P. Murugesan, E.M. V., J.A. Moses, C. Anandharamakrishnan, *Journal of Environmental Chemical Engineering*, 8 (2020) 104377.

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