

**28<sup>th</sup> Young Investigators' Seminar**  
**on Analytical Chemistry**

**YISAC 2023**

**BOOK OF ABSTRACTS**



**June 25<sup>th</sup> - 28<sup>th</sup>, 2023.**

Organized by:

**University of Belgrade - Faculty of Chemistry**



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## About YISAC

Young Investigators' Seminar on Analytical Chemistry (YISAC), is the traditional scientific meeting, organized yearly by one of the participating institutions. It is intended to be an international conference for young researchers in a rather advanced state of their study, usually post-graduate, such as MSc or Ph.D. students together with their supervisors. The main goal of the YISAC seminar is to prepare young investigators for their future scientific life (representation of their own research achievements, attendance of international symposia, project proposals).

YISAC is focused on analytical chemistry and its peripheral areas.

The scientific programme of Seminar is based on oral presentations only (approximately 15 minutes) followed by a discussion (approximately 5 minutes). Depending of the field of analytical chemistry, the Seminar is divided into individual sessions chaired by a student.

All participants are involved in cultural and social programme of the Seminar.

Each YISAC event include a conference dinner (for all participants) and a supervisor's dinner, where - at the supervisors' dinner - the next venue of the seminar is determined, followed by discussion of current scientific pending problems.

There are no conference fees.



***University of Belgrade - Faculty of Chemistry is hosting the Seminar this year.***

***Welcome!***

## About organizers and sponsors of YISAC 2023



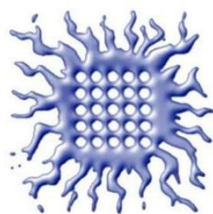
**The Faculty of Chemistry, University of Belgrade (FCUB)** is an internationally renowned, high-quality center for scientific research and high education, which encompasses studies at BSc, MSc, PhD and postdoctoral level, and represents one of the most important and prestigious institutions in Serbian research area and society. Research activities are conducted in several areas, such as chemistry of natural products, environmental protection and remediation, development and application of new analytical methods, computational chemistry, food chemistry, biochemistry, biotechnology and material science. In total, FCUB has 148 research laboratories including a well-established IT center. In addition to the national RTD projects, FCUB has extensive experience in coordination and management of international projects including EU FP7, TEMPUS IV, NATO, ANSO, HORIZON 2020, HORIZON EUROPE and NIH projects.

FCUB comprise groups of researchers active in drug design, synthesis, natural products isolation and characterization, analysis and structural determination as well as testing of activity of selected compounds, food and molecular biotechnology groups and miscellaneous groups like chemical education and theoretical chemistry.

*The Department of Analytical Chemistry of the Faculty of Chemistry of the University of Belgrade* was founded in 1971, at the same time as the other Departments that still exist within the Faculty of Chemistry. The first head of the Department was Professor Willim Weigand. Since then, the head of the Department has been replaced by prof. Tomislav Janjić, prof. Tibor Pastor, prof. Gordana Milovanović, prof. Lidija Pfenndt, prof. Marija Todorović, prof. Živoslav Tešić and prof. Snezana Nikolić-Mandić. The Department of Analytical Chemistry currently has 31 members, of which 16 are teaching and 15 are non-teaching staff. The head of the department is prof. Dušanka Milojković Opsenica. Analytical chemistry as a scientific discipline is as old as chemistry itself. It is interesting that the first chemical expert work published in Serbia in 1843 was related to the qualitative analysis of water. The content of certain substances was then described with "a lot", "a lot", "a little" ... At the end of the 19<sup>th</sup> and the beginning of the 20<sup>th</sup> century, analytical chemistry was dealt with, among others, by Sima Lozanić (he analyzed drinking and mineral waters, the tailings in the mercury mine on Avala, the Sokobanj and Jelica meteorites), Marko Leko (analyzed drinking water), Milorad Jovičić (analyzed chrome minerals), and in the lectures of Mihail Rašković, the first professor of chemistry at the Lyceum, analytical chemistry was also represented.

After World War II, the first professor of chemistry at the Faculty of Philosophy was Svetozar Jovanović, who together with Momir Jovanović laid the foundations of qualitative chemical analysis. After them, the qualitative chemical analysis was taken over by Tomislav Janjić, and the quantitative by Vilim Vajgand, at one time both professors at the Department of Analytical Chemistry of the Faculty of Chemistry of the University of Belgrade, who are considered the founders of almost all scientific fields of analytical chemistry in Serbia.

Today, the Department of Analytical Chemistry represents a modern and dynamic environment in which, through educational and scientific-research activities, trends in a large number of areas of analytical chemistry, such as food and natural product analysis, identification of bioactive compounds, electrochemistry, sensors, development of new materials, application and development of analytical methods in the examination of physico-chemical parameters of both compounds of environmental importance and biologically active compounds, drug analysis, chemometrics and advanced data processing (pattern recognition, classification, experimental design and optimization) are fully followed. The Department of Analytical Chemistry is dedicated to the continuous improvement of its teachers and associates and has numerous collaborations with prestigious scientific and research institutions in the country and the world.



**Vinča Institute of Nuclear Sciences** is regarded as Serbia's leading scientific institute in fundamental and applied research, owing to its size, scientific productivity, international reputation in research, and the quality of its scientific personnel and research facilities. It is unique in the multidisciplinary nature of its scientific capacities, with a unique infrastructure for the most ambitious research projects of strategic significance for the Republic of Serbia.

Since its foundation, the Institute has contributed that Yugoslavia, along with Serbia, has been included in the first five nuclear powers for knowledge and scientific achievements in the first two decades after the second world war. The work on nuclear research brought together experts from a broad range of related scientific fields which helps building knowledge and expertise throughout the following years.

The result of these activities has made a direct contribution to the national economic development encompass major areas of health, defense, industry and education. The following fundamental pillar in area of industrial and technological production were established: Electronic industry Niš, Department of Technical Physics, Faculty of Electrical Engineering in Belgrade, Faculty of Physical Chemistry, INEP Institute, ITNMS Institute, Mihajlo Pupin Institute, Institute of Physics, Belgrade. The first computers in our country were created at the Vinca Institute. Two Presidents of the Serbian Academy of Sciences and Arts came from the Vinca Institute. More than 1000 patents and technological solutions has been granted to the Institute.

Vinča Institute is a member of the University of Belgrade and has been actively involved in the conducting of basic, postgraduate and doctoral studies. Over the past seventy years, more than 1000 Ph.D. thesis have been made at the Institute. Each year University of Belgrade promote between 20 and 30 our students to Ph.D. researchers and many students from Universities all around Serbia do their Ph.D. studies in Vinca. In this way, the scientific staff of the Institute significantly contributes to improving the quality of teaching of the University of Belgrade and actively participates in the process of knowledge exchange in science-education model in Serbia.

Today, the Institute employs 311 researchers, and 210 Ph.D. students working on over a hundred national and international projects, as well as in international scientific research collaborations in which the Republic of Serbia is a member.

With extensive international scientific cooperation Vinča Institute promotes good will, strengthens political image of Republic of Serbia, helps civil society and private business through projects that bear tangible results.

Through the gates of the Vinča Institute annually passes over 1000 students and students, who participate in the special educational programs of the Institute, tailored to the needs of the age to which they belong. Through these education programs, young people acquire basic concepts about the science and its methodological principles, as well as basic knowledge in areas of special interest. It has been shown that these education programs for young have a significant impact on increasing number of students pursuing a higher education and boosting national economical development.



The basic activities of the **Institute of Chemistry, Technology and Metallurgy (ICTM)** are fundamental and applied multidisciplinary scientific research and design and development of technological processes in the following areas: Chemistry and Chemical Technology, Organic Chemistry, Electrochemistry, Catalysis, Microelectronic Technologies, Macromolecular and Polymer Materials, Biochemistry and Biotechnology, Materials Science, Metallurgy of Powders and Sintered Materials, Instrumental Analysis, Chemical Engineering, Nanoscience and Nanotechnology, Micro-Electromechanical Systems (MEMS), Sensor, Optoelectronics, Plasmonics, Semiconductor Technologies, Magnetic Materials and Magnetism, Metals and Metal Alloys, Environmental Protection and Remediation

ICTM is equipped with advanced tools for fabrication and characterization in all the areas listed above. The Institute has about 200 researchers (150 Ph.D.), mainly chemists, physico-chemists, engineers of chemical technology, electro, and mechanical engineers.

Activities of the Institute are carried out in six specialized research departments: Department of Chemistry, Department of Electrochemistry, Department of Microelectronic Technologies, Department of Catalysis and Chemical Engineering, Department of Materials and Metallurgy, and Department of Ecology and Technoeconomics.

Activities of the Department of Chemistry cover scientific and applied research in organic chemistry, biochemistry and biotechnology, biomacromolecules, chemistry of synthetic polymers, environmental chemistry, and theoretical and computational chemistry.

Department of Electrochemistry deals with fundamental scientific research in the fields of electrochemistry and electrochemical engineering: kinetics of electrode processes, electrochemistry of halogens and their compounds, electroorganic reactions, electrochemistry of double-layer, adsorption of organic compounds, corrosion and corrosion protection, mass transfer in electrochemical systems, electrode materials, metal deposition, electroanalytical chemistry and electrochemical sensors, electrometallurgy, etc.

Department of Microelectronic Technologies deals with multidisciplinary research in the fields of sensors, microelectromechanical systems (MEMS), nanoscience and nanotechnology, photonics and plasmonics, as well as semiconductor science and technology. Researches start from the fundamental concepts and theoretical research and ends up with constructed devices or systems.

Department of Catalysis and Chemical Engineering is a unique national research institution in the field of catalysis and chemical engineering. Department covers the entire spectrum of activities in the field of catalysis, catalytic processes and chemical engineering, from basic research and development of new technologies, to their application in the industry.

Department of Materials and Metallurgy doing research in the field of metallurgy of powder and sintered composite materials. The department offers services in the

scientific research in the field of powder metallurgy, development of technological processes for the production and application of powder, composite and other special materials, as well as high-quality components for special purpose materials.

Department of Ecology and Technoeconomics is a scientific, research and consulting unit of ICTM, specialized in the areas of engineering and market management in process industries, designing and engineering of process technologies, and laboratory research and testing.





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The primary activities of our company are wholesale, maintenance and servicing of analytical, process, and general laboratory equipment, along with training users for successful and high-quality work on the instrument.

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On the other hand, Analysis Lab for calibration and validation offers the services of calibration, validation, and equipment testing, with a wide variety of accreditations.

In April 2021, the company Analysis Adria d.o.o. was founded, based in Ljubljana, with the aim of greater engagement, better business in the region and market expansion.

#### Sales program:





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The company Primalab d.o.o. with a headquarter in Polzela, Slovenia, was established on June 1<sup>st</sup>, 2006 by Mrs. Mojca Divjak Gulin and Mr. Simon Uršič.

Primalab d.o.o. is from January 1<sup>st</sup>, 2010 the distributor of the company Metrohm AG, Herisau on the whole market of the former Yugoslavia (except Macedonia) and Albania. We are now authorised representative and in charge for selling, supporting, enforcing warranty claims and servicing Metrohm products.

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## SCIENTIFIC PROGRAMME OF YISAC 2023

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**Sunday, June 25<sup>th</sup>, 2023**

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*Location:* University of Belgrade - Faculty of Chemistry, Studentski trg 12-16, 11000 Belgrade, Serbia

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**from 18:00**      Registration  
                         Welcome party

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**Monday, June 26<sup>th</sup>, 2023**

*Location:* University of Belgrade - Faculty of Chemistry, Studentski trg 12-16, 11000 Belgrade, Serbia

09:00 - 09:20      Opening of YISAC 2023

**09:20 - 11:20**

**SESSION I: Voltammetric methods**

*Chairmen:* Olha Sarakhman and Martina Zatloukalová

09:20 - 09:40      **Nikola Turuntaš**  
Electroanalytical performance of boron doped diamond electrode for the determination of solifenacin

09:40 - 10:00      **Tijana Mutić**  
Fabrication of bismuth-oxychloride supported carbon paste electrode for sensitive and selective Quinine sensing

10:00 - 10:20      **Aleksandar Mijajlović**  
A novel carbon paste electrode modified by NP-Y<sub>2</sub>O<sub>3</sub> doped with the g-C<sub>3</sub>N<sub>4</sub> for sensitive electrochemical detection of herbicide bentazone in river, soil, and vegetable samples

10:20 - 10:40      **Maksimiljan Dekleva**  
Activated Graphite Glass Composite Thick Film Working Electrodes for Voltammetric Detection of Pesticides

10:40 - 11:00      **Egzontina Shabani**  
Electrochemical Detection of Phenolic Compounds in Extra Virgin Olive Oils using a Modified Glassy Carbon Electrode with Multi-Walled Carbon Nanotubes and Titanium Dioxide Nanoparticles: An Organic Solvent-Free Approach

11:00 - 11:20      **Jelena Ostojić**  
Detection and quantification of caffeine and theobromine with screen-printed boron-doped diamond electrode

**11:20 - 11:40      Coffee Break**

**11:40 - 13:00**

**SESSION II: Extraction methods / Degradation studies**

*Chairmen:* Jelena Ostojić and Tilen Šimenko Lalič

11:40 - 12:00      **Jasmina Mušović**  
Extraction and separation of technology critical elements using Ionic liquids based and deep eutectic solvents based aqueous biphasic systems

12:00 - 12:20      **Edita Bjelić**  
Extraction of bioactive compounds from biomass using hydrophobic deep eutectic solvents

12:20 - 12:40      **Szabolcs Bognár**  
Eco-inspired removal of agricultural herbicide tembotrione in the presence of various plant based ZnO nanomaterials using renewable solar energy

12:40 - 13:00      **Dušica Jovanović**  
Application of green synthesized ZnO nanoparticles based on banana peel extract in the photocatalytic degradation of ciprofloxacin

13:00 - 13:40 **Lunch Break**

13:40 - 15:20

**SESSION III: Electrochemical sensors**

*Chairmen: Josipa Dugeč and Abdelatif Laroui*

13:40 - 14:00	<b>Olha Sarakhman</b> Biomass use and its implications for sensor development
14:00 - 14:20	<b>Marija Kovačević</b> Optimization of Electrochemical Sensor for the Determination of Neonicotinoids
14:20 - 14:40	<b>Miroslav Kováč</b> 3D printed PLA-carbon electrodes activated by atmospheric air plasma: Toward improved performance in electrochemical sensing
14:40 - 15:00	<b>Gylxhane Kastrati</b> Advancing Protein Kinase Studies: Immobilization and Sensor Development
15:00 - 15:20	<b>Alnilan Lobato</b> Comparison of gelatin- and polyaniline-based sensors for impedimetric detection of SARS-CoV-2 infection on screen-printed carbon electrodes

15:20 - 15:40 **Coffee Break**

15:40 - 17:00

**SESSION IV: Chromatographic and optical methods**

*Chairmen: Špela Pok and Milinko Perić*

15:40 - 16:00	<b>Tilen Šimenko Lalič</b> Development of gas chromatographic-tandem mass spectrometric method for the determination of alkylphenols in aqueous samples
16:00 - 16:20	<b>Tamara Pócsová</b> Study of Parameters of Microextraction by Packed Sorbent of Nitro Compounds in Water Samples
16:20 - 16:40	<b>Ana Šijanec</b> Determination of artemisinin in micellized formulation
16:40 - 17:00	<b>Antea Hrepić</b> Investigating Crater Geometry and Empirical Modeling for Enhanced Laser Ablation Inductively Coupled Plasma Mass Spectrometry Analysis

**from 19:00** **Supervisors' dinner**  
'Mala Kolubara' restaurant (Ivankovacka 2, 11000 Belgrade)

**Tuesday, June 27<sup>th</sup>, 2023**

*Location:* University of Belgrade - Faculty of Chemistry, Studentski trg 12-16, 11000 Belgrade, Serbia

**09:00 - 10:40**

**SESSION V: Environmental analysis**

*Chairmen:* Dušica Jovanović and Szabolcs Bognár

09:00 - 09:20	<b>Gloria Zlatić</b> Impact of <i>Artemisia annua L.</i> on microbiologically influenced corrosion of steel in a simulated marine environment
09:20 - 09:40	<b>Špela Pok</b> Microplastics with adsorbed contaminants: Development of analytical methods for monitoring pollutants and their photodegradation products
09:40 - 10:00	<b>Milinko Perić</b> Potential of $Ti_3C_2T_x$ in applications based on water purification
10:00 - 10:20	<b>Nevena Malinović</b> The effect of selected biostimulators on the stability of the active components of fungicides based on mancozeb and metalaxyl
10:20 - 10:40	<b>Jelena Tomić</b> Influence of the selected biostimulators on the prolonged action and stability of imidacloprid
<b>10:40 - 11:00</b>	<b>Coffee Break</b>

**11:00 - 12:40**

**SESSION VI: Amperometric methods / Soft interfaces**

*Chairmen:* Tijana Mutić and Nikola Turuntaš

11:00 - 11:20	<b>Sanja Mutić</b> Amperometric determination of cholesterol using cholesterol oxidase immobilized on Pt,Ru-C nanocomposite and an ionic liquid-modified carbon paste electrode
11:20 - 11:40	<b>Marek Haššo</b> A simple, high-throughput and portable electrochemical platform for rapid quantification of tannic acid in beverages by batch injection analysis with amperometric detection
11:40 - 12:00	<b>Josipa Dugeč</b> The effects of the ionic strength of the supporting media on the electrochemical response: thin-layer phenomena of the gallic acid at the single-wall carbon nanotubes
12:00 - 12:20	<b>Abdelatif Laroui</b> Electrochemical behavior of ionic and neutral surfactant at the polarized liquid-liquid interface
12:20 - 12:40	<b>Martina Zatloukalová</b> Electrochemical Analysis of Interaction of Nitro-fatty Acids with POPC Lipid Membrane
<b>12:40 - 13:20</b>	<b>Lunch Break</b>

<b>SESSION VII: Other methods</b>	
<i>Chairmen: Ana Šijanec and Alnilan Lobato</i>	
<b>13:20 - 15:00</b>	
	<b>Fouad Alloun</b>
13:20 - 13:40	Ferrimagnetic behavior of the 3D phosphate $K_4CoFe_3P_5O_{20}$ with $T_c = 17K$ : Synthesis, structural study, and optical properties
	<b>Aicha Elaouni</b>
13:40 - 14:00	Synthesis of $Bi_2WO_6$ Photocatalysts Using Surfactant-assisted Hydrothermal Method: Characterization and Photocatalytic Activity
	<b>Ksenija Rutnik</b>
14:00 - 14:20	Determination of changes in hop chemical composition under different storage conditions
	<b>Leona Hofmeisterová</b>
14:20 - 14:40	Identification of <i>Arcobacter spp.</i> using the PCR method with electrophoretic detection
	<b>Andrijana Bilić</b>
14:40 - 15:00	Understanding the interactions between nadolol and hydroxyl radical: A computational study
<b>15:00 - 15:20</b>	<b>Coffee Break</b>
<b>15:20</b>	Closing of YISAC 2023
<b>from 19:00</b>	<b>Conference dinner</b> 'Konoba Akustik' kafana (Cara Dušana 13, 11000 Belgrade)

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**Wednesday, June 28<sup>th</sup>, 2023**

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*Location:* University of Belgrade - Faculty of Chemistry, Studentski trg 12-16, 11000 Belgrade, Serbia

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**from 10:00      City tour - optional**

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## **Amperometric determination of cholesterol using cholesterol oxidase immobilized on Pt,Ru-C nanocomposite and an ionic liquid-modified carbon paste electrode**

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Cholesterol as very important biomolecule is the precursor of many biologically significant compounds which give strength and flexibility to the biological membranes. It is also a crucial component in lipoproteins, and has an important role to transport hydrophobic molecules in hydrophilic media such as blood [1, 2]. The analytical performance of carbon paste electrodes (CPE) bulk modified with ionic liquid 1-allyl-3-methylimidazolium dicyanamide ([AMIM][DCA]), and surface modified with platinum on graphitized carbon (Pt-C) or platinum-ruthenium alloy on graphitized carbon (Pt,Ru-C) for analysis of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) were compared. The prepared working electrodes were characterized using scanning electron microscopy–energy-dispersive X-ray spectrometry, together with electrochemical impedance spectroscopic, cyclic voltammetric, and amperometric techniques. After method optimization, an enzyme cholesterol oxidase (ChOx) was immobilized on the surface of Pt,Ru-C/IL-CPE by Nafion®. The improved cholesterol amperometric determination was achieved in phosphate buffer solution pH 7.50 at a working potential of 0.60 V. Under the optimized experimental conditions, a linear relationship between oxidation current and cholesterol concentration was in the concentration range from 0.31 to 2.46 μM, with an estimated detection limit of 0.13 μM and relative standard deviation (RSD) below 4.2%. The optimized amperometric method in combination with the developed ChOx/Pt,Ru-C/IL-CPE biosensor showed good repeatability and high selectivity towards cholesterol biosensing despite the presence of possible interferences. The ChOx/Pt,Ru-C/IL-CPE was tested for the determination of the free cholesterol, by its enzymatic reaction product H<sub>2</sub>O<sub>2</sub>, in a human blood serum sample. The percentage recovery ranged from 99.08 to 102.81%, while RSD was below 2.0% for untreated, as well as for spiked human blood serum sample.

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