Chair of Analytical and Physical Chemistry

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ABSTRACT

The Chair for Analytical and Physical Chemistry currently consists of ten professors and two associates. A number of researchers and other associates also contribute to the work carried out within the Chair. Throughout every level of the studies (Undergraduate Academic Studies, Master Academic Studies, and Doctoral Academic Studies), the students attend a great number of courses within these scientific fields. The members of the Chair are the authors of 14 university coursebooks, workbooks, as well as practicums. The professors, associates and researchers of the Chair deal with the following fields of scientific research: the GC-MS analysis of PAHs with the optimization of the method of samples preparation, the development and validation of the ICP-OES methods, the development and validation of kinetic spectrophotometric methods, the HPLC determination of total polyphenols, flavonoids and anthocyanins with the examination of the kinetics of their degradation, the spectrophotometric and the cyclic voltammetry determination of antioxidant activity. A large number of papers has been published in international and national journals. The research laboratories are equipped with ICP-AES, HPLC, spectrophotometers, automatic titrator, analytical balances, high purity water system, vacuum evaporator, pH-meters, conductometers, and other minor laboratory equipment. The researchers of the Chair have participated in many national scientific-research projects, as well as international projects such as Erasmus, Tempus, FP7, The Researchers’ Night, and they have also attended the postdoctoral specializations and study visits abroad, which contribute to the good cooperation between the Chair and other universities in the world.


**Staff of the Chair**

The Chair for Analytical and Physical Chemistry includes the following professors and associates: Snežana Mitić (*Head of the Chair*), Vesna Stankov-Jovanović (*Head of the Division of Chemistry at the Center for Scientific and Professional Activities in Natural and Mathematical Sciences*), Snežana Tošić, Violeta Mitić (*Head of the Department of Chemistry*), and Aleksandra Pavlović as full professors; Sofija Rančić, Emilija Pecev-Marinković, Ivana Rašić Mišić, Milan Mitić as associate professors; Milan Stojković as an assistant professor and Jelena Cvetković and Jelena Mrmošanin as teaching assistants. Marija Ilić as a scientific associate, Marija Dimitrijević, and Ana Miletić as research associates, Slobodan Ćirić as a research assistant, professional associates and other associates in the laboratories also participate in teaching and research activities.

![Staff of the Chair](image)

*Figure 1. The Staff of the Chair for Analytical and Physical Chemistry*
Studies

At the first level of studies (three-year undergraduate academic studies-Chemistry) students are introduced to the following courses in the field of analytical and physical chemistry: Analytical Chemistry 1, Analytical Chemistry 2, Physical Chemistry 1, Structure of Atoms and Molecules, Analytical Chemistry 3, Physical Chemistry 2, Instrumental Analytical Chemistry as obligatory courses and Statistical Data Analysis, Selected Topics in Volumetric Analysis, Complex Samples Preparation, Principles of Quality Control in Analytical Laboratory and Molecular Spectra as elective courses. At the two-year second level of master academic studies-Chemistry (modules: Research and Development, and Teacher of Chemistry) and Applied Chemistry (modules: Applied Chemistry, and Environmental Chemistry) students are introduced to the following courses: Electrochemistry, Modern Optical Methods of Analysis, Modern Electroanalytical Methods, Chemometrics, Selected Topics in Instrumental Analysis, Kinetics and Catalysis, Environmental Analytical Chemistry, Methodology of Chemistry Teaching 2 and School Practice 2 as obligatory courses, and Physico-Chemical Bases of Separation Methods in Chemistry, Selected Topics in Physical Chemistry, Physical Chemistry of Solids, Scientific Research Methodology, Working with Talented Students, Food Chemistry Analysis, Bioanalytical Chemistry, Kinetic Methods of Analysis, Analysis of Toxic Substances, and Environmental Electroanalytical Methods as elective courses. Doctoral academic studies-Chemistry in duration of three years include the following elective courses: Equilibria in Chemistry, Selected Topics in Optical and Related Methods of Chemical Analysis, Selected Topics in Electrochemical Methods of Analysis, Atomic Spectroscopy, Molecular Spectroscopy, Instrumental Analysis 1, Instrumental Analysis 2, Physical and Chemical Methods for Equilibrium Determination in Complex Media, Separation Methods, Kinetic Methods of Analysis, Selected Topics in Physical Chemistry, Selected Topics in the Applications of Organic Reagents in Chemical Analysis.

Laboratory equipment

The laboratory equipment of the Chair for Analytical and Physical Chemistry (Fig. 2) includes:
- Inductively coupled plasma atomic emission spectrometer (ICP-AES) iCAP 6300 Duo (Thermo Scientific, Cambridge, UK);
- HPLC Agilent-1200 (Agilent Technologies, Santa Clara, California, USA) with Ultra Violet-Visible–Diode Array Detection (UV-Vis DAD) detector and Fluorescence Detector (FLD);
- Spectrophotometer Agilent-8453 (Agilent Technologies, Santa Clara, California, USA);
- Spectrophotometer UV-1800 Shimadzu (Shimadzu Corporation, Kyoto, Japan);
- Spectrophotometer Spectra 2000 (LaboMed, INC., Los Angeles, California, USA);
- Lambda 15 UV/VIS Spectrophotometer (Perkin-Elmer, Waltham, Massachusetts, USA);
- Analytical balance AB204-S (Mettler Toledo Greifensee, Switzerland);
- ED5A Heating Circulator with Open Bath (Julabo, Seelbach, Baden-Württemberg, Germany);
- Rotavapor R200 (BUCHI, New Castle, USA);
- Automatic titrator 716 DMS Titrino (Metrohm, Switzerland);
- MicroMed high purity water system (TKA Wasseraufbereitungssysteme GmbH, Germany).

**Figure 2.** Laboratory equipment
Research Projects

Since 2000, researchers, members of the Chair for Analytical and Physical Chemistry, have been included in the following national projects:

- Ethnopharmacological study of the region of South-Eastern Serbia (2017-);
- 172047: Natural products of plants and lichens: isolation, identification, biological activity and application (2011-);
- 172051: Development of new and improvement of existing electrochemical, spectroscopic and flow injection (FIA) methods on environmental quality monitoring (2011-);
- 172061: Combinatorial libraries of heterogeneous catalysts, natural products, modified natural products, and analogs: The approach to new biologically active agents (2011-);
- 142015: Development and application of methods for industrial products and environment quality monitoring (2006-2010);
- 142054: Secondary metabolites: Biological and antioxidant activity (2006-2010);
- 1211: Development of new and improvement of existing analytical methods for industrial products and environment quality monitoring (2001-2005);
- 2812: Investigation of chemical composition and bioactivity of secondary metabolites of plants species from genera Achillea, Acinos, Artemisia and Calamintha (2001-2005);

They have taken part in following international projects as well:

- ERASMUS+ (Capacity building in higher education), 573806-EPP-1-2016-1-RS-EPPKA2-CBHE-JP, Development of master curricula for natural disasters risk management in Western Balkan countries (NatRisk) (2016-);
- TEMPUS,544006-TEMPUS-1-2013-1-RS-TEMPUS-SMGR, FUSE-FosteringUniversity Support Services and Procedures for Full Participation in the European Higher Education Area (2013-2016);
Postdoctoral research and study visits

Several researchers, members of the Group for Analytical and Physical Chemistry, were on postdoctoral stays abroad supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia within the program of postdoctoral fellowships for young scientists. In 2013, Milan Mitić was on a five-month postdoctoral stay at the Laboratory of Food Science and Technology, School of Chemistry, The Aristotle University of Thessaloniki (under the supervision of Prof. Dr. Maria Tsimidou and the collaboration of Dr. Eleni Naziri). In 2008, Milan Mitić was on a three-month study visit at the National Institute for Agricultural Research Laboratory, Montpellier, INRA, France. The training was carried out under the supervision of Jean-Marc Souquet (INRA, France). Vesna Stankov Jovanović was on a six-month postdoctoral stay at University Pierre and Marie Curie (Paris, France) under the program "Research in Paris 2011" (2011-2012). In 2018, she was also on a one-month study visit at University of Natural Resources and Life Sciences (BOKU, Vienna, Austria) and in 2010 she was a visiting researcher at the Institute for Water Education at Delft University (UNESCO-IHE). Since 1986, Vesna Stankov-Jovanović has collaborated with the Department of Chemistry and Hydrogeology of the Petnica Research Center and since 2006, she has lectured various courses to school pupils.
Collaboration

Researchers at the Group for Analytical and Physical Chemistry cooperate with the following institutions: Middlesex University, London, UK; Technical University Crete, Greece; Obuda University, Budapest, Hungary; University of Messina, Messina, Italy; University "Otto Friedrich", Bamberg, Germany; Jagiellonian University, Krakow, Poland; University of Malaga, Malaga, Spain; Masaryk University, Brno, Czech Republic; University of Marseille, France; University of Poitiers, France; University of Ljubljana, Slovenia; Ondokuz Mais University, Samsun, Turkey; University of Tirana, Albania; University Alexandar Moisiu, Durres, Albania; University of Sarajevo, Bosnia and Herzegovina, and University of East Sarajevo, Bosnia and Herzegovina.

Research work

Research work includes:

▪ investigation of a novel sorbent to the quick, easy, cheap, effective, rugged, and safe technique for soil sample preparation for the determination of polycyclic aromatic hydrocarbons (PAHs) by GC-MS analysis;

▪ optimization the QuEChERS (Quick, Easy, Cheap, Effective, Rugged and Safe) technique, in order to establish an efficient method for the extraction of PAHs from the soil, using various sorbent and solvent system combinations, followed by GC-MS analysis;

▪ development and validation of the ICP-AES method for determination of elements in soil, water, plants, foods, etc.;

▪ development and validation of kinetic spectrophotometric methods for the determination of metals, amino acids, the residue of pesticides and pharmaceuticals in the soil, water, foods, and pharmaceutical preparations;

▪ identification and quantification of polyphenolic compounds in food and plants by HPLC chromatography;
- determination of total polyphenols, flavonoids and anthocyanins in food and plants using spectrophotometric methods;
- evaluation of food and plant antioxidant activity by spectrophotometric techniques such as 1) radical scavenging activity (2,2-diphenyl-1-picrylhydrazyl, DPPH), 2) cation decolorization activity (2,2’-azino-bis (3-ethylbenzothiazoline-6-sulphonic acid, ABTS), 3) ferric reducing antioxidant power (FRAP), 4) cupric reducing antioxidant capacity (CUPRAC), and 5) total reducing power (TRP);
- evaluation of food and plant antioxidant activity by electrochemical technique-cyclic voltammetry;
- chemometric characterization of food and plants according to their antioxidant activities, polyphenolic and metal contents;
- investigation of the kinetics of the degradation of catechins and procyanidins during food storage and preparation.

Selected research papers

spectrometry method for macro and trace element determination in berry fruit samples. Analytical Methods, 8, 4844-4852.


**Published books in Serbian and chapters in edited books**