

COURSE DESCRIPTION

Academic year: 2022/2023	
University: Comenius University Bratislava	
Faculty: Faculty of Pharmacy	
Course ID: FaF.KFANF/08-Mgr-A/20	Course title: New Trends in Analytical Chemistry
Educational activities: Type of activities: lecture / laboratory practicals Number of hours: per week: 1 / 2 per level/semester: 14 / 28 Form of the course: on-site learning	
Number of credits: 3	
Recommended semester: 4.	
Educational level: I.II.	
Prerequisites:	
Course requirements: Obligatory elective course. Final assessment: after passing laboratory practices – examination. Presence on all forms of education is obligatory. Examination is performed in written form (in person, in case of distance learning (e.g. during the pandemic period) exam can be performed via MS Teams according to the teacher's decision). It is necessary to reach at least 60% of a total score for successful passing of the examination. Scale of assessment (preliminary/final): 0/100	
Learning outcomes: The course expands the knowledge gained in the module Analytical Chemistry II with the latest trends in the procedures of pretreatment and analysis of pharmaceutically relevant samples. In this context, it deals with the automation and miniaturization of the analytical procedure, using new materials (sensors, stationary phases, additives), methodologies (LIF, MS / MS, UHPLC, SFC, CDEKC, etc.), combined techniques (especially LC-MS, CE -MS) and multidimensional (2D LC, 2D-CE) techniques, on-line (e.g. SPE-LC) and miniaturized (microdialysis, microextraction, etc.) sample preparation prior to analysis. The student will learn the importance and the strategy of optimization, and practical application potential of such methods increasingly promoted in the effectiveness of analytical procedures in research and routine pharmaceutical laboratories. When developing a reliable analytical method, students will also become familiar with the basics of validation of methods in the pharmaceutical analysis according to existing guidelines. Laboratory exercises are focused on the use of modern instrumental techniques, which are selected separation methods (liquid chromatography, gas chromatography, capillary zone electrophoresis, isotachophoresis), methods of polycomponent elemental analysis (radionuclide X-ray fluorescence analysis), the latest approaches in electrochemical and spectral analytical methods as well as computer simulation methods and molecular modeling methods. The knowledge and experience that students will gain after completing the course will be a good basis for successful completion of the thesis, as well as in doctoral studies (PhD.).	
Class syllabus: • Advanced sample preparation methods prior to instrumental analysis	

- o microdialysis
- o Microextraction (mSPE, mLLE)
- o Ultrafiltration
- o Ultracentrifugation
- Development, optimization, and validation of an analytical method for pharmaceutical use.
- o Optimization and validation parameters of the method for pharmaceutical analysis
- o Validation protocol in pharmaceutical analysis
- o National and transnational pharmacopoeias in the process of validation of analytical methods
- New electrochemical methods and their specifics
- o Traditional vs. new electrode materials (carbon, metal, nanomaterials)
- o Electrode modifications (nanoparticles, enzymes, polymers, mediators, ionic liquids, nucleic acids)
- o Electrode formats: traditional, miniaturized, screen-printed
- o Advanced electrochemical techniques
- o Affinity and biocatalytic biosensors for biomedical research and practice
- New trends in spectral methods
- o Advanced Optical Methods (LIF)
- o Advanced NMR techniques (2D NMR)
- o Trends in mass spectrometry (tandem mass spectrometry, MSn), and ionization techniques (ESI, APPI, APCI, MALDI, ICP, ...)
- New trends in chromatographic separation methods
- o New types of stationary phases (monoliths, solid-core particles, functional group modifications)
- o Advances in instrumental design (UHPLC, UHTLC, SFC)
- o Miniaturization of HPLC systems (micro, nano)
- o Peak capacity, orthogonality, and chromatographic modes in the two-dimensional arrangement, LC-LC (heart cut analytical approach), LCxLC (comprehensive analytical approach)
- o Combined multidimensional chromatographic techniques LC-GC
- New trends in electrophoretic separation methods
- o Principles, advantages, limitations, and possibilities of using online sample pretreatment techniques
- o Miniaturization of systems (chips)
- o Combined multidimensional techniques (ITP-ITP, ITP-CZE, CZE-CZE)
- o Hybrid separation techniques (capillary electrochromatography (CEC), micellar electrokinetic chromatography (MEKC))

Recommended literature:

Mikuš, P., Maráková, K.: Hyphenated electrophoretic techniques in advanced analysis. Bratislava : KARTPRINT, 2012. 217 s. (scientific monograph)

Languages necessary to complete the course:

english language

Notes:

Past grade distribution

Total number of evaluated students: 13

A	ABS	B	C	D	E	FX
38,46	0,0	0,0	0,0	38,46	15,38	7,69

Lecturers: prof. RNDr. Peter Mikuš, PhD.

Last change: 16.02.2023

Approved by: prof. RNDr. Peter Mikuš, PhD.