



Study program: Integrated Academic Studies in Pharmacy
Course title: Analytical Chemistry I
Teacher: Radomir V. Malbaša, Nataša P. Milošević, Vesna B. Tepavčević, Zita Farkaš Agatić
Course status: Compulsory
ECTS Credits: 6
Condition: General chemistry
Course aim Acquiring theoretical and practical knowledge of chemical reactions that are important in the qualitative and quantitative chemical analysis of pharmaceutical products.
Expected outcome of the course: Students learn about the application of analytical reactions in chemical analysis, as well as the methods of ion separation and identification. Practical application of knowledge on ion separation and identification in laboratory work. Systematic and fractional analysis of ions in model and real systems, using precipitation and chromatographic methods.
Course description <i>Theoretical education</i> <ol style="list-style-type: none"> Analytical chemistry as a scientific discipline. The aims of chemical analysis. Analytical signals. Classification and importance of analytical chemistry. General course of analysis. Preventive measures in laboratories and first aid in case of accident. Dispersion systems. Solutions. Qualitative and quantitative composition of solution. Dissolution of substances. Water as a solvent. Calculation of the quantitative composition of solution - examples. Colloidal solutions. Chemical balance. Law of mass action. Equilibrium constant. Thermodynamic, stoichiometric and stepwise equilibrium constants. Types of equilibrium constants (examples). The behavior of strong electrolytes in solution. Acid-base reactions and balance. Calculation of pH in solutions of acids, bases, salts. Buffers. Acid-base balance in non-aqueous solutions, sH. Stoichiometric calculations. Complex-forming reactions. Cyclical and non-cyclical (chelate) complexes. Equilibria in solutions of complexes. Stability constants and instability constants of complexes. Cumulative stability constants of complexes. Conditional stability constants of complexes. The application of complex-forming reactions in chemical analysis. Oxide-reduction reactions. Redox pairs. Electrode potentials. Standard redox potentials. Formal redox potential. Effects of pH on redox potential. Equilibrium constants of oxide-reduction reactions. Application of redox reactions in analytical chemistry. Precipitation reactions. Solubility of ionic compounds in water. Thermodynamic and stoichiometric solubility product. The importance of the solubility product. Quantitative precipitation. Factors affecting the quantitative precipitation: the value of the solubility product, the concentration of ions in the solution, temperature, solvent, pH. Dissolution of weakly soluble compounds (conditions). Examples of a dissolution of weakly soluble hydroxides and salts. Stoichiometric calculations. Qualitative chemical analysis. Types of analyses. Analytical reactions: selective, group, specific, sensitive, proofing, masking. Reagents. Conditions for performing chemical reactions. Spot test. Dissolution of a sample for the analysis. New methods of sample preparation. Analytical groups of cations and anions. Systematic course of a complete analysis. Cationic analysis. Conditions for the precipitation and separation of I-V groups of cations. Specific and sensitive reactions for the analysis of certain cations. Anionic analysis. Basic principles of chromatographic analysis. Classification. Examples of the chromatographic separation of anions and cations (within the analytical groups) by means of column chromatography and thin-layer chromatography. <i>Practical education:</i> Analysis of anions in a purely anionic and in a complete analysis. <u>Hydrogen-sulphide cationic analysis</u> The separation and detection of cations of the I analytical group. The separation and detection of cations of the IIa analytical group. The separation and detection of cations of the IIb analytical group. The separation and detection of cations of the IIIa analytical group. The separation and detection of cations of the IIIb analytical group. The separation and detection of cations the IV and V of the analytical group.

Preparations for a complete cation and anion analysis

The separation and detection of cations of the I, IV and V analytical group.

The separation and detection of cations of the III, IV and V analytical group.

Complete analysis of cations and anions.

Identification of ions in a pharmaceutical preparation .

Qualitative chromatographic analysis of certain cations and anions

The separation and identification of cations of the I analytical group by thin-layer chromatography.

Separation and identification of halide anions by thin-layer chromatography.

Literature

Compulsory

1. Harvey D. Modern Analytical Chemistry. Boston: McGraw-Hill; 2000. (selected chapters)

Additional

1. Scoog DA, West DM, Holler FJ, Crouch SR, Fundamentals of Analytical chemistry. Belmont: Brooks/Cole; 2004. (selected chapters)

Number of active classes

Theory: 30

Practice: 60

Teaching methods

Lectures, laboratory exercises, consultations.

Student activity assessment (maximally 100 points)

Pre-exam activities	points	Final exam	points
Lectures	5	Written	
Practices	15	Oral	30
Colloquium	2 ×25	
Essay			