Study program: Integrated academic studies of pharmacy

Type and level of the study program: integrated academic studies

Course title: ANALYTICAL CHEMISTRY I(PhII-ACHEMI)

Teacher: Radomir V. Malbaša, Nataša P. Milošević, Vesna B. Tepavčević

Course status: compulsory

ECTS Credits: 7

Condition: General chemistry; Inorganic chemistry

Course aim

The aim of this course is to offer students the theoretical and practical knowledge of chemical reactions important for the qualitative and quantitative chemical analysis of the pharmaceutical products.

Expected outcome of the course:

Students acquire the theoretical and practical knowledge of the application of analytical reactions in chemical analysis and certain methods of ionic separation and identification. Laboratory practice in the field of separation and identification of ions. Systematic and fractional analysis of ions in model and real systems, using the methods of precipitation and chromatographic methods.

Course description

Theoretical education

1. 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. **2.** Dispersion systems. Solutions. Qualitative and quantitative composition of solution. Dissolution of substances. Water as a solvent. Example of calculating the composition of the solution. Colloidal solutions. **3.** Chemical balance. Law of mass action. Equilibrium constant. Thermodynamic, stoichiometric and gradual equilibrium constants. Types of equilibrium constants (examples). **4.** The behavior of strong electrolytes in solution. **5.** Acid-base reactions and balance. Calculation of pH in solutions of acids, bases, salts. Buffers. Acid-base balance in non-aqueous solutions, pH. Stoichiometric calculations. **6.** Complex-forming reactions. Cyclical and non-cyclical (chelate) complexes. Equilibria in solutions of the complex. Stability constants and instability contants of complexes. The cumulative stability constant of the complex. Conditional stability constant of the complex. The application of complex-forming reactions in chemical analysis. **7.** Oxide-reduction reactions. Redox pairs. Electrode potentials. Standard redox potentials. Formal redox potential. Effects of pH on redox potential. Equilibrium constant of oxide-reduction reaction. Application of redox reactions in analytical chemistry. **8.** Precipitation reactions. Solubility of ionic compounds in water. Thermodynamic and stoichiometric solubility product. The importance of the solubility product. Quantitative precipitation. Factors affecting the completeness of precipitation: the value of the solubility product, the concentration of ions in the solution, temperature, solvent, pH. Dissolution of weakly soluble compound (conditions). Examples of the dissolution of weakly soluble hydroxides and salts. Stoichiometric calculations. **9.** Qualitative chemical analysis. Types of analyses. Analytical reactions: selective, group, specific, sensitive, established. 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 of precipitation and separation of I-V groups of cations. Specific and sensitive reactions for the analysis of certain cations. Anionic analysis. **10.** 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.

Practical education: exercises, other forms of education, research related activities

1. Analysis of anions in a purely anionic and in a complete analysis.
2. Hydrogen-Sulphide cationic analysis. 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.
3. 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.
4. 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. McGgaw-Hill, Boston, 2000.
2. Analytical chemistry laboratory manual (Internal script).

Additional

1. Scoog DA, West DM, Holler FJ, Crouch SR. Fundamentals of Analytical chemistry. Brooks/Cole, Belmont, 2004.

Number of active classes				Other:
Lectures: 30	Practice: 60	Other types of teaching:	Research related activities:	

Teaching methods: lectures, laboratory exercises, consultations.

Student activity assessment (maximally 100 points)

Pre-exam activities	**points**	**Final exam**	**points**
Lectures		Written	
Practices	10	Oral	30
Colloquium	2 x 30	.....	
Essay			