Study Programme: Master Academic Studies in Chemistry

Course Unit Title: Physical Chemistry of Surfaces

Course Unit Code: IHN-514

Name of Lecturer(s): Full professor Branislav Jović; Assistant professor Branko Kordić

Type and Level of Studies: Master of Science Degree

Course Status (compulsory/elective): Elective

Semester (winter/summer): Winter

Language of instruction: English

Mode of course unit delivery (face-to-face/distance learning): Face-to-face

Number of ECTS Allocated: 6

Prerequisites: None

Course Aims:

Expanding student knowledge about processes at the phase boundaries, with special emphasis on the solid /liquid interface. Deepening student knowledge about thermodynamic analysis of surfaces and improving experimental skills for characterisation of surface processes which are important for understanding numerous environmental and adsorption-catalytic processes.

Learning Outcomes:

After the successful completion of the course, the student will be able to understand the processes at interfaces, and to independently plan and perform the investigation of the adsorbent characteristics and the adsorption process. On the basis of the obtained results, student will be able to explain and interpret the observed surface phenomena by applying the modern theory of processes at surfaces and interfaces.

Syllabus:

Theory

Surfaces and phase boundaries. Free surface energy versus surface tension. Chemical and physical interactions at the surfaces. Electrostatic forces and an electric double layer. Capillary phenomena. Adsorption on solid surfaces. Adsorption on the solid / gas interface. Adsorption on the solid /liquid interface. Kinetic and equilibrium adsorption models. Adsorption from one-component and multicomponent solutions. Adsorption on natural adsorbents (geosorbents). Geosorption and the concept of retardation.

Practice

The student will have the task to investigate the adsorption process of the selected organic compound on a chosen powdered adsorbent. The student will characterize the selected adsorbent (activated carbon or geosorbent) by determining the BET specific area the pore size. Student task will be to explain adsorption kinetics of the organic compound on the selected adsorbent from the aqueous solution and to characterize adsorption under adsorption equilibrium conditions. The students will analyze the results of the adsorption experiments and present them in the form of report that will then be defended.

Required Reading:

1. Worch, E., Adsorption technology in water treatment,Walter de Gruyter GmbH & Co. KG, Berlin, 2012.
2. Schwarzenbach, R.P., Gschwend, P.M., Imboden, D.M.: Environmental Organic Chemistry – Second Edition, Wiley, 2003.

Weekly Contact Hours:	**Lectures:** 3	**Practical work:** 2	
Teaching Methods: Lectures, laboratory work, desk study projects			
Knowledge Assessment (maximum of 100 points): 100			
Pre-exam obligations	points	**Final exam**	points
Active class participation	30	written exam	30
Practical work	20	oral exam	20