PhD STUDIES COURSE UNIT DESCRIPTION

Name of subject	Field of science, code	Faculty / Center	Department
Environmental Chemistry	Chemistry N 003	Faculty of Chemistry and Geosciences	Department of Analytical and Environmental Chemistry
Student's workload	**Credits**	**Student's workload**	**Credits**
Lectures		Consultations	
Independent study	7	Seminars	

Course annotation

The Environmental Chemistry course for PhD students contains the following chapters: 1. Atmospheric pressure dependence on the altitude. Temperature changes in atmosphere layers. Energy equilibrium in atmosphere. The scientific explanation of "Greenhouse effect". Dynamics of atmosphere: convection, advection, molecular and turbulent diffusion. 2. Composition of atmosphere. Water vapour in atmosphere. The mean lifetime of atmosphere components. Sources and leakage of atmosphere components. 3. Photochemical peculiarities of atmosphere above deserts, grasslands, swamps and oceans. Photochemical processes in urban atmosphere. 4. Chemistry of stratosphere. Catalytic and non-catalytic cycles of oxygen destruction. Atmospheric aerosol. The types and particle size of aerosols. Sources of aerosols. Physical properties of atmospheric aerosols. Chemical composition of atmospheric aerosols. 5. Evolution of Earth's atmosphere. The primary atmosphere. Early secondary atmosphere. Influence of emerged life to Earth's atmosphere. Oxygen in Earth's atmosphere. The oxygen – carbon cycle in atmosphere. Ozone layer depletion problem. Composition of atmosphere and clime. Pollution of atmosphere and acid rains. 6. Hydrological cycle and global water reservoir. Chemical composition of oceans and rivers. Carbonate equilibriums (distribution of carbonate particles, rain water pH, carbon dioxide solubility in water). 7. Acidity, basicity, total inorganic carbon. Calcium in water. Oxidation – reduction processes in water. Concept of pE. 8. Complex equilibriums. Ligands in natural waters. Influence of pH to the chemical form of ligands. The ratio between free and complex metal ions. Ligand influence to solubility of insoluble compounds. Humus compounds as ligands. Organic compounds in natural waters. 9. Composition of soil, the main chemical elements. Fractional composition of soil particles. The structure of main minerals. Structure and properties of clay minerals. 10. Ion exchange equilibriums in soil. The capacity of cation exchange. The non-specific adsorption and chemisorption of cations on soil minerals. The mechanisms of cation chemisorption. Decay processes in soil. Redox and complex equilibriums in soil.

Reading list

1. S. Armalis. Atmosferos Chemija. Vilnius University Press, Vilnius, 2009.
2. W. Stumm, J.J. Morgan. Aquatic Chemistry, 2nd ed. John Wiley & Sons, New York, USA, 1981.
3. M.B. McBride. Environmental Chemistry of Soils. Oxford University Press, UK, 1994.
4. J.H. Seinfeld, S.N. Pandis. Atmospheric Chemistry and Physics: from Air Pollution to Climate Change. John Wiley & Sons, New York, USA, 2006.
5. M.Z. Jacobson. Atmospheric Pollution: History, Science, and Regulation. Cambridge University Press, UK, 2002.
6. S.E. Manahan. Environmental Chemistry 7th ed. CRC Press LLC, Boca Raton, USA, 2000.
7. R.M. Harrison. Principles of Environmental Chemistry. RSC Publishing, Cambridge, UK, 2007.

The names of consulting teachers	Science degree	Main scientific works published in a scientific field in last 5 year period
Artūras Katelnikovas	Dr.	1. A. Linkeviciute, J. Būdienė, E. Naujalis, **A. Katelnikovas**, J. Barauskas. Development, Characterization and Stability Study of Lipid Liquid Crystalline systems for Delivery of Cranberry Flavonoids, *European Journal of Lipid Science and Technology* **118** (2017) 1600373. DOI: 10.1002/ejlt.201600373 2. E. Raudonyte-Svirbutaviciene, C.-W. Tai, A. Neagu, V. Vickackaite, A. Zarkov, V. Jasulaitiene, **A. Katelnikovas**. Photochemical approach to the synthesis of Ag-CeO_2 nanoheterostructures and their

		photocatalytic activity on tributyltin degradation. *Journal of Photochemistry and Photobiology A: Chemistry* **351** (2018) 29-41. DOI: 10.1016/j.jphotochem.2017.10.008 3. I. Mackevic, J. Grigorjevaite, M. Janulevicius, A. Linkeviciute, S. Sakirzanovas, **A. Katelnikovas**. Synthesis and Optical Properties of Highly Efficient Red-Emitting $K_2LaNb_5O_{15}:Eu^{3+}$ Phosphors. *Optical Materials* **89** (2019) 25-33. DOI: 10.1016/j.optmat.2018.12.045 4. J. Grigorjevaite, E. Ezerskyte, A. Minderyte, S. Stanionytė, R. Juskenas, S. Sakirzanovas, **A. Katelnikovas**. Optical Properties of Red Emitting $Rb_2Bi(PO_4)(MoO_4):Eu^{3+}$ Powders and Ceramics with High Quantum Efficiency for White LEDs. *Materials* **12** (2019) 3275. DOI: 10.3390/ma12193275 5. M. Janulevicius, V. Klimkevicius, A. Vanetsev, V. Plausinaitiene, S. Sakirzanovas, **A. Katelnikovas**. Controlled Hydrothermal Synthesis, Morphological Design and Colloidal Stability of $GdPO_4{\cdot}nH_2O$ Particles. *Materials Today Communications* **23** (2020) 100934. DOI: 10.1016/j.mtcomm.2020.100934 6. E. Ezerskyte, J. Grigorjevaite, A. Minderyte, S. Saitzek, **A. Katelnikovas**. Temperature-Dependent Luminescence of Red-Emitting $Ba_2Y_5B_5O_{17}:Eu^{3+}$ Phosphors with Efficiencies Close to Unity for Near-UV LEDs. *Materials* **13** (2020) 763. DOI: 10.3390/ma13030763 7. M. Janulevicius, V. Klimkevicius, L. Mikoliunaite, B. Vengalis, R. Vargalis, S. Sakirzanovas, V. Plausinaitiene, A. Zilinskas, **A. Katelnikovas**. Ultralight Magnetic Nanofibrous $GdPO_4$ Aerogel. *ACS Omega* **5** (2020) 14180-14185. DOI: 10.1021/acsomega.0c01980 8. V. Klimkevicius, M. Janulevicius, A. Babiceva, A. Drabavicius, **A. Katelnikovas**. Effect of Cationic Brush-Type Copolymers on the Colloidal Stability of $GdPO_4$ Particles with Different Morphologies in Biological Aqueous Media. *Langmuir* **36** (2020) 7533-7544. DOI: 10.1021/acs.langmuir.0c01130 9. J. Grigorjevaite, E. Ezerskyte, J. Paterek, S. Saitzek, A. Zabiliute-Karaliune, P. Vitta, D. Enseling, T. Jüstel**, A. Katelnikovas**. Luminescence and Luminescence Quenching of $K_2Bi(PO_4)(MoO_4):Sm^{3+}$ Phosphors for Horticultural and General Lighting Applications. *Materials Advances* **1** (2020) 1427-1438. DOI: 10.1039/D0MA00369G

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