

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Kemija okoljskih sistemov
Course title:	Chemistry of Environmental Systems

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Ekotehnologije, 3. stopnja	/	1	1
Ecotechnologies, 3 rd cycle	/	1	1

Vrsta predmeta / Course type Izbirni / Elective

Univerzitetna koda predmeta / University course code: EKO3-753

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
50	20	20		10	200	10

**Navedena porazdelitev ur velja, če je vpisanih vsaj 10 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 10 students are enrolled. Otherwise the contact hours are linearly reduced and transferred to individual work.*

Nosilec predmeta / Lecturer: Prof. dr. Milena Horvat
Prof. dr. Ester Heath

Jeziki / Predavanja / Lectures: Slovenski ali angleški / Slovene or English
Languages: Seminar: Angleški / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Zaključen študij druge stopnje naravoslovne ali tehniške smeri ali zaključen študij drugih smeri z dokazanim poznavanjem osnov področja predmeta (pisna dokazila, pogovor).

Prerequisites:

Completed second level studies in natural sciences or engineering or completed second level studies in other fields with proven knowledge of fundamentals in the field of this course (certificates, interview).

Vsebina:

Kemija tal.
 Osnove pedologije.
 Lastnosti talnih sistemov in podtalnice.
 Porazdelitev, usoda in vpliv polutantov v tleh.
 Ocena kvalitete tal in vodnega okolja.
 Osnove biogeokemije tal (speciacija polutantov, biorazpoložljivost, degradacija, transport in biološki/toksikološki vplivi v tleh).

 Atmosferska kemija.
 Fotokemija stratosfere in troposfere.
 Degradacija organskih spojin, nastanek aerosolov, nastanek ozonom heterogena kemija lastnosti aerosolov.

Content (Syllabus outline):

Soil chemistry:
 Introduction to pedology
 Properties of soil and groundwater
 Properties and the distribution, fate and effects of pollutants in soil environments.
 Assessment of soil and water quality.
 Basis of biogeochemistry of soils including pollutant speciation, bioavailability, degradation, transport and biological/toxicological effects in soil.

 Atmospheric chemistry:
 Photochemistry of the stratosphere and troposphere.
 Degradation of organic compounds, formation of

Življenjska doba organskih spojin, radikali.
Atmosfersko kroženje in vpliv na atmosfersko onesnaženje.

Voda.
Kemijska ravnotežja.
Sestava vodnih okolij (jezera, reke, morja).
Kroženje snovi v vodnem okolju (ravnotežja, precipitacija, porazdelitev, redoks reakcije).

aerosol precursors, ozone formation, heterogeneous chemistry, aerosol properties
Lifetimes of chemical compounds, radicals and radical families
Atmospheric circulation and its implications for the transport and mixing of atmospheric pollution

Aquatic chemistry
Advanced equilibrium chemistry
Composition of aquatic environments (lakes, rivers, seawater)
Processes controlling the formation of the aquatic environments. (equilibria cover acid-base, precipitation-, complex-, and redox-equilibria).

Temeljni literatura in viri / Readings:

- John H. Seinfeld, Spyros N. Pandis Atmospheric Chemistry And Physics: From Air Pollution to Climate Change , John Wiley & Sons Inc (August 2006)
- Colin Baird, Michael C. Cann, Michael Cann, Environmental Chemistry W H Freeman & Co (September 2004)
- Gary W. Vanloon, Stephen J. Duffy, Environmental Chemistry: A Global Perspective Oxford Univ Pr (May 2005)
- R. Cornelis (ed.): Handbook of Elemental Speciation, Techniques and Methodology. Chichester: John Wiley & Sons (2003), 657 p., ISBN 0-471-49214-0
- G.I. Sunahara et al. (eds.). Environmental Analysis of Contaminated Sites. New York: John Wiley&Sons (2002), 465 p., ISBN 0-471-98669-0
- Open science literature

Cilji in kompetence:

Glavni cilj predmeta je razumevanje okoljske kemije organskih in anorganskih kontaminantov v procesih, kot so biorazgradnje, hidrolize, fotodegradacije, sorpcije, izhlapevanja in bioakumulacije. Procesi so povezani s fizikalno-kemijsko in biološko strukture in značilnostmi okolja (voda, vodni sedimenti, vodna biota, tla in zrak).

Študent bo ob zaključku sposoben:

- Razumeti temeljne kemijske procese v zraku, vodi, tleh in sedimentih.
- Razumeti fizikalne, kemijske in biološke značilnosti okolja, ki vplivajo na porazdelitev in usodo kemijskih onesnaževal v okolju.
- Uporabiti pridobljeno znanje pri opisu in razumevanju kemijskih procesov v izbranih primerih onesnaženih okolij.

Objectives and competences:

The main goal of the course is understanding of environmental chemistry of organic and inorganic contaminants in processes such as biodegradation, hydrolysis, photodegradation, sorption, volatilization, and bioaccumulation. The processes are related to the physical, chemical, and biological properties and characteristics of the environmental compartments (water, aquatic sediments, aquatic biota, soil, and air).

The student will be able to:

- Understand the basic chemical processes in the air, water, soil and sediments.
- Understand the physical, chemical and biological characteristics of the environment that affect the distribution and fate of chemical pollutants in the environment.
- Use acquired knowledge in the description and understanding of chemical processes in selected cases of polluted environments.

Predvideni študijski rezultati (izidi):

Znanje in razumevanje:

- Kemijski procesi v okolju s poudarkom na razumevanju reakcij in porazdelitve glavnih onesnaževal v okolju.
- Razumevanje kemije v okolju v najširšem smislu s poudarkom na interakcijah med naravnimi procesi in človekovo dejavnostjo.

Prenesljive/ključne spretnosti in drugi atributi:

- Uporaba domače in tuje literature.
- Vključevanja znanja v gradnjo hipotez za reševanje problemov, ciljano k temi doktorata.
- Sposobnost razumevanja osnov okoljskega modeliranja kemijskih procesov.

Intended learning outcomes:

Knowledge and understanding:

- Environmental chemistry of pollutants, reactions, cycling and partitioning among different environmental compartments.
- Understanding of chemistry in the context of environmental processes, with special emphasis on interactions between natural processes and human activities.

Transferable / Key Skills and other attributes:

- Use of national and international literature
- Incorporation of knowledge into the construction of hypotheses for problem solving, thematically linked to postgraduate thesis
- Ability to understand basics of environmental modeling of chemical processes.

Metode poučevanja in učenja:

Sistematična predavanja

- razgovor
- reševanje problemov
- eksperimentalno delo

Terensko delo

- praktični primeri

Learning and teaching methods:

Systematic lectures

- conversation
- problem solving
- experimental work

Fieldwork

- practical examples.

Načini ocenjevanja:Delež (v %) /
Weight (in %)**Assessment:**

Seminarska naloga	25 %	Seminar work
Zagovor seminarske naloge, pri katerem dokaže osvojitve vseh študijskih izidov z vsaj po enim konkretnim primerom	50 %	Defense of the seminar work where the student demonstrates the achievement of all learning outcomes with at least one specific case for each outcome
Ustni izpit	25 %	Oral exam

Reference nosilca / Lecturer's references:

- KOTNIK, Jože, HORVAT, Milena, BEGU, Ermira, SHLYAPNIKOV, Yaroslav, SPROVIERI, Francesca, PIRONE, Nicola. Dissolved gaseous mercury (DGM) in the Mediterranean Sea: spatial and temporal trends. *Marine Chemistry*, 2017, 193, 8-19.
- BRATKIČ, Arne, VAHČIČ, Mitja, KOTNIK, Jože, OBU, Kristina, BEGU, Ermira, WOODWARD, E. Malcolm S., HORVAT, Milena. Mercury presence and speciation in the South Atlantic Ocean along the 40°S transect. *Global biogeochemical cycles*, 2016, 30, 2, 105-119.
- RUBINO, Angelo, OGRINC, Nives, FAJON, Vesna, HORVAT, Milena, et al. Biogeochemical, isotopic and bacterial distributions trace oceanic abyssal circulation. *PloS one*, 2016, 11, 1, 0145299-1-0145299-12.
- ČESEN, Marjeta, LENARČIČ, Kaja, MISLEJ, Vesna, LEVSTEK, Meta, KOVAČIČ, Ana, CIMRMANČIČ, Bernardka, URANJEK ŽEVART, Nataša, KOSJEK, Tina, HEATH, David John, SOLLNER DOLENC, Marija, HEATH, Ester. The occurrence and source identification of bisphenol compounds in wastewaters.

Science of the total environment, 2018, 616-617, 744-752.

- KOSJEK, Tina, NEGREIRA, Noelia, HEATH, Ester, LOPEZ DE ALDA, Miren, BARCELÓ, Damià. Aerobic activated sludge transformation of vincristine and identification of the transformation products. Science of the total environment, ISSN 0048-9697, 2017, vol. 610/611, str. 892-904