

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	Koloidna kemija okolja
<b>Course title:</b>	Environmental Colloid Chemistry

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

**Vrsta predmeta / Course type** Izbirni / Elective

**Univerzitetna koda predmeta / University course code:** EKO3-754

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Druge oblike Others	Samost. delo Individ. work	ECTS
15	15			15	105	5

*\*Navedena porazdelitev ur velja, če je vpisanih vsaj 15 študentov. Drugače se obseg izvedbe kontaktnih ur sorazmerno zmanjša in prenese v samostojno delo. / This distribution of hours is valid if at least 15 students are enrolled. Otherwise the contact hours are linearly reduced and transferred to individual work.*

**Nosilec predmeta / Lecturer:** Prof. dr. Nives Ogrinc  
Prof. dr. Ivan Sondi

**Jeziki / Predavanja / Lectures:** slovenščina, angleščina / Slovenian, English  
**Languages: Vaje / Tutorial:**

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

Diploma druge stopnje bolonjskega študija iz področja naravoslovja in tehnologije oz. znanje, ki je ekvivalentno univerzitetni izobrazbi s področja naravoslovja in tehnologije.

**Prerequisites:**

Diploma of the second level of the Bologna studies in natural sciences and technology or equivalent university degree.

**Vsebina:**

Narava in lastnosti mikro- in nano- delcev v raztopini in nove instrumentalne tehnike, ki se uporabljajo za njihovo karakterizacijo. Suspendirana snov in sedimenti. Osnovne lastnosti, struktura in površinske fizikalno-kemijske karakteristike koloidov, glinenih mineralov, karbonatov, kovinskih oksidov in oksihidratov. Biomineralizacija in bio-anorganski koloidi. Površinski naboj in potencial ter elektrokemijska dvojna/trojna plast. Elektrokinetika in zeta potencial. Stabilnost koloidov in procesi agregacije mikro- in nano- delcev v naravnih vodnih okoljih. Osnovni fizikalno-kemijski procesi interakcij trdnih

**Content (Syllabus outline):**

Nature and properties of aquatic micro- and nanosized mineral particles and instrumental techniques, which can be used for their characterization. Suspended materials and sediments. Basic properties, structural and interfacial physico-chemical characteristics of colloids, clay minerals, carbonates, oxides, and oxyhydrates. Biomineralization and bio-inorganic colloids. Surface charge and potential and the electrochemical double/triple layer. Electrokinetics and the zeta-potential. Colloidal stability and the processes of aggregation of micro- and nanosize particles in natural aquatic environments.

površin, ki katalizirajo, inhibirajo in reagirajo z organskimi in anorganskimi spojinami. Kompleksiranje površine na meji med trdno fazo in raztopino. Kontaminanti in polutanti v naravnih vodah. Mikro- in nano- koloidi pri procesih, vezavi, transportu in depoziciji polutantov v okolju. Uporaba koloidov pri reševanju nekaterih ekoloških problemov.

Basic physico-chemical processes of interaction of solid surfaces that catalyze, inhibit, or react with organic and inorganic compounds. Surface complexation at the solid/liquid interface. Contaminants and pollutants in natural waters. Micro- and nanosize colloids in processes of binding, transport, and deposition of pollutants in nature. The use of colloids to resolve some ecological problems.

#### Temeljna literatura in viri / Readings:

- Maurice, P.A., 2009. Environmental Surfaces and Interfaces from the Nanoscale to the Global Scale. John Wiley. New Jersey. 441 p.
- Nieto, F., Livi, K.J.T. (Editors). 2013. Minerals at the Nanoscale. European Mineralogical Union. Vol 14. London. 440 p.
- Stumm, W., 1992. Chemistry of the Solid-Water Interface. John Wiley. New York. 428 p.
- Hunter, R.J., 2001. Foundations of Colloid Science. Oxford University Press. 806 p.
- Wilkinson, K.J., Lead, J.R. (Eds.), 2007. Environmental Colloids and Particles: Behaviour, Separation and Characterization. IUPAC Series on Analytical and Physical Chemistry of Environmental Systems. Wiley, 687 p.
- Buffle, J., van Leeuwen, H.P. (Eds.), 1992. Environmental Particles. Environmental Analytical and Physical Chemistry Series. Lewis Publisher, 554 p.
- Droppo, I.G., Leppard, G.G., Liss, S.N., Milligan, T.G. (Eds.), 2005. Flocculation in Natural and Engineered Environmental Systems. CRC Press, 438 p.
- Pregledni članki iz : Journal of Colloid and Interface Science, Surface and Colloid Science, Advances in Colloid Interface Science, Langmuir, etc.

#### Cilji in kompetence:

Glavni namen predmeta je razumevanje osnov koloidne in površinske kemije ter predstavitev fizikalno-kemijskih procesov na fazni meji med trdno snovjo in raztopino (površina koloidov – raztopina). Predmet je usmerjen v razumevanje vloge koloidov pri kemijskih in bioloških reakcijah, pri mobilnosti in transportu polutantov v naravnih okoljih in v tehnologiji.

Predmet seznanja študente z osnovami koloidne kemije in njihovo uporabo v okolju in tehnologijah

#### Objectives and competences:

It concerns selected topics of fundamental of Colloid and Surface Chemistry. Introduction to physico-chemical processes at the solid/liquid (surfaces of colloids – aquatic system) interfaces. The course is devoted towards understanding their role in the chemical and biological reactions, mobility and transport of contaminants in natural environments and engineered aquatic systems.

This course prepares students in the fundamentals of colloid chemistry and their application in the environment and corollary technologies

#### Predvideni študijski rezultati:

Znanje in razumevanje:

- Osnove koloidne in površinske kemije
- Pomen koloidov v okolju in tehnologijah ter njihova uporaba pri reševanju praktičnih problemov

Študenti bodo z uspešno opravljenimi obveznostmi

#### Intended learning outcomes:

Knowledge and Understanding

- Basics in colloid and surface chemistry
- The importance of colloids in the environment, technologies and their relevance to solve practical problems

Students successfully completing this course will

tega predmeta pridobili:

- Obvladanje raziskovalnih metod na področju koloidne kemije, razumevanje procesov in transporta polutantov v okolju
- Sposobnost uporabe pridobljenega znanja v praksi
- Kooperativnost, delo v skupini (in v mednarodnem okolju)

acquire:

- The student will master research methods in the field of colloid chemistry, understanding of processes and transport of pollutants in the environment
- The ability of students to use knowledge in practical work,
- Work in team (in international environment).

**Metode poučevanja in učenja:**

- Predavanja
- Seminarji
- Konzultacije
- Individualno delo

**Learning and teaching methods:**

- Lectures
- Seminar work
- Consultations
- Individual work

Delež (v %) /

Weight (in %)

**Načini ocenjevanja:**

**Assessment:**

Seminarska naloga	50 %	Seminar work
Ustni zagovor seminarske naloge	50 %	Oral defense of seminar work

**Reference nosilca / Lecturer's references:**

- RUBINO, Angelo, BENSI, Manuel, HAINBUCHER, Dagmar, ZANCHETTIN, Davide, MAPELLI, Francesca, OGRINC, Nives, MARCHETTO, Davide, BORIN, Sara, CARDIN, Vanessa, FAJON, Vesna, HORVAT, Milena, TARICCO, Carla, BALDI, Franco. Biogeochemical, isotopic and bacterial distributions trace oceanic abyssal circulation. PloS one, 11, 1, 0145299-1-0145299-12, 2016, doi: 10.1371/journal.pone.0145299.
- TAMŠE, Samo, OGRINC, Nives, WALTER, Lynn M., TURK, Daniela, FAGANELI, Jadran. River sources of dissolved inorganic carbon in the Gulf of Trieste (N Adriatic) : stable carbon isotope evidence. Estuaries and coasts 38, 151-164, 2015.
- SONDI, Ivan, MIKAC, Nena, VDOVIĆ, N, IVANIĆ, Maja, FURDEK, M, ŠKAPIN, Damir, Srečo. Geochemistry of recent aragonite-rich sediments in Mediterranean karstic marine lakes: Trace elements as pollution and palaeoredox proxies and indicators of authigenic mineral formation. Chemosphere 168, 786-797, 2017.
- ČADEŽ, Vida, LEONARDI, Adrijana, KRIŽAJ, Igor, KAZAZIĆ, Saša, SALOPEK SONDI, Branka, SONDI, Ivan. Formation and morphogenesis of a cuttlebone's aragonite biomineral structures for the common cuttlefish (*Sepia officinalis*) on the nanoscale: Revisited. J. Colloid. Interface Sci. 354, 95-104, 2017.
- IVANIĆ, Maja, LOJEN, Sonja, GROZIĆ, Dino, JURINA, Irena., ŠKAPIN, Damir, Srečo, TROSKOT-ČORBIĆ, Tamara, MIKAC, Nena, JURAČIĆ, Mladen, SONDI, Ivan. Geochemistry of sedimentary organic matter and trace elements in modern lake sediments from transitional karstic land-sea environment of the Neretva River delta (Kuti Lake, Croatia) Quaternary International, 2017. doi.org/10.1016/j.quaint.2017.03.050 .