

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Radiokemija
Course title:	Radiochemistry

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Ekotehnologije, 2. stopnja	/	1	2
Ecotechnologies, 2 nd cycle	/	1	2

Vrsta predmeta / Course type Izbirni / Elective

Univerzitetna koda predmeta / University course code: EKO2-742

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	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. Ljudmila Benedik
Prof. dr. Borut Smodiš
Doc. dr. Marko Štok

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

Prerequisites:

Completed first 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:

Radionuklidi in uporaba radiokemijskih metod:

- Jedrske reakcije in kemija radioaktivnih izotopov;
- Proizvodnja radionuklidov in označenih spojin;
- Kemijske separacije radioaktivnih spojin;
- Jedrska energija in njeni vplivi na okolje, kemija jedrskega gorivnega cikla;
- Radionuklidi v geokemiji, kozmokeemiji in v znanosti o življenju;
- Radioaktivni sledilci pri kemijskih raziskavah;
- Kemija naravnih in umetnih radionuklidov v okolju.

Content (Syllabus outline):

Radionuclides and applications of radiochemical methods:

- Nuclear reactions and chemistry of radioactive isotopes;
- Production of radionuclides and labelled compounds;
- Chemical separations of radioactive compounds;
- Nuclear energy and its environmental effects, chemistry of the nuclear fuel cycle;
- Radionuclides in geo-, cosmo- chemistry and in the life sciences;
- Radiotracers in chemical research;

- Chemistry of natural and man-made radionuclides in the environment.

Temeljni literatura in viri / Readings:

- G. Choppin, J.-O. Liljenzin, J. Rydberg, C. Ekberg. Radiochemistry and Nuclear Chemistry, 4th Edition. Kidlington: Academic Press (2013), ISBN 978-0-12-405897-2.
- J.-V. Kratz, K. H. Lieser. Nuclear and Radiochemistry, 3rd Edition. Weinheim: Wiley-VCH (2013), ISBN 978-3-527-32901-4.
- J. Lehto, X. Hou. Chemistry and Analysis of Radionuclides: Laboratory Techniques and Methodology. Weinheim: Wiley - VCH (2011), ISBN 978-3-527-32658-7.
- M. F. L'Annunziata. Handbook of Radioactivity Analysis, 3rd Edition. London: Academic Press (2012), ISBN: 9780123848734.
- G. F. Knoll. Radiation Detection and Measurements, 4th Edition. N.Y.: John Wiley & Sons (2011), ISBN: 978-1-118-02691-5.
- N. Tsoulfanidis, S. Landsberger. Measurement and Detection of Radiation, 3rd Edition. Boca Raton: CRC Press (2011).
- D. A. Atwood. Radionuclides in the Environment. John Wiley & Sons (2010), ISBN: 978-0-470-71434-8.
- Ciljani izbor znanstvenih objav. / Targeted selection of scientific publications.

Cilji in kompetence:

Cilj predmeta je seznaniti študenta z radiokemijskimi postopki in tehnikami za izbrane aplikacije.

Cilj se navezuje na kompetence:

- Obvladovanje raziskovalnih metod, postopkov in procesov ter razvoj kritične in samokritične presoje;
- Sposobnost uporabe znanja na akademski ravni in v praksi;
- Razvoj komunikacijskih sposobnosti in spretnosti, posebej komunikacije v mednarodnem okolju;
- Kooperativnost, delo v skupini in v mednarodnem okolju;
- Obvladovanje specifičnosti rokovanja z radioaktivnimi snovmi, še posebej pri delu z odprtimi viri ionizirajočih sevanj.

Objectives and competences:

The objective of the course is to acquaint a student with radiochemical procedures and techniques for selected applications.

This objective is related to competences:

- Command of research methods, procedures and processes, and well-formed skills for critical judgment;
- Critical thinking at both academic level and in practice;
- Communication ability and skills in the international environment;
- Ability to work in a team and in international environment;
- Command for specific handling of radioactive materials and in particular for work with open sources of ionising radiation.

Predvideni študijski rezultati (Izidi):

- Poznati in razumeti osnovne principe radiokemije;
- Pojasniti specifičnosti kemijskih separacij radioaktivnih spojin;
- Izbrati ustrezen radiokemijski postopek za določitev iskanega radionuklida;
- Uporabiti primeren radioaktiven sledilec pri specifični aplikaciji;

Intended learning outcomes:

- Know and understand basic principles of radiochemistry;
- Explain specificities of chemical separations of radioactive compounds;
- Select appropriate radiochemical procedure for determination of a given radionuclide;
- Apply suitable radioactive tracer for a specific application;

<ul style="list-style-type: none"> • Presoditi pomen posameznega radionuklida jedrskega gorivnega cikla s kemijskega stališča; • Napovedati kemijsko obnašanje izbranega radionuklida v okolju; • Vzpostaviti sposobnost komunikacije v angleškem jeziku na področju radiokemije. 	<ul style="list-style-type: none"> • Judge the importance of particular radionuclide of the nuclear fuel cycle from the chemical point of view; • Predict chemical behaviour of a selected radionuclide in the environment; • Establish the ability to communicate in English in the field of radiochemistry.
--	--

Metode poučevanja in učenja:

<p>Predavanja. Seminar. Vključevanje v projekte za reševanje izbranih problemov. Priprava seminarske predstavitve.</p>
--

Learning and teaching methods:

<p>Lectures. Seminar work. Participation in projects for solving selected problems. Preparation of the seminar presentation.</p>
--

Delež (v %) /

Načini ocenjevanja:

Weight (in %)

Assessment:

<p>Seminarska naloga. Zagovor seminarske naloge, pri katerem študent dokaže osvojitve vseh študijskih izidov z vsaj po enim konkretnim primerom.</p>	<p>50 % 50 %</p>	<p>Seminar work. Defence of the seminar work where the student demonstrates the achievement of all learning outcomes with at least one specific case for each outcome.</p>
--	----------------------	--

Reference nosilca / Lecturer's references:

<ul style="list-style-type: none"> • SMODIŠ, Borut. Thirty years of k_0-NAA at JSI, Ljubljana : implementation, progress, achievements. Journal of radioanalytical and nuclear chemistry, ISSN 0236-5731, 2018, vol. 315, str. 685-688, doi: 10.1007/s10967-017-5633-z. [COBISS.SI-ID 30912807] • ŠTROK, Marko, SMODIŠ, Borut, MAZEJ, Darja. Bi-210 - from interference to advantage in Pb-210 determination with liquid scintillation counter. Applied radiation and isotopes, ISSN 0969-8043, 2016, vol. 109, str. 296-300, doi: 10.1016/j.apradiso.2015.12.049. [COBISS.SI-ID 29159463] • SMODIŠ, Borut, ČERNE, Marko, JAČIMOVIČ, Radojko, BENEDIK, Ljudmila. Transfer of uranium and radium to Chinese cabbage from soil containing elevated levels of natural radionuclides. Journal of radioanalytical and nuclear chemistry, ISSN 0236-5731, 2015, vol. 306, iss. 3, str. 685-694, doi: 10.1007/s10967-015-4198-y. [COBISS.SI-ID 28785447] • PLANINŠEK, Petra, BENEDIK, Ljudmila, SMODIŠ, Borut. Comparison of various dissolution techniques for determination of Po-210 in biological samples. Applied radiation and isotopes, ISSN 0969-8043, 2013, vol. 81, str. 53-56, doi: 10.1016/j.apradiso.2013.03.008. [COBISS.SI-ID 26684711] • SMODIŠ, Borut, ŠTROK, Marko, ČERNE, Marko, PLANINŠEK, Petra, BENEDIK, Ljudmila. Radioanalytical techniques for the determination of U-238, Ra-226 and Pb-210 in the environment. Radiochimica acta, ISSN 0033-8230, 2013, vol. 101, no. 8, str. 519-524, doi: 10.1524/ract.2013.2052. [COBISS.SI-ID 26943527]
--