

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Koloidna biologija
Course title:	Colloidal Biology

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: EKO3-871

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: Doc. dr. Aleš Lapanje

Jeziki /	Predavanja / Lectures:	Slovenski ali angleški / Slovene or English
Languages:	Vaje / Tutorial:	Slovenski ali angleški / Slovene or English

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

Zaključen študij druge stopnje ustrezne (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:

Osnove

- Definicija koloidne biologije;
- Osnovni pojmi koloidov, razmejitve med molekularno in koloidno biologijo;
- Opis tipičnih koloidnih pojavov, pomembnih v biologiji in biotehnologiji (vezave encimov, protiteles in drugih bioloških makromolekul, celične suspenzije, pritrjanje celic, biofilmi, skupki, flokuli...);
- Osnove koloidnih modelov celice;
- Osnove elektrostatske interakcije med celicami in površinami, Ohshima model;
- Osnovni pojmi DVLO teorije, pomembni pri medceličnih interakcijah.

Content (Syllabus outline):

Basics

- Defining of colloidal biology
- Basic concepts of colloids, distinguishing molecular and colloidal biology
- Description of typical colloidal processes important in biology and biotechnology (enzyme, antibody and other macromolecular binding, cell suspensions, cellular attachments, biofilms, aggregates, flocs...)
- Basic concept of colloidal model of the cell
- Basics of electrostatic interactions between cells and surfaces, Ohshima model
- Basics of DVLO theory important in intercellular interactions

<p>Tehnika/Biotehnika</p> <ul style="list-style-type: none"> • Enkapsulacijski postopki celic; • Antimikrobne prevleke, delci in koloidi; • Modifikacije celičnih površin; • Splošni problemi v biotehnoških procesih, kjer so udeleženi koloidni pojavi (neželene flokulacije, penjenje ...). <p>Ekoremediacijske tehnologije</p> <ul style="list-style-type: none"> • Splošne informacije o celičnih suspenzijah in koloidih v čistilnih napravah; • Splošne informacije koloidnih interakcij med celicami in tlemi. <p>Okolje</p> <ul style="list-style-type: none"> • Tipični pojavi v okolju, posredovani s pritrjenimi celicami (raztapljanje kamnine, bakterijsko posredovano zamrzovanje ledu, celični agregati v zraku, flokulacija v vodnih vrtinah...); • Informacije o bioloških interakcijah na kratko razdaljo med mikrobi, rastlinami ali živalmi. <p>Biologija in biotehnologija</p> <ul style="list-style-type: none"> • Splošne informacije ob tvorbi biofilmov (celični skupki, aktivnost celic, vpliv difuzije...). <p>Materiali</p> <ul style="list-style-type: none"> • Biološko posredovana korozija. 	<p>Engineering/Bioengineering</p> <ul style="list-style-type: none"> • Cell encapsulations • Antimicrobial surfaces, particles and colloids • Modifications of cell surfaces • General problems in biotechnology processes interfering with colloids (flocculation, foaming...) <p>Ecoremediation technologies</p> <ul style="list-style-type: none"> • General information on cellular suspensions and colloids in water processing plants • General information on colloid interactions between cells in the soil <p>Environment</p> <ul style="list-style-type: none"> • Typical phenomena caused by the attached cells (weathering of minerals, water freezing by bacteria, cell aggregates in the air, flocculation of cells in water wells...) • Information on biological interactions of the short distance between microbes plants or animals <p>Biology and biotechnology</p> <ul style="list-style-type: none"> • General information on biofilm formation (cellular aggregates, cellular activities, effects of diffusion...) <p>Materials</p> <ul style="list-style-type: none"> • Biocorrosion processes
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Temeljni literatura in viri / Readings:

Knjiga / Book:

- H. Ohshima, Biophysical Chemistry of Biointerfaces, John Wiley & Sons, Inc., 2010
- N. Cioffi, Nano-Antimicrobials - Progress and Prospects, Springer, 2012
- N. S. Mosier, M. R. Ladisch, Modern biotechnology, John Wiley & Sons, Inc., 2011
- I. Ahmad, F. M. Husain, Biofilms in plant and soil health, John Wiley & Sons, Inc., 2017
- V. Nedovic, R. Willaert, Application of cell immobilization biotechnology, Springer, 2006

Revije / Periodicals:

- Nature Biotechnology
- Colloids and surfaces B
- Biomacromolecules
- Environmental science and technology

Pregledni članki, izbor v tekočem letu/Review articles, yearly selection.

Cilji in kompetence:

Vpeljati študente v osnove:

- koloidnih procesov pomembnih za biološke pojave,
- razumevanje fizikalnih interakcij med celicami,
- razumevanje posledic koloidnih procesov na biološke procese,
- spoznavanje bioloških procesov, posredovanih s koloidi,
- razumevanje koncepta celic in makromolekul kot koloidnih delcev,
- razumevanje elektrostatskih interakcij med celicami,
- razumevanje procesa pritiranja celic,
- razumevanje odzivov celic na različne površine in različne organizacijske oblike (agregati, biofilmi...),
- razumevanje vplivov fizikalnih lastnosti koloidov na delovanje celic,
- razumevanje difuzijskih pojavov nutrientov in toksikantov v smislu aktivnosti celic,
- spoznavanje uporabe koloidov v biotehnoloških in ekoremediacijskih procesih.

Kompetence:

- pridobivanje sposobnosti celovitega reševanja problemov v bioreaktorskih, ekoremediacijskih sistemih, okoljskih meritvah in vrednotenjih materialov,
- vključevanje znanja o koloidnih interakcijah v biosferi v tematiko doktorata,
- obvladovanje celičnih enkapsulacijskih tehnik.

Objectives and competences:

To introduce students to the basics of:

- colloidal processes important in biological phenomena
- understanding physical interactions between cells
- understanding effects of colloidal processes on biological processes
- overview of biological processes mediated by colloids
- understanding concept of cells and macromolecules as colloidal particles
- understanding electrostatic interactions between cells
- understanding processes of attachments of cells
- understanding responses of cells on different surfaces and within different type of organisations (aggregates, biofilms...)
- understating effects of physical properties of colloids on the cellular functioning
- understanding diffusion phenomena of nutrients and toxicants on the cell activity
- overview of the use of colloids in the biotechnological and ecoremediation processes

Competencies:

- acquiring abilities of solving complex problems in bioreactor and ecoremediation systems, environmental measurements and analysis of materials
- integration of acquired knowledge of colloidal interactions in biosphere into the doctoral research work
- mastering encapsulation techniques for cells

Predvideni študijski rezultati:

Študent z uspešno zaključenim predmetom bo pridobil osnovno znanje na naslednjih področjih:

- znanje za izboljšanje izkoristkov v bioprocenih tehnologijah,
- znanje za boljši razvoj bikompozitov,
- znanje na področju biokorozivnih pojavov,
- sposobnost apliciranja znanja na področju biotehnologije, ved o materialih in okoljskih tehnologijah,
- vključevanje teh znanj pri reševanju problemov v sklopu disertacije.

Intended learning outcomes:

The student with the successful completion of the course will acquire basic knowledge in the following areas:

- knowledge to increase efficiencies in bioprocess technologies
- knowledge for more efficient development of biocomposites
- knowledge in the field of biocorrosion processes
- ability to implement knowledge on the field of biotechnology, material science and environmental technologies

- integration of these skills in problem solving in the context of the dissertation.

Metode poučevanja in učenja:

Interaktivno delo s študentom.
Poudarek je predvsem na reševanju realnih problemov, ki so povezani z raziskovalnim delom kandidata.

Learning and teaching methods:

Interactive work with students.
The focus is on solving real problems that are related to the research work of the student.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Seminarska naloga.	60 %	Seminar.
Ustni izpit.	40 %	Oral examination.

Reference nosilca / Lecturer's references:

- ZRIMEC, Jan, LAPANJE, Aleš. DNA structure at the plasmid origin-of-transfer indicates its potential transfer range. Scientific reports, ISSN 2045-2322, 2018, vol. 8, str. 1820-1-1820-10, doi: 10.1038/s41598-018-20157-y.
- HOREMANS, Benjamin, LAPANJE, Aleš, et al. Biocarriers improve bioaugmentation efficiency of a rapid sand filter for the treatment of 2, 6-dichlorobenzamide (BAM)-contaminated drinking water. Environmental science & technology, ISSN 0013-936X. [Print ed.], 2017, vol. 51, issue 3, str. 1616-1625, doi: 10.1021/acs.est.6b05027.
- RIJAVEC, Tomaž, LAPANJE, Aleš. Cyanogenic Pseudomonas spp. strains are concentrated in the rhizosphere of alpine pioneer plants. Microbiological research, ISSN 0944-5013, 2017, vol. 194, str. 20-28, doi: 10.1016/j.micres.2016.09.001.
- RIJAVEC, Tomaž, LAPANJE, Aleš. Hydrogen cyanide in the rhizosphere : not suppressing plant pathogens, but rather regulating availability of phosphate. Frontiers in microbiology, ISSN 1664-302X, 2016, vol. 7, str. 1785-1-1785-14, doi: 10.3389/fmicb.2016.01785.
- MIRTič, Janja, RIJAVEC, Tomaž, ZUPANČIČ, Špela, ZVONAR POBIRK, Alenka, LAPANJE, Aleš, KRISTL, Julijana. Development of probiotic-loaded microcapsules for local delivery : physical properties, cell release and growth. European Journal of Pharmaceutical Sciences, ISSN 0928-0987. [Print ed.], Aug. 2018, vol. 121, str. 178-187, doi: 10.1016/j.ejps.2018.05.022.