

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	BIOTEHNOLOŠKI PROCESI IN NAPRAVE
Course Title:	PROCESSES AND EQUIPMENT IN BIOTECHNOLOGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
VŠŠP Kemijska tehnologija, 1. stopnja	/	2.	4.
PSP Chemical Technology, 1 st Cycle	/	2 nd	4 th

Vrsta predmeta / Course Type:

izbirni strokovni / Elective Professional

Univerzitetna koda predmeta / University Course Code:

KTSI5

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	15	15 LV	/	/	75	5

Nosilec predmeta / Lecturer:

prof. dr. Polona Žnidaršič Plazl / Dr. Polona Žnidaršič Plazl, Full Professor
prof. dr. Andreja Žgajnar Gotvajn / Dr. Andreja Žgajnar Gotvajn, Full Professor

Jeziki / Languages:

Predavanja / Lectures: slovenski / Slovenian

Vaje / Tutorial: slovenski / Slovenian

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

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

Prerequisites:

The course has to be assigned to the student.

Vsebina:

Biotehnološki procesi proizvodnje antibiotikov in izbranih biotransformacij. Kvalitativni in kvantitativni opis posameznih faz postopka: priprava surovin, bioreakcija, imobilizacija biokatalizatorja, izolacija produkta. Procesna shema postopka. Posamezne osnovne operacije in naprave v izbranih biotehnoloških procesih: uporaba kemijsko inženirskih principov pri analizi in razvoju procesa. **Proces ravnanja z nastalimi odpadki.** Viri in vrste nastalih odpadkov (plinasti, tekoči, trdni) v biotehnološkem procesu. Odpadki kot surovina in energent, njihova možna predelava (kompostiranje, anaerobna stabilizacija), recikliranje, ponovna

Content (Syllabus outline):

Biotechnological process of antibiotics production and selected biotransformations. Qualitative and quantitative description of individual phases of the process: upstream, bio-reaction, biocatalyst immobilization and downstream. Process flow diagram. Unit operations and equipment in the selected biotechnological processes: application of chemical engineering principles in the analysis and development of the process. **Waste management.** Sources and types of wastes (gas, liquid, solid), generated in biotechnological process. Wastes as material

uporaba. Vpliv odpadkov na okolje, problematika farmacevtskih učinkovin in mikropolutantov v okolju, hormonski motilci. Napredne tehnologije čiščenja specifičnih tehnoloških odpadnih vod. Metode minimizacije nastalih odpadkov.

and energy source, recovery options (composting, anaerobic stabilization), recycling, reuse. Environmental impact of wastes, pharmaceuticals, micro-pollutants and endocrine disrupting chemicals in the environment. Advanced processes for the treatment of specific industrial wastewaters. Waste minimisation approaches.

Temeljna literatura in viri / Readings:

- P. Raspor (ur.), Biotehnologija – osnovna znanja, Bia. d.o.o., Ljubljana, 1996 (40%)
- M. Roš, Sodobni postopki čiščenja odpadnih vod, Fit media, Velenje 2015

Cilji in kompetence:

Cilj predmeta je da študent med študijem pridobljeno znanje uporabi pri analizi tipičnega biotehnološkega procesa in procesa ravnanja z nastalimi odpadki. Predmetno specifične kompetence:

- študent spozna integralno vlogo osnovnih operacij v izbranem kemijsko tehnološkem procesu
- obvlada procesno shemo, sestavljeno iz osnovnih operacij oziroma aparatov za izbrani tehnološki proces.
- spozna metodologijo ravnanja z nastalimi trdnimi, tekočimi in plinastimi odpadki

Objectives and Competences:

The objective is that the student uses the acquired knowledge to analyse a typical biotechnological as well as waste management process. Specific competences are:

- student recognizes the integral role of unit operations in a selected biotechnological process,
- student acquaints a process scheme, composed of unit operations and equipment for a selected biotechnological process,
- student acquaints a methodology of solid, liquid and gas waste management.

Predvideni študijski rezultati:

<u>Znanje in razumevanje</u> Študent zna integrirati kemijsko inženirska znanja pri vodenju tehnoloških procesov in reševanju problemov ki pri tem nastanejo.
<u>Uporaba</u> Pridobljena znanja je sposoben uporabiti pri reševanju posameznih praktičnih primerov in problemov v biotehnološki proizvodnji in industrijskih procesih ravnanja z odpadki.
<u>Refleksija</u> Uporaba splošnih znanj in osnovnih principov kemijskega inženirstva, analiza in kritično ovrednotenje tehnološkega procesa oziroma posameznega postopka in naprave v laboratorijskem in industrijskem merilu.
<u>Prenosljive spretnosti</u> Razvita sposobnost identifikacije in reševanja problemov, kritičnega razmišljanja in logičnega

Intended Learning Outcomes:

<u>Knowledge and Comprehension</u> Student is able to integrate chemical engineering knowledge during the control of a biotechnological process and solve the arised problems.
<u>Application</u> Student is able to use the acquired knowledge to solve the particular practical problems and cases in a biotechnological and waste treatment process.
<u>Analysis</u> Use of general knowledge and basic principles of chemical engineering, analysis and critical evaluation of a biotechnological process as well as particular operation and equipment on a laboratory and industrial scale.
<u>Skill-transference Ability</u> Developed skill to identify and solve problem, critical thinking and making logical conclusions.

sklepanja. Sposobnost uporabe literature, zbiranja in interpretacije podatkov in njihove kritične evalvacije.

Ability of literature data using, data collection and interpretation as well as their critical evaluation.

Metode poučevanja in učenja:

Predavanja, laboratorijske vaje in seminarji.

Learning and Teaching Methods:

Lectures, seminars, laboratory exercises.

Načini ocenjevanja:

Pisni in ustni izpit
Laboratorijske vaje
Pisna seminarska naloga
Ocene: 6-10 (pozitivno), 1-5 (negativno)

Delež (v %) /

Weight (in %)

Assessment:

Written and oral exam
Laboratory exercises
Written seminar project
Marks: 6-10(positive), 1-5 (negative)

Reference nosilca / Lecturer's references:

- M. Bajić, I. Plazl, R. Stloukal, **P. Žnidaršič Plazl**. Development of a miniaturized packed bed reactor with ω -transaminase immobilized in LentiKats®. *Process Biochem.*, 2017, 52: 63-72,
- N. Miložič, M. Lubej, M. Lakner, **P. Žnidaršič Plazl**, I. Plazl. Theoretical and experimental study of enzyme kinetics in a microreactor system with surface-immobilized biocatalyst. *Chem. Eng.J.*, 2017, 313:374-381
- R. Wohlgemuth, I. Plazl, **P. Žnidaršič Plazl**, K. V. Gernaey, J. M. Woodley. Microscale technology and biocatalytic processes: opportunities and challenges for synthesis. *Trends Biotechnol.*, 2015, 33: 302-314
- KORICA, Predrag, POŽGAJ, Đurđica, CIRMAN, Andreja, **ŽGAJNAR GOTVAJN, Andreja**. Decomposition analyses of the municipal waste generation and management in Croatian and Slovenian regions. *Journal of material cycles and waste management*, ISSN 1438-4957, 2016, doi: 10.1007/s10163-016-0573-1. [COBISS.SI-ID 1537314243].
- RAČIČ KOZMUS, Aleksandra, **ŽGAJNAR GOTVAJN, Andreja**, LOBNIK, Aleksandra, NOVAK, Nina, KLASINC, Aljaž, ZUPANČIČ, Gregor Drago. Anaerobic treatment to improve sludge recovery at a deinked fiber pulp and paper mill. *Tappi journal*, ISSN 0734-1415, Feb. 2016, vol. 15, no. 2, str. 127-137, ilustr. [COBISS.SI-ID 1536809411].
- ČEHOVIN, Matej, MEDIC, Alojz, SCHEIDELER, Jens, MIELCKE, Joerg, RIED, Achim, KOMPARE, Boris, **ŽGAJNAR GOTVAJN, Andreja**. Hydrodynamic cavitation in combination with the ozone, hydrogen peroxide and the UV-based advanced oxidation processes for the removal of natural organic matter from drinking water. *Ultrasonics Sonochemistry*, ISSN 1350-4177, 2017, vol. 37, str. 394-404, ilustr. <http://www.sciencedirect.com/science/article/pii/S1350417717300457>, doi: 10.1016/j.ultsonch.2017.01.036. [COBISS.SI-ID 1537341379].