

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	BIOTEHNOLOŠKI PROCESI IN NAPRAVE
<b>Course Title:</b>	PROCESSES AND EQUIPMENT IN BIOTECHNOLOGY

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

**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:**

Osnove načrtovanja, vodenja in analize bioprocesov. Snovne bilance, bioreakcijska kinetika in prenos kisika v bioprocesih. Izbrani primeri industrijskih procesov: proizvodnja antibiotikov, organskih kislin in aminokislin, kortikosteroidov, biofarmacevtikov. Vloga biotehnologije pri valorizaciji lignocelulozne biomase in v krožnem gospodarstvu. Vpliv farmacevtske industrije na okolje. Problematika farmacevtskih učinkovin in mikropolutantov v okolju. Napredne tehnologije za čiščenje farmacevtskih odpadnih vod. Uporaba biotehnološki procesov za odstranjevanje onesnaženja iz odpadnih vod. Biološke in rastlinske

**Content (Syllabus outline):**

Basic principles of bioprocess design, operation, and analysis. Mass balances, bioreaction kinetics and oxygen transfer in bioprocesses. Selected industrial bioprocesses: antibiotics, organic acids, amino acids, corticosteroids, biopharmaceuticals production. The role of biotechnology in lignocellulose biomass valorization and in circular economy. Impacts of pharmaceutical industry on the environment. Pharmaceuticals and micropollutants in the environment. Advanced processes for wastewater treatment. Biotechnological processes for pollutant

čistilne naprave. Odstranjevanje odpadkov s kompostiranjem in anaerobno razgradnjo.

removal from wastewaters. Biological wastewater treatment plants and constructed wetlands. Degradation of solid waste with composting and anaerobic degradation.

### Temeljna literatura in viri / Readings:

- Ratlidge, C., Kristiansen, B. Basic biotechnology, 3rd Ed. Cambridge University Press, Cambridge, 2006 (10%)
- Žnidaršič Plazl, P., Podgornik, H. Vaje iz biotehnologije, 2. izdaja. Fakulteta za kemijo in kemijsko tehnologijo UL, Ljubljana, 2011 (15%)
- Žnidaršič Plazl, P., Pavko, A. Praktikum iz biokemijskega inženirstva. Fakulteta za kemijo in kemijsko tehnologijo, Ljubljana UL. 2005 (15%)
- M. Roš, Sodobni postopki čiščenja odpadnih vod, Fit media, Velenje 2015 (30%)

### 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:

#### Znanje in razumevanje

Študent zna integrirati kemijsko inženirska znanja pri vodenju tehnoloških procesov in reševanju problemov ki pri tem nastanejo.

#### Uporaba

Pridobljena znanja je sposoben uporabiti pri reševanju posameznih praktičnih primerov in problemov v biotehnološki proizvodnji in industrijskih procesih ravnanja z odpadki.

#### Refleksija

Uporaba splošnih znanj in osnovnih principov kemijskega inženirstva, analiza in kritično ovrednotenje tehnološkega procesa oziroma posameznega postopka in naprave v laboratorijskem in industrijskem merilu.

#### Prenosljive spretnosti

Razvita sposobnost identifikacije in reševanja

### Intended Learning Outcomes:

#### Knowledge and Comprehension

Student is able to integrate chemical engineering knowledge during the control of a biotechnological process and solve the arisen problems.

#### Application

Student is able to use the acquired knowledge to solve the particular practical problems and cases in a biotechnological and waste treatment process.

#### Analysis

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.

#### Skill-transference Ability

Developed skill to identify and solve problem,

problemov, kritičnega razmišljanja in logičnega sklepanja. Sposobnost uporabe literature, zbiranja in interpretacije podatkov in njihove kritične evalvacije.

critical thinking and making logical conclusions. 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:**

Delež (v %) /

Weight (in %) **Assessment:**

Pisni izpit	<b>70 %</b>	Written exam
Laboratorijske vaje	<b>15 %</b>	Laboratory exercises
Seminarske naloge	<b>15 %</b>	Written seminar project
Ocene: 6-10 (pozitivno), 1-5 (negativno)		Marks: 6-10(positive), 1-5 (negative)

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

- M. Tišma, **P. Žnidaršič-Plazl**, G. Šelo, I. Tolj, M. Šperanda, A. Bucić-Kojić, M. Planinić. *Trametes versicolor* in lignocellulose-based bioeconomy: state of the art, challenges and opportunities. *Bioresour. Technol.*, 2021, **330**, 124997, doi: [10.1016/j.biortech.2021.124997](https://doi.org/10.1016/j.biortech.2021.124997).
- F. A. Vicente, I. Plazl, S.P.M. Ventura, **P. Žnidaršič-Plazl**. Separation and purification of biomacromolecules based on microfluidics. *Green Chem.*, 2020, **22**, 4391-4410, doi: [10.1039/c9gc04362d](https://doi.org/10.1039/c9gc04362d).
- **P. Žnidaršič-Plazl**. The promises and the challenges of biotransformations in micro-flow. *Biotechnol. J.*, 2019, 14, 1800580, doi: [10.1002/biot.201800580](https://doi.org/10.1002/biot.201800580).
- 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.
- **ŽGAJNAR GOTVAJN, Andreja**, KALČÍKOVÁ, Gabriela. Delamination of plastic-coated waste paper by enzymes of the white rot fungus *Dichomitus squalens*. *Journal of environmental management*. Dec. 2018, vol. 228, str. 165-168.
- KALČÍKOVÁ, Gabriela, TRATAR-PIRC, Elizabeta, **ŽGAJNAR GOTVAJN, Andreja**. Aerobic and anaerobic biodegradation potential of leachate from old active landfill. *Desalination and water treatment*. [Print ed.]. 2016, vol. 57, iss. 19, str. 8619-8625.