COURSE DESCRIPTION CARD - SYLLABUS

Course name

Techniques of biocomponent separation

Course

Field of study

Bioinformatics

Year/Semester

1/2

Area of study (specialization)

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	30	
Tutorials	Projects/seminars	

Number of credit points

5

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

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Prerequisites

Basic knowledge of physics, organic chemistry, physical chemistry of physical and biochemical processes; knowledge of cell biology; general academic-level math skills, basic knowledge of laboratory equipment and safety rules in a chemical laboratory

Course objective

The aim of course is to gain the knowledge and skills in the field of membrane separation methods of mixtures;Theoretical foundations of individual membrane separation techniques; Areas of application of membrane techniques for the separation of biocomponents and natural substances; Membrane modules and principles of construction of membrane installations; Hybrid systems in the processes of obtaining and isolating low molecular weight organic bio-compounds.

Course-related learning outcomes

Knowledge

A graduate knows and understands:

- complex physicochemical and biochemical processes, including the principles of appropriate selection of materials, raw materials, apparatus and devices for their implementation and product characterization (K_W02)

- basics of using biocatalysts and biomaterials in biochemical processes (K_W07)

- social, economic and legal conditions of its activity and the need to take them into account in practice, including issues related to the protection of intellectual and industrial property (K_W13)

Skills

A graduate is able to:

- fluently use and integrate information obtained from literature and electronic sources, in Polish and English, interpret and critically evaluate it (K_U01)

- perform advanced measurements and laboratory experiments and interpret their results (K_U03)

- under the supervision of a research tutor, plan and perform research tasks using analytical, simulation and experimental methods (K_U06)

Social competences

A graduate is ready to:

- cooperate and work in team taking various roles (K_K02);

- determining priorities for the implementation of a task defined by oneself or others (K_K03)

- take the responsibility for the assessment of threats resulting from the research techniques used and for creating safe working conditions (K_K06)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture classes:

Written exam graded in the range 0-100 pts and the following scale is assumed:

3 50,1-60,0 %

3.5 60,1-70%

4 70,1-80,0 %

4.5 80,1-90 %

5 90,1-100 %

Laboratory classes:

current evaluatoin of student's knowledge before each class and grading the reports with the results of laboratory experiments.

Programme content

Lecture:

1. Introduction to membrane separation techniques (basic definitions, qualitative and quantitative characteristics of accompanying phenomena, eg. biofouling).

2. Pressure-driven and concentration-driven techniques of membrane separation (theoretical basis and examples of applications in the processes of separation / concentration / purification of biocomponents and natural substances).

3. Bipolar electrodialysis in the processes of separation of bioconversion products and natural substances.

4. Enzymatic membrane reactors (structure, catalytic membranes, examples of applications).

5. Hybrid and multi-stage separation systems based on membrane techniques for the separation and concentration of biocomponents and natural products.

Laboratory classes:

The laboratory block will include practical exercises on the issues presented during the lectures, in particular: 1) Working with selected membrane separation modules; 2) Designing multi-stage membrane separation systems for the separation and concentration of biocomponents; 3) Application of pressure-driven and osmotic-driven membrane techniques (RO and FO) for concentration of aqueous solutions of natural substances.

Teaching methods

Lecture: Presentation and discussion

Laboratory classes: practical excercices made by students in separation laboratory.

Bibliography

Basic

1. M. Bodzek, J. Bohdziewicz, K. Konieczny, Techniki membranowe w ochronie środowiska, Wydawnictwo Politechniki Śląskiej, Gliwice, 1997.

2. J. Rautenbach, Procesy membranowe, WNT, Warszawa 1996.

3. skrypt pod red. K. Prochaska, Techniki separacji membranowej, Wydawnictwo PP, Poznań 2012.

Additional

1. P. W. Atkins, Chemia fizyczna, Wyd. Nauk. PWN, Warszawa 2003.

2. J. Ceynowa, Membrany selektywne i procesy membranowe, Membrany teoria i praktyka,z. II, Wykłady monograficzne i specjalistyczne, Toruń 2009, 7–29.

3. M.Mulder, Basic Principles of Membrane Technology, Kliwer Academic Publishers, Dfordrecht 1992

4. H. Strathmann, Ion-Exchange Membrane Separation Processes, Elsevier, New York 2004.

5. M.Szczygiełda, K.Prochaska, Downstream separation and purification of bio-based alpha-ketoglutaric acid from post-fermentation broth using a multi-stage membrane process, Process Biochemistry, 96, 38–48, 2020.

6. M. Szczygiełda, K. Prochaska, Effective separation of bio-based alpha-ketoglutaric acid from post-fermentation broth using bipolar membrane electrodialysis (EDBM) and fouling analysis, Biochemical Engeenering Journal, 166, 107883, 2021.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	60	2,5
Student's own work (literature studies, preparation for laboratory classes, preparation for tests/exam) [1]	65	2,5

[1] delete or add other activities as appropriate