COURSE DESCRIPTION CARD - SYLLABUS

Course name
Separation project - sustainable separation processes in the processing of waste streams [S1TOZ1>PS-zpswpso]

Course

Field of study
Circular System Technologies

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
0

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
30

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of general chemistry, physical chemistry, thermodynamics, organic chemical technology and chemical engineering, as well as environmental protection, including types of pollution; the ability to acquire knowledge from the indicated sources. Basic knowledge of designing and modeling multi-stage processes. Ability to use a foreign language to a degree enabling the use of scientific literature.

Course objective

The aim of the course is to gain theoretical and practical knowledge in the field of design and balancing of sustainable separation processes used in water renewal processes.

Course-related learning outcomes

Knowledge:
k_w01 student has mathematical knowledge necessary for solving practical engineering problems

k_w07 student has a basic knowledge of the processes of neutralization and recovery of industrial and municipal waste
k_w21 student has basic knowledge related to the selection of devices used in circular system technologies

Skills:
k_u01 student is able to obtain information from literature, databases, and other sources related to circular system technologies, also in a foreign language, integrate them, interpret them, draw conclusions and formulate opinions
k_u02 student uses computer programs supporting the implementation of tasks typical for circular system technologies
k_u07 student is able to take part in the debate by presenting and assessing opinions regarding circular system technologies
k_u08 student is able to plan and organize work individually and in a team
k_u12 student is able to select and evaluate the usefulness of tools and methods for solving problems regarding circular system technologies
k_u15 student, on the basis of the acquired knowledge, is able to develop an independent or team project/report on the work done and make its multimedia presentation
k_u17 student is able to make a mass and energy balance for both unit processes and the entire installation used in circular system technologies
k_u20 student knows how to perform process designs installation based on circular system technologies

Social competences:
k_k02 student is independent and creative in individual work and works effectively in a team, performing various roles; evaluates objectively the effects of his work and team members
k_k09 student is able to work in team on circular system technologies including interdiciplinary tasks

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Evaluation of the prepared multimedia presentations (0-50pts) evaluation of the project task (0-50 pts).
The final grading scale is applied:
3 51 - 60 pts
3,5 71-80 pts
4 71 - 90 pts
4,5 81-90 pts
5 91 - 100 pts

Programme content

Designing the concept of water renewal technology based on sustainable separation processes. Development of a general technological scheme and mass balance of the installation (for example: whey, waste glycerol, fruit and vegetable pomace). Introduction of the concept of mass balance and calculation of the mass balance of devices related to processes in the field of circular system technologies. As part of the course, students perform a mass balance of a selected technological installation. The project includes a description of the installation, basic mass balance calculations, a block flow diagram of the installation with piping and instrumentation devices. Development of a preliminary techno-economic analysis.

Teaching methods

Creating a multimedia presentation based on the available literature on the subject in Polish and English. Drawing technological flowsheets and balancing of installations. Participation in didactic classes. Discussion during classes and consultations related to the implementation of the project. Creating project documentation.

Bibliography

Basic
1. K. Scott, Handbook of industrial membranes, Elsevier Advanced Technology, 1998

2. M. Bodzek, J. Bohdziewicz, K. Konieczny, Techniki membranowe w ochronie środowiska, Wydawnictwo Politechniki Śląskiej, Gliwice, 1997
3. J. Rautenbach, Procesy membranowe, WNT, Warszawa 1996
4. Biernacka, T. Suchecka, Techniki membranowe w ochronie środowiska, Wyd. SGGW, Warszawa 2004
Additional
1. Z. Zhang, W. Zhang, E. Lichtfouse, Membranes for Environmental Applications, Springer, 2020
2. M. Szczygiełda, K. Prochaska, Downstream separation and purification of bio-based alpha-kethoglutaric acid from post-fermentation broth using a multi-stage membrane process, Process Biochem., 96 (2020) 38-48.
2. M. Szczygiełda, K. Prochaska, Alpha-ketoglutaric acid production using electrodialysis with bipolar membrane, J. Membr. Sci., 536 (2017) 37-43.
3. J. Antczak, M. Szczygiełda, K. Prochaska, Nanofiltration separation of succinic acid from post-fermentation broth: Impact of process conditions and fouling analysis , J. Ind. Eng. Chem., 77 (2019), 253-261.
4. M. Szczygiełda, J. Antczak, K. Prochaska, Separation and concentration of succinic acid from post-fermentation broth by bipolar membrane electrodialysis (EDBM), Sep. Purif. Technol., 181 (2017) 53-59.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	38	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	37	1,50