GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Separation techniques, PG_00049129		
Field of study	Chemical Technology		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2023/2024
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Process Engineering and Chemical Technology -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Donata Konopacka-Łyskawa	
	Teachers	dr inż. Edyta Słupek dr hab. inż. Donata Konopacka-Łyskawa dr inż. Patrycja Makoś-Chełstowska	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	30	2.0	18.0	50

Subject objectives	Acquainting students and organizing knowledge on processes and techniques that are used to separate components of one and two-phase mixtures in the form of gas, steam, proper solutions, colloidal solutions, suspensions. Presenting students the possibilities of using various methods for purification and separation of pure substances and groups of chemical compounds. Developing the ability to separate mixtures with selected methods.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_W01	The student has knowledge of the operations and processes used to separate heterogeneous and homogeneous mixtures. The student knows the principles of designing and carrying out balances of adsorption, membrane, extraction, and crystallization processes.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
K7_K01	The student is able to critically evaluate the separation procedures described in the literature on the subject, use the acquired knowledge to solve cognitive problems, as well as practical problems in the separation, purification, and isolation of components.	[SK4] Assessment of communication skills, including language correctness [SK5] Assessment of ability to solve problems that arise in practice [SK2] Assessment of progress of work
K7_U01	The student can obtain information on the selection of a separation method appropriate for a given application from literature, databases, and other sources, also in English, and can present it using information and communication techniques. The student can critically evaluate the information obtained, discuss the advantages and disadvantages of the proposed methods and justify his opinion.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools

Subject contents

"Classic" separation processes. Membrane processes: classification, transport of components through the membrane, concentration polarization, microfitration, ultrafiltration, nanofiltration, reverse osmosis, permeation, pervaporation. Adsorption processes: sorbents, gas-solid and liquid-solid equilibria, adsorption kinetics, desorption (PSA, TSA, inert gas). Gas and liquid chromatography. Ion exchange. Extraction and leaching: extraction with a supercritical solvent, using the so-called green solvents. Techniques of separation of mixtures using an electric field. Crystallization: crystallization with a supercritical solvent, zone crystallization, addition crystallization. Integrated processes.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Presentation	100.0%	10.0%
Written exam	60.0%	40.0%
Laboratory	100.0%	50.0%

Recommended reading

Basic literature	1. J. D. Seader, E. J. Henley, D. K. Roper, Separation proces principles. Chemical and Biochemical Operations. 3rd Ed., J. Wiley, 2011 2. W. L. McCabe, J. C. Smith, P. Harriot : Unit operations of chemical engineering, Wyd. 7, The McGrow Hill Comp. Inc. 2005
Supplementary literature	1. R.Ven (ed), Encyclopedia of Separation Technology, vol. 1 i 2, J.Wiley, 1997 2. M. Mulder, Basic principles of membrane technology, Kluwer Academic Publishers, London 1991 3. L. R. Snyder, J. J. Kirkland, J. W. Dolan, Introduction to modern liquid chromatography, Wiley 2010
eResources addresses	Adresy na platformie eNauczanie: Techniki rozdzielania - laboratorium - 2023/24 - Moodle ID: 29399 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29399 Techniki rozdzielania - laboratorium - 2023/24 - Moodle ID: 29399 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=29399

Example issues/ example questions/ tasks being completed	1. Describe the phenomenon of concentration polarization and methods of its elimination. 2. Draw a membrane installation consisting of two modules with the retentate from the first module flowing as feed to the second module. Mark all streams. Write a balance of whole streams and the higher retention A component for the this installation. Assuming that for a given membrane the retention coefficient for component A is R and its concentration in the feed $C_{A,N}$, give the theoretical concentration of component A in the permeate. 3. On the basis of the respective exit curves, explain how bed height affects breakthrough time and bed saturation time. 4. Explain one selected desorption method. 5. Characterize briefly the technique of ion exchange. Explain the terms: ion exchanger capacity, ion exchanger selectivity. 6. Based on the appropriate graphs (for two-component and three-component systems), explain the method used to determine the driving force of the crystallization process. 7. The bitumen extraction process from oil was carried out with the use of subcritical propane. For the assumed composition of feed, explain determination of the amount of extractant needed and the change of the composition of the extract phase when more propane is used.
Work placement	Not applicable