GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Chromatographic methods, PG_00066116		
Field of study	Metody chromatograficzne		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Specialty subject group
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Analytical Chemistry -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Agata Kot-Wasik	
	Teachers		

Lesson types

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

eNauczanie source address: https://enauczanie.pg.edu.pl/moodle/mod/folder/view.php?id=2171393

Moodle ID: 38084 Metody Chromatograficzne
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=38084

Additional information:

Wykłady są podzielone na dwie części: podczas spotkań odbywa się typowa część wykładowa, a druga część polega na uczestnictwie w wybranych przez studentów webinariach.

Podczas zajęć laboratoryjnych studenci są podzieleni na podgrupy, aby samodzielnie przeprowadzać eksperymenty. Studenci mogą przynosić na zajęcia próbki do analizy (np. z domowej apteczki lub materiały badawcze, które wykorzystają w swojej pracy dyplomowej).

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	5.0	15.0	50

Subject objectives

The aim of the lectures is to familiarize students with various techniques that enable separation of mixtures of substances. Separation techniques with the speciall attention to chromatographic techniques, belong to the most commonly used laboratory techniques. No modern chemical laboratory can exist without them.

The student will be acquainted with techniques such as: modern liquid chromatography, capillary gas chromatography, liquid chromatography, supercritical fluid chromatography, capillary electrophoresis , two-dimensional techniques , identification process.

Student will do experiments by himself using HPLC, GC and mass spectrometry.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_K01] is aware of the problems related to the profession of a chemist, is able to assess the effects of the activity performed	is aware of the connections between chemical and related sciences as well as the necessity to broaden their knowledge	[SK2] Ocena postępów pracy [SK1] Ocena umiejętności pracy w grupie
[K7_W02] identifies analytical techniques appropriate for solving specific analytical tasks – also in the production plant	has ordered, expanded knowledge related to modern analytical chemistry related to the use of chromatographic methods	[SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym [SW2] Ocena wiedzy zawartej w prezentacji [SW1] Ocena wiedzy faktograficznej
[K7_U05] analyzes the functioning of devices, equipment and technological lines used in laboratories and the chemical industry	The student has knowledge of analyzing the functioning of the equipment used in the laboratory, including liquid and gas chromatographs; describes the structure and principles of operation of scientific equipment, - defines and presents the structure of typical devices.	[SU4] Ocena umiejętności korzystania z metod i narzędzi [SU1] Ocena realizacji zadania
[K7_U02] prepares detailed documentation of the results of independently conducted experiments and analyzes the obtained results, uses professional vocabulary with understanding and prepares and communicates information	has the ability to express, in an accessible way, the acquired knowledge and presenting the results of scientific discoveries concerning chemistry and using information techniques to deepen their knowledge and willing to obtain information on the latest discoveries	[SU2] Ocena umiejętności analizy informacji [SU1] Ocena realizacji zadania

Subject contents

Course content – lecture

Chromatography. Efficiency, selectivity, resolution, analysis time - the key goals of optimization. Achievements (milestones) of Tswiet today. Efficiency, selectivity, resolution, analysis time - the key goals of optimization. Modern gas chromatography. Methods of introducing analyte into the column, detection, applications.Gas and liquid chromatography as complementary techniques, similarities and differences in the optimization of separation conditions. Contemporary performance liquid chromatography.Mechanisms of retention, interaction, mobile phases, flow, detection, applications.Ultra-fast liquid and gas chromatography. Fast and ultra-fast chromatographic analysis. Chromatography of the mobile phase in supercritical state. Advantages and disadvantages of SFC. Chiral chromatography. Separation of enantiomers GC, HPLC, SFC. Combined techniques. Multidimensional chromatography. Theoretical basis and Appliance, cons, advantages and applications of techniques GCxGC and LCxLC.Electromigration techniques : CE, MECK, ITP.

Course content – laboratory

Course 1. GC technique: construction of a modern chromatograph, installation of a capillary chromatographic column, commissioning, GC-MS analysis using PAH as an example, identification of compounds (MS), determination of elution order, correlation of retention time and vapor pressure of compounds, working with the NIST library.

Course 2. HPLC technique: construction of a modern chromatograph, installation of a chromatographic column, commissioning, LC-DAD analysis using the example of WWA, identification of compounds (UV-VIS), determination of elution order, correlation of retention time and log Kow.

Course 3. Student can choose:

- Identification of active substance (MS), testing the purity of antibiotics.
- Identification of active substance (MS), testing the purity of CBD.
- Identification of a compound brought by a student for analysis.

Prerequisites and co-requisites

basic knowledge of analytical chemistry

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
attendance, class participation, final essay tests of each part	60.0%	100.0%

Recommended reading

Basic literature	Fundamentals of chromatography. Author: Witkiewicz Zygfryd. Publisher: WNT. Year of publication: 2000 or later. Fundamentals of chromatography and electromigration techniques. Authors: Witkiewicz Zygfryd and Kałużna-Czaplińska Joanna. Publisher: WNT. Year of publication: 2011.
Supplementary literature	scientific data (publiactions) available in Elsevier, ScienceDirect, Webof Science

	eResources addresses	Basic https://chemistlibrary.wordpress.com/wp-content/uploads/2015/07/chromatography-and-separation-science-2003-ahuja.pdf - Materials are presented in Englisg, but written in good way to understand. Supplementary https://www.knauer.net/blog/blog-9/hplc-basics-97 - will be pointed during lectures

Example issues/ example questions/ tasks being completed	List the four main parameters of capillary columns in GC and briefly discuss their impact on resolution. Define the retention coefficient and explain what it measures. List ways in which it can be increased. Explain why hydrogen is the best choice for capillary columns with a thin stationary phase film. Define the scope of applications (in general) of the GC technique. Additionally, list four different specific applications (what and in what sample) of this technique. Test questions. 1. Select the correct statements: gas chromatography is a faster technique than liquid chromatography liquid chromatography allows for the quantitative and qualitative determination of gases in liquids gas chromatography does not allow for the quantitative and qualitative determination of proteins in blood 2. What determines the retention time of an analyte select the correct answers: the length of the chromatographic column the linear velocity of the mobile phase the flow rate of the mobile phase the type of detector the temperature of the analysis 3. A mass spectrometer is a universal detector used in liquid chromatography, gas chromatography, and SFC. True or false? 4. The mobile phase in gas chromatography interacts with the analyte. True or false? 5. The stationary phase in liquid chromatography does not interact with the analyte. True or false? 6. The sample is introduced into the HPLC system dissolved in the following solvents (select the correct answers): • toluene • benzene • water • methanol • ether • hydrochloric acid • acetonitrile • CS2 • hexane 7. Select the detectors used in GC: • FID • MS • NMR • ECD • UV-VIS (DAD) • MS/MS • QCAD 8. Select the detectors used in HPLC: • FID • MS • NMR • ECD • UV-VIS (DAD) • MS/MS • QCAD 9. Select the detectors used in SFC: • FID • MS • NMR • ECD

	• UV-VIS (DAD) • MS/MS • QCAD 10. The order of elution in GC depends on the type of stationary phase and the properties of the analytes which ones? (fill in) 11. The order of elution in HPLC depends on the type of stationary phase, mobile phase, and properties of the analytes which ones? (fill in)
Practical activites within the subject	Not applicable

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