

Subject card

Subject name and code	From oligomers to microplastics – facing modern challenges, PG_00170598						
Field of study	Chemical Business						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2025/2026		
Education level	Bachelor's studies		Subject group		Optional subject group		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
Semester of study	4		ECTS credits		1.0		
Learning profile	academic		Assessment form		credit		
Conducting unit	Faculty of Chemistry -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Joanna Drzeżdżon				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	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	15		2.0		8.0	25
Subject objectives	The aim of the course is to provide knowledge of the structure, properties and fate of polymers - from simple oligomers to microplastics - in the context of their role in the modern world, their impact on the environment and human health, and the challenges associated with their production, use and degradation. Students will gain an interdisciplinary perspective combining chemistry, toxicology, materials engineering and social and regulatory aspects related to the circulation of polymers in nature and the economy.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[BCHINŻ_U01] On the basis of the acquired knowledge, identifies, analyses and solves engineering tasks and problems in broadly understood chemistry.	Students will evaluate the effects of environmental parameters on polymer degradation and fragmentation	[SU1] oral statement/conversation/discussion [SU4] test/exam - oral or written
	[BCHINŻ_K06] Is familiar with the general principles of creating and operating forms of individual entrepreneurship.	The student analyses business models related to the recovery and treatment of polymer waste	[SK5] implementation of a problem task [SK8] observation of student's independent or team work
	[BCHINŻ_W10] Applies safety and hygiene principles when working on a test and measurement stand or in the field.	Student lists the hazards of working with microparticles and nanoplastics	[SW4] test/exam - oral or written [SW1] oral statement/conversation/discussion
	[BCHINŻ_K05] Is convinced of the importance of behaving in a professional manner in every situation, taking full responsibility in the field of engineering activities and their impact on the natural environment and compliance with the principles of professional ethics.	The student recognizes the environmental consequences of polymer design decisions	[SK1] oral statement/conversation/discussion
	[BCHINŻ_U08] Uses the chemical nomenclature and engineering terminology properly.	Students will correctly use terminology related to polymer structures, biodegradation, fragmentation	[SU1] oral statement/conversation/discussion [SU4] test/exam - oral or written
	[BCHINŻ_K01] Identifies the level of her/his own knowledge and skills as well as the need to update engineering knowledge, continuous professional training and personal development.	Student identifies sources of sound knowledge on microplastics and dynamically changing regulations	[SK1] oral statement/conversation/discussion [SK8] observation of student's independent or team work
	[BCHINŻ_U05] Evaluates the usefulness and functioning of existing engineering and technical solutions as well as research and measurement methods in the chemical industry.	The student analyses current technologies for processing, recycling and decomposition of polymers	[SU1] oral statement/conversation/discussion [SU8] observation of student's independent or team work
	[BCHINŻ_W12] Has basic knowledge of man as an entity creating economic structures in the chemical business and has elementary knowledge of the principles and motives of human action in these structures.	The student explains the impact of social, consumer and regulatory trends on the development of the biopolymer and plastics recycling market	[SW4] test/exam - oral or written [SW1] oral statement/conversation/discussion
	[BCHINŻ_W01] Describes the relationship between the economy and the functioning of the chemical industry.	The student understands the impact of the circular economy, eco-design and EU regulations (e.g. SUP Directive) on industry	[SW1] oral statement/conversation/discussion
Subject contents	Interdisciplinary content combining topics from chemistry, materials engineering, environmental protection and medical sciences. The fundamentals of the structure and classification of oligomers and polymers, their synthesis processes and the role that plastics play in everyday life and industry. Contemporary technologies for the production and processing of polymers are also discussed, with a particular focus on the problems of polymer durability, degradation and fragmentation leading to the formation of micro- and nanoplastics. The course examines microplastic migration pathways in aquatic, soil and atmospheric environments and their effects on living organisms and human health - including microplastic toxicokinetics, oxidative stress mechanisms, immune responses and potential pathogenic effects. Participants will also learn about the regulatory, economic and ethical aspects of the plastics cycle in the economy and modern solutions in the spirit of the circular economy, including biodegradable alternatives and recycling strategies.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	written test and open question	51.0%	100.0%

Recommended reading	Basic literature	Crawford, C.B., Quinn, B. (2016). Microplastic Pollutants. Elsevier. Andrady, A.L. (2011). Microplastics in the marine environment. <i>Marine Pollution Bulletin</i>, 62(8), 15961605. Geyer, R., Jambeck, J.R., Law, K.L. (2017). Production, use, and fate of all plastics ever made. <i>Science Advances</i>, 3(7), e1700782. World Health Organization (WHO). (2019). Microplastics in Drinking Water. WHO.
	Supplementary literature	Hale, R. C., Seeley, M. E., La Guardia, M. J., Mai, L., & Zeng, E. Y. (2020). A global perspective on microplastics. <i>Journal of Geophysical Research: Oceans</i>, 125(1), e2018JC014719. Tirkey, A., & Upadhyay, L. S. B. (2021). Microplastics: An overview on separation, identification and characterization of microplastics. <i>Marine pollution bulletin</i>, 170, 112604.
	eResources addresses	Basic https://www.who.int/publications/i/item/9789241516198 - World Health Organisation report on health risks associated with microplastics in drinking water.
Example issues/ example questions/ tasks being completed	Contemporary issues in the life cycle of plastics - from oligomer synthesis to microplastic formation and migration. What are the main sources of microplastics in the environment? How do the chemical properties of polymers affect their persistence and toxicity? Can microplastics accumulate in living organisms and what are their potential health effects, including medical aspects related to oxidative stress, inflammation or endocrine disruption? Recycling, the circular economy and the role of the chemical industry in reducing the problem are also addressed. The course includes analysing use cases of alternative biodegradable materials, interpreting data from environmental reports (e.g. WHO) and taking part in discussions based on scientific literature and reports from international institutions and organisations.	
Work placement	Not applicable	

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