



Subject card

Subject name and code	Polymers in the Circular Economy - Biopolymers and Plastic Recycling, PG_00072670						
Field of study	Chemical Technology, Chemistry, Biotechnology, Engineering and Technologies of Energy Carriers, Corrosion , Green Technologies, InfoBioChem						
Date of commencement of studies	February 2026	Academic year of realisation of subject			2026/2027		
Education level	second-cycle studies	Subject group					
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			English		
Semester of study	2	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Polymer Technology -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		mgr inż. Przemysław Gnatowski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	0.0	0.0	45
	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	45		2.0		28.0	75
Subject objectives	The objective of the course is to provide students with advanced knowledge in the chemistry, technology, and life cycle of polymer materials within the context of the transition from a linear economy to a circular economy.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_W04] recognises scientific, technological, organisational and economic opportunities and constraints in technology and related fields		The student is ready to take into account the technological possibilities and limitations of recycling and the reuse of recycled materials in their professional activities, guided by the principles of sustainable development and the circular economy.		[SW1] Assessment of factual knowledge		
	[K7_U02] carries out experiments using properly selected techniques and apparatus, taking advantage of new developments in technology and related fields		is able to independently synthesize a biopolymer, investigate the susceptibility of samples to degradation under composting conditions, and perform a chemical recycling process (glycolysis) using laboratory apparatus.		[SU4] Assessment of ability to use methods and tools		
	[K7_K02] understands the non-technical aspects and implications of graduate activity, including the impact on the environment		is aware of environmental pollution resulting from polymer waste (such as microplastics) and recognizes the necessity of implementing Environmental Life Cycle Assessment (LCA) and the circular economy framework.		[SK2] Assessment of progress of work		

Subject contents	Course content – lecture <ul style="list-style-type: none"> • Introduction to the circular economy. • Life cycle of plastics. • Biopolymers definitions and classification. • Bio-based polymers. • Chemistry and technology of biodegradable polymers. • Mechanical recycling. • Chemical recycling. • Advanced recycling methods. • Challenges of plastics additives. • Eco-design. • Applications of recyclates and biopolymers. • Microplastics and environmental pollution. • Life cycle assessment (LCA) in materials engineering. 			
	Course content – laboratory <ul style="list-style-type: none"> • Identification of waste streams and material analysis. • Synthesis/preparation of a selected biopolymer/bioplastic. • Testing the susceptibility of selected polymer samples to degradation in a composting environment. • Chemical recycling glycolysis. • Testing and property improvement of recyclates (multiple processing) / LCA analysis. 			
Prerequisites and co-requisites				
Assessment methods and criteria		Subject passing criteria	Passing threshold	Percentage of the final grade
		Lecture - test	60.0%	60.0%
		Laboratories - reports, attendance (min. 85%)	60.0%	40.0%
Recommended reading	Basic literature	Devasahayam, Sheila; Singh, Raman; Strezov, Vladimir; Recycling and Resource Recovery from Polymers, MDPI, 2022 Devasahayam, Sheila; Dyer, Laurence; Recycling and Resource Recovery from Polymers II, MDPI, 2024 Francis, Raju; Recycling of Polymers - Methods, Characterization and Applications, John Wiley & Sons, 2017		
	Supplementary literature	Standards for testing the physical, chemical, mechanical and functional properties of polymers and for composting and biodegradation, eg.: ISO 527, ISO 1133, ISO 11357, EN 13432, ISO 20200		
	eResources addresses			
Example issues/ example questions/ tasks being completed	Chemical structure of polymers and its influence on their properties; methods for the identification of plastic waste streams; separation and recycling techniques for plastics; plastics in the Circular Economy (CE) framework; principles and application of Life Cycle Assessment (LCA) in polymer engineering.			
Practical activities within the subject	Not applicable			

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