GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Circular economy, PG_00068912		
Field of study	Cosmetic technologies		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
Education level	first-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	assessment
Conducting unit	Department of Chemistry Technology and Biotechnology of Food -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Robert Tylingo	
	Teachers	dr hab. inż. Robert Tylingo	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	0.0	15.0	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

The aim of the course is to introduce students to circular economy principles and their application in the cosmetics industry. Students learn the interrelations between raw materials, formulation, manufacturing, packaging, use and end-of-life management, as well as basic environmental assessment tools, especially life cycle thinking and LCA. The course develops the ability to critically assess the opportunities, risks and trade-offs of CE solutions in cosmetics and prepares students for evidence-based technical debat

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_K03] understands the social role and importance of providing society with reliable information and opinions	The student formulates and communicates, in a responsible and evidence-based manner, arguments concerning circular economy solutions in the cosmetics industry; distinguishes environmental claims from evidence, identifies risks of greenwashing, and participates in substantive debate on the technical, environmental and social consequences of proposed solutions.	[SK1] Assessment of group work skills [SK4] Assessment of communication skills, including language correctness
[K6_K02] is aware of the potential threats and opportunities related to the development of science and technology for the natural environment and society	The student identifies and critically evaluates the opportunities and risks associated with implementing circular economy solutions in cosmetics, especially in raw materials, formulations, processes and packaging; indicates environmental hotspots, possible burden shifting across life-cycle stages, and justifies solution choices with regard to quality, safety and technological feasibility.	[SK2] Assessment of progress of work [SK5] Assessment of ability to solve problems that arise in practice

<table>
<tr><td>Subject contents</td><td>Course content – lecture
Lecture: linear model versus circular economy; two material cycles; R-hierarchy; life cycle thinking, LCA and environmental hotspots; specificity of rinse-off and leave-on cosmetics; raw materials, green chemistry and safe-by-design; manufacturing processes, mass and energy balances, loss minimisation, CIP; cosmetic packaging: mono-materials, PCR, product-pack compatibility, pumps and atomisers, pigments, labels, emptiability, refill/reuse, design for recycling; business models, EPR, environmental claims and greenwashing, implementation barriers.

Course content – seminar
Seminar: mini Oxford-style debates based on literature and reports; preparation of arguments for and against, problem questions and short conclusions. Debate topics include, among others, refill versus recycling, producer responsibility for waste, product passport, reduction of consumption versus expansion of recycling, reusable packaging and hygiene issues, and banning the destruction of unsold products.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>No formal prerequisites. Recommended competences include a basic understanding of general and organic chemistry, introductory knowledge of materials and manufacturing processes, the ability to interpret simple numerical data, charts and diagrams, and readiness for teamwork, short source analysis and discussion.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Lecture-test</td><td>60.0%</td><td>60.0%</td></tr>
<tr><td>Seminary-presentation</td><td>60.0%</td><td>40.0%</td></tr>
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<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>Liu, L., Ramakrishna, S. (eds.), An Introduction to Circular Economy, Springer, Singapore, 2021.
Fink, J.K., Food Safety, Plastics and Sustainability: Materials, Chemicals, Recycling and the Circular Economy, Wiley-Scrivener, Hoboken, 2023.
Lacy, P., Rutqvist, J., Waste to Wealth. The Circular Economy Advantage, Palgrave Macmillan, London, 2015.</td></tr>
<tr><td>Supplementary literature</td><td>Heisel, F., Hebel, D.E., Building Better Less Different. Circular Construction and Circular Economy, Birkhäuser, Basel, 2022.

Bigdeloo, M., Teymourian, T., Kowsari, E., Ramakrishna, S., Ehsani, A., Sustainability and Circular Economy of Food Wastes: Waste Reduction Strategies, Higher Recycling Methods, and Improved Valorization, Materials Circular Economy, 3, 2021.

Dong, L., Liu, Z., Bian, Y., Match Circular Economy and Urban Sustainability: Re-investigating Circular Economy Under Sustainable Development Goals (SDGs), Circular Economy and Sustainability, 1, 2021.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Explain the differences between the linear model and the circular economy using a selected cosmetic product as an example.
Identify environmental hotspots for a rinse-off product in a cradle-to-grave approach.
Assess whether changing packaging from multi-material to mono-material always improves overall environmental performance.
Compare PET, HDPE and PP as cosmetic packaging materials with regard to recycling, formulation compatibility and quality requirements.
Propose a refill system for a selected cosmetic product and identify its technological, microbiological, logistical and consumer-related limitations.
Prepare a debate position based on at least two sources and formulate 34 problem questions for the audience. Example motion: Waste management costs should be borne more by producers than by consumers or The destruction of unsold new cosmetics should be legally prohibited.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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