GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Nanocosmetics, PG_00069711		
Field of study	Nanotechnology		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
Education level	first-cycle studies	Subject group	Optional subject group 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	3	Language of instruction	Polish
Semester of study	6	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Chemistry Technology and Biotechnology of Food -> Faculty of Chemistry -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Szymon Mania	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	15.0	0.0	30

E-learning hours included: 0.0

eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=1178

Moodle ID: 1178 Nanokosmetyki
https://enauczanie.pg.edu.pl/2025/course/view.php?id=1178

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	3.0	42.0	75

Subject objectives

The aim of the course is to familiarize students with the theoretical foundations and practical aspects of nanotechnology in cosmetology and cosmetics technology. Students will gain knowledge of the types of nanocarriers and nanomaterials used in cosmetics (e.g., liposomes, niosomes, metal nanoparticles, nanoemulsions, dendrimers), their physicochemical properties, and mechanisms of action in contact with the skin and its appendages. The course also covers the safety of nanomaterials in cosmetics, applicable legal regulations (REACH, EU Cosmetics Regulation), risk assessment requirements, and trends in nanocosmetology.
As part of the project, students will learn to analyze the composition and effects of selected cosmetic formulations, develop a concept for their own product containing nanocarriers, and assess the potential benefits and risks associated with its use.
The course will provide students with the ability to critically evaluate modern cosmetics using nanotechnology, familiarize themselves with the research methods used in the analysis of nanocosmetics, and consciously consider ethical, health, and regulatory aspects.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W07] has systematic knowledge of the physical and chemical principles of nanotechnology (methods of obtaining nanostructures, types of nanostructures, their properties, basic research methods).	The student knows the types of nanocarriers and nanomaterials used in cosmetics, understands their physicochemical properties and principles of action in contact with the skin	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K6_U10] can forecast and assess potential negative biological and ecological effects of producing nanostructures on an industrial scale and their practical application.	The student is able to assess the safety of using nanocosmetics, identify potential health and environmental hazards, and propose solutions to minimize the risk.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task

Subject contents	**Lecture Contents (15h)** **Introduction to Nanocosmetics (2h)** • definition and scope of nanotechnology in cosmetology • history and market trends of nanocosmetics • differences between conventional cosmetics and nanocosmetics **Nanocarriers and Nanomaterials in Cosmetics (3h)** • liposomes, niosomes, micelles, dendrimers • nanoemulsions and microemulsions • metallic nanoparticles (Ag, Au, ZnO, TiO) and their functions in cosmetics • polymeric and biopolymeric nanoparticles **Physicochemical Properties and Mechanisms of Action (2h)** • penetration through the skin barrier • controlled release of active ingredients • stability and interactions of nanocarriers with the skin **Research Methods in Nanocosmetic Analysis (2h)** • characterization of nanostructures: DLS, SEM/TEM, UV-Vis spectroscopy, FTIR • in vitro and ex vivo skin penetration studies • antioxidant and antimicrobial activity tests **Safety of Nanocosmetics (2h)** • nanoparticle toxicity, bioaccumulation • risk assessment and safety standards • examples of controversial applications **Legal Regulations and Ethical Aspects of Nanocosmetics (2h)** • Regulation (EC) No 1223/2009 on cosmetic products • nanomaterial registration requirements (REACH, CPNP)

- manufacturers responsibility, ethics, and consumer trust

Future and Innovations in Nanocosmetology (2h)

- smart delivery systems, personalized cosmetics
- bio-inspired nanomaterials
- green and sustainable technologies in cosmetics

Project Nanocosmetics (15h)

Format: teamwork (34 students), step-by-step tasks, elements of practical and critical analysis.

Stages and Tasks (15h)

Introduction and Challenge Selection (1h)

- choosing a product category (e.g., anti-aging, photoprotection, cosmetics for problematic skin, natural cosmetics).
- discussion of project evaluation criteria (properties safety analytics).

Analysis of Nanocarriers and Active Ingredients (2h)

- characterization of the selected nanocarrier (liposomes, nanoemulsions, dendrimers, ZnO/TiO nanoparticles).
- literature and MSDS analysis.
- assessment of potential and limitations (stability, skin penetration, physicochemical properties).

Mini-Analytics and Properties Assessment (3h)

- simulation of simple experiments:
  - **UV-Vis spectrophotometry** stability/UV filter absorption evaluation.
  - **rheological assessment** comparison of fluids/gels (e.g., alginate, gelatin).
  - **emulsion stability** phase separation observation over time.
- interpretation of results in the context of product quality.

Safety and Regulatory Assessment (3h)

- identification of potential health and environmental risks.
- proposal of risk-minimization strategies.

	• reference to regulations (Regulation 1223/2009, REACH, CPNP).
	
	Product Concept Development (4h)
	
	• preparation of a cosmetic description: form, composition, mechanism of action.
	• proposal of analytical methods for quality monitoring (e.g., spectroscopy, stability tests).
	• preparation of a short report (56 pages) including:
	  • nanocarrier and active ingredient analysis,
	  • mini-analytics results,
	  • safety assessment,
	  • justification of regulatory compliance.
	
	Summary and Discussion (2h)
	
	• group discussion of reports.
	• comparison of different team strategies: efficacy vs. safety.

Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Project realization	60.0%	50.0%
Lecture colloquium	60.0%	50.0%

<table>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Regulacja (WE) nr 1223/2009 dotycząca produktów kosmetycznych podstawowy dokument prawny obowiązujący w UE.

Ustawa z dnia 4 października 2018 r. o produktach kosmetycznych (Dz.U. 2018 poz. 2227) polska ustawa wdrażająca regulacje unijne.

S. L. Rowe, Nanotechnologia w kosmetologii, Wydawnictwo Naukowe PWN, Warszawa, 2019 wprowadzenie do zastosowań nanomateriałów w kosmetykach.

A. Gołębiewska, A. Szymańska, Kosmetologia i farmakologia skóry , Wydawnictwo Lekarskie PZWL, Warszawa, 2021 mechanizmy działania składników aktywnych, aspekty bezpieczeństwa.

J. Łopusiewicz, Nanomateriały zastosowanie, bezpieczeństwo i ryzyko, Wydawnictwo Naukowe UM Wrocław, 2020 przegląd nanostruktur stosowanych m.in. w kosmetykach.

J. Gromadzka, Kosmetyki. Od receptury do zastosowania, Wydawnictwo Naukowe UMK, Toruń, 2018 podstawy technologii kosmetyków, w tym z udziałem innowacyjnych składników.

ECHA (Europejska Agencja Chemikaliów), Wytyczne REACH i CLP dotyczące nanomateriałów dostępne w wersji polskiej online.

Komisja Europejska, SCCS Wytyczne dotyczące oceny bezpieczeństwa składników kosmetycznych i ich nanomateriałów (wersja polska, dokumenty KE).</td></tr>
<tr><td>Supplementary literature</td><td>S. R. Mishra (red.), Nanocosmetics: Fundamentals, Applications and Toxicity (podstawy nanonośników, toksykologia, case studies).

H. Schaefer, T. Lochhead (red.), Delivery System Handbook for Personal Care and Cosmetic Products (rozdz. o liposomach, nanoemulsjach, polimerowych nośnikach).</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">Sample Questions (theoretical and problem-based)
• What are the main advantages of using liposomes as carriers of active substances in cosmetics?
• Why are nanoemulsions more stable than macroscopic emulsions?
• How can the effectiveness of a UV filter containing TiO nanoparticles be experimentally evaluated?
• What are the potential health risks associated with silver nanoparticles in cosmetics?
• How can one distinguish between a marketing misuse of the word nano and the actual application of nanotechnology in a cosmetic product?</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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