Subject card

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| Subject name and code | Active ingredients in cosmetology and industry: Shaping the future with innovations and trends, PG_00170300 | | |
| Field of study | Chemistry | | |
| Date of commencement of studies | October 2026 | Academic year of realisation of subject | 2027/2028 |
| 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 | 2.0 |
| Learning profile | academic | Assessment form | credit |
| Conducting unit | Department of Organic Chemistry -> Faculty of Chemistry -> Rector | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr Aleksandra Walewska | |
| | Teachers | | |

**Lesson types**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 30.0 | 0.0 | 0.0 | 0.0 | 0.0 | 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 | 5.0 | 20.0 | 55 |

**Subject objectives**

**Familiarization with modern active substances** discussing the latest discoveries in the field of cosmetology and the chemical industry, including ingredients with proven care, therapeutic, and protective effects.

**Analysis of trends and innovations** presenting current developments in the cosmetic and industrial markets, such as natural cosmetics, biotechnology, and sustainable production.

**Evaluation of the effectiveness and safety of ingredients** learning critical analysis of product compositions, interpretation of scientific research, and principles of assessing the safety of active substances in the context of legal regulations.

**Development of practical skills** acquiring competencies in selecting appropriate substances for different types of cosmetic and industrial products, as well as the ability to create innovative formulations.

| Learning outcomes | Course outcome | Subject outcome | Method of verification |
|---|---|---|---|
| | [CHEML3_K06] Raises her/his professional and personal competences by using information provided in various sources. | The student is able to search for, analyze, and select reliable sources of information to make informed decisions regarding the selection of active substances and technologies used in cosmetology and industry.<br>They can critically evaluate available data and use it to optimize cosmetic formulations and implement innovative solutions | [SK1] oral statement/conversation/ discussion<br>[SK5] implementation of a problem task |
| | [CHEML3_W05] Has basic knowledge of the chemical specialisation studied. | The student has in-depth knowledge of the physicochemical and biological properties of active substances used in cosmetology and industry.<br>They are familiar with advanced techniques for the synthesis, analysis, and evaluation of the effectiveness of active substances and understand their mechanisms of action.<br>They understand the principles of cosmetic and industrial product formulation, including interactions between ingredients, formulation stability, and the impact of various factors on product effectiveness and safety. | [SW1] oral statement/ conversation/discussion<br>[SW5] implementation of a problem task |
| | [CHEML3_K08] Formulates opinions in the field of science with caution and criticism in their expression. | The student is able to critically analyze available data regarding new active substances and technologies used in cosmetics and industrial products.<br>They are able to formulate opinions on innovative solutions, considering both the benefits and potential risks associated with the introduction of new ingredients.<br>They can assess the quality of scientific research and test results conducted on active substances, taking into account their methodology and limitations | [SK1] oral statement/conversation/ discussion<br>[SK5] implementation of a problem task |
| | [CHEML3_W03] Explains the relationship between the structure of matter and its observed properties. | The student understands how the chemical structure of active substances affects their physical, chemical, and biological properties, which is crucial in the design and production of cosmetics and industrial products.<br>They are familiar with advanced mechanisms of interactions between the molecules of active substances and the components of products, such as solubility, stability, bioavailability, and biological activity. | [SW1] oral statement/ conversation/discussion<br>[SW5] implementation of a problem task |
| | [CHEML3_W02] Describes the properties of elements and the most important chemical compounds, enumerates the methods of their preparation and methods of analysis. | The student has advanced knowledge of the properties of chemical elements and the most important chemical compounds used in cosmetology and industry, including their functions, reactivity, stability, and impact on the human body. They understand the analytical techniques used to assess the quality, purity, and effectiveness of active substances | [SW1] oral statement/ conversation/discussion<br>[SW5] implementation of a problem task |
| | [CHEML3_U07] Prepares documented elaboration on a specific problem in the field of selected chemical and physical issues. | The student is familiar with methods of analyzing and interpreting scientific data on active substances used in cosmetology and industry and is able to prepare a reliable study on these topics. | [SU1] oral statement/conversation/ discussion<br>[SU5] implementation of a problem task |

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [CHEML3_K03] Establishes priorities in the right way for the implementation of tasks specified by herself/himself and/or by others. | The student is able to correctly define priorities in conducting research and analysis on active substances, taking into account scientific, technological, economic, and legal aspects. | [SK1] oral statement/conversation/ discussion<br>[SK5] implementation of a problem task |
| [CHEML3_U01] Identifies, analyses and solves problems in the field of broadly understood chemistry on the basis of the acquired knowledge. | The student is able to identify problems related to ingredient compatibility, active substance degradation, and their bioavailability in cosmetics and industrial products.<br>They understand the impact of various factors (e.g., pH, temperature, presence of other ingredients) on the performance of active substances and the methods of modifying them to optimize formulations. | [SU1] oral statement/conversation/ discussion<br>[SU5] implementation of a problem task |
| [CHEML3_K01] Identifies the level of her/his own knowledge and skills and the need for continuous learning and personal development. | The student is able to assess their level of knowledge about active substances used in cosmetology and industry, understanding their properties, applications, and production technologies. They are aware of current trends and innovations in the field of cosmetics and industry, recognizing the need for continuous monitoring of new scientific discoveries and technological developments. | [SK1] oral statement/conversation/ discussion<br>[SK5] implementation of a problem task |
| [CHEML3_U08] Presents in an understandable way the basic facts about chemistry using a scientific language typical of chemical sciences. | The student is able to translate complex chemical issues into language that is understandable for people outside the field of chemistry, while maintaining scientific precision and accuracy. They can explain how specific active substances affect the properties of cosmetic and industrial products, describing the chemical processes behind their actions, such as moisturizing mechanisms, antioxidation, or cell regeneration | [SU1] oral statement/conversation/ discussion<br>[SU5] implementation of a problem task |
| [CHEML3_W04] Characterises the basic methods of chemical compound analysis. | A student knows the basic methods of qualitative and quantitative analysis of active substances used in cosmetology and industry and understands the principles of analytical techniques. | [SW1] oral statement/ conversation/discussion<br>[SW5] implementation of a problem task |

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| Subject contents | Chemical and Biochemical Properties of Active Substances Used in Cosmetics and Industry: The structure-function relationship of active substances, chemical stability, reactivity, and biodegradability. Mechanisms of action of active substances.<br><br>Innovative Technologies in the Production of Active Substances: biotechnology, nanotechnology, and green chemistry.<br><br>Modern Trends in Active Substances in Cosmetics: active substances of natural and organic origin, use of plant extracts and bioactive compounds, biotechnological substances: probiotics, peptides, enzymes.<br><br>Active Substances in Industrial Products.<br><br>Challenges in the Development and Production of Active Substances.<br><br>Practical Aspects: selection, formulation, and testing of active substances.<br><br>Future Perspectives and Innovations.<br><br>Market Trends and Consumer Demands. |
| Prerequisites and co-requisites | Fundamentals of Organic Chemistry and Biochemistry |

Assessment methods and criteria

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| | 51.0% | 100.0% |

Recommended reading

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| Basic literature | • Cosmeceuticals and Active Cosmetics<br><br>Edited By Raja Sivamani, Jared R. Jagdeo, Peter Elsner, Howard I. Maibach; CRS Press, 2015<br><br>• Introduction to Cosmetic Formulation and Technology, Gabriela Baki, 2nd Edition, 2023 |
| Supplementary literature | Scientific journal articles:<br><br>Journal of Dermatologic Science and Cosmetic Technology; Natural Products and Bioprospecting; Biotechnology Advances,<br><br>European Journal of Pharmaceutics and Biopharmaceutics; Colloid and Interface Science Communications |
| eResources addresses | |

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| Example issues/ example questions/ tasks being completed | |
| Work placement | Not applicable |

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