# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Microplastics - methods of determination and removal [S2TOZ1>MMOiU]

## Course

Field of study
Circular System Technologies

Year/Semester
1/1

Area of study (specialization)
Material recycling and chemical recovery

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

## Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
15

## Number of credit points

4,00

## Coordinators

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## Lecturers

## Prerequisites

The student should have a basic knowledge of general chemistry, materials science and instrumental analytical techniques relating to the characterization of materials, with particular emphasis on polymeric materials. In addition, the student should have a basic knowledge of environmental chemistry in the context of environmental contaminants.

## Course objective

The purpose of the course is to provide students with knowledge of microplastic as an environmental pollutant and a source of other pollutants, to master the ability to assess microplastic migration within the product life cycle, and to practically apply available tools for analyzing and assessing microplastic pollution in the environment.

## Course-related learning outcomes

Knowledge:

K_W01 Has an in-depth knowledge of physics, chemistry and other related fields relevant to the field of study, useful for describing and solving complex tasks in the field of study.
K_W02 Has advanced, structured and theoretically underpinned knowledge of the principles of a closed-loop economy and the reasons why it is implemented.
K_W04 Has structured, advanced knowledge to recognize, assess the harmfulness and neutralize factors hazardous to the environment.
K_W09 Uses the basic legal, economic and ethical acts of environmental protection and closed-loop economy efforts.
K_W10 Has a structured knowledge of sampling, sample storage and the proper selection of analytical techniques for their determination.
K_W14 Knows and understands the basic processes in the life cycle of equipment and apparatus, technical facilities and systems used in closed loop technologies.

Skills:
K_U02 Can plan, prepare and present a presentation on the implementation of a research task and conduct a substantive discussion on a given topic.
K_U04 Can identify and critically evaluate technical solutions for waste recycling in accordance with the principles of a closed loop economy.
K_U05 Can independently plan and implement his/her own lifelong learning to improve personal professional competence.
K_U08 Can selectively adapt knowledge of chemistry and related fields in planning and implementation of research and technological tasks in the area of technologies based on closed-loop economy and analyze their impact on the environment.
K_U09 Can interact with others and take a leading role in a team to solve engineering problems concerning methods and equipment used in technologies, including those related to the closed-loop economy.
K_U12 Can plan and carry out experiments related to closed-loop technologies and can interpret the obtained results and draw conclusions.

Social competences:
K_K01 Is aware of personal responsibility resulting from his professional role and the emergence of moral and ethical issues in the context of professional activities.
K_K02 Understands the need to popularize knowledge of sustainable production and technological solutions in a closed-loop economy.
K_K03 Critically evaluates his/her knowledge, understands the need for further education and improvement of his/her professional, personal and social competencies.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired in the lecture is verified in a written exam. Passing threshold: 50% of the points.
The basis for passing the project is the development, preparation in the form of a presentation of the concept of microplastic migration within the product life cycle, taking into account potential sources of microplastic release into the environment and solutions that can reduce the amount of microplastic released from the product.
The basis for passing the laboratory classes will be the correct execution of the scheduled exercises and the passing of a colloquium at the end of the class in the form of a test. In justified cases, it is possible to pass the course with a test. In addition, the student is required to provide in electronic form to e-courses 3 reports from the completed classes covering each of the discussed analytical techniques.
In justified cases, it is permissible to complete the course online.

## Programme content

The course program content covers basic issues related to microplastics as a new group of pollutants in the context of closed-loop technology.

## Course topics

The lectures for the subject discuss the sources and pathways of microplastic into the environment, will

present the dangers of microplastic and the current standards and regulations for microplastic in the environment. The problem of microplastic from the perspective of the economy and closed-loop technology will be discussed, and possible alternatives seeking to minimize the share of microplastic in the economy will be presented.
In the scope of project course, students will prepare a project demonstrating the migration of microplastic within the life cycle of a product, including potential sources of microplastic release into the environment and solutions that can reduce the amount of microplastic released from the product.
During the laboratory class, students will get a hands-on look at techniques for identifying microplastic contamination in samples. As part of the course, students will independently make model systems containing microplastic contamination, and then perform analyses to study the quantitative and/or qualitative contamination in samples. Students will also become familiar with various techniques for preparing samples for analysis, depending on the chosen analytical technique. The class will be implemented in the form of 3 meetings, in which students will (1) prepare model solutions, then prepare samples for analysis and perform microscopic identification of the contaminants to be analyzed; (2) prepare samples for analysis, then perform identification of contaminants using spectroscopic methods; (3) prepare samples for analysis, then perform identification of contaminants using chromatographic methods.

## Teaching methods

Lecture: multimedia presentation, discussion.
Project: multimedia presentation, discussion.
Laboratory: practical laboratory activities.

## Bibliography

Basic:
GC/LC, Instruments, Derivatives in Identifying Pollutants and Unknowns / Crippen Raymond C.
Metody spektroskopowe i spektrometria mas w zastosowaniu do identyfikacji związków organicznych : praca zbiorowa. T. 1 / pod redakcją Wojciecha Zielińskiego i Andrzeja Rajcy
Wstęp do technologii polimerów / Ewa Głowińska, Paulina Parcheta-Szwindowska, Janusz Datta
Identification of materials via physical properties chemical tests and microscopy / by A. A. Benedetti-Pichler.

Additional:
Wybrane mikrozanieczyszczenia organiczne w wodach i glebach / Maria Włodarczyk-Makuła
Bruce E. Rittmann, Perry L. McCarty, Environmental Biotechnology: Principles and Applications, McGraw-Hill Education, 2001
Z. Wnuk, Ekologia i ochrona środowiska. Wybrane zagadnienia, Wydawnictwo Uniwersytetu Rzeszowskiego, 2010

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 100 | 4,00 |
| Classes requiring direct contact with the teacher | 49 | 2,00 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 51 | 2,00 |