COURSE DESCRIPTION CARD - SYLLABUS

Course name
Techniques of electrochemical oxidation of organic waste [S1TOZ1>TEUOO]

Course

Field of study
Circular System Technologies

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

The student has a basic knowledge of chemistry, physics and mathematics. He knows the rules of environmental protection related to chemical production.The student understands the need for continuous training and improvement of their professional and personal competences.

Course objective

Transfer of knowledge on the techniques of electrochemical oxidation of organic waste, taking into account the methods and design of reactors as well as mechanisms of the occuring reactions.

Course-related learning outcomes

Knowledge:
1. has knowledge of physics and chemistry to understand the phenomena and changes occurring in technological and environmental processes - [k_w02].
2. has systematized, theoretically founded knowledge of inorganic, organic, physical and analytical chemistry - [k_w04].
3. has basic knowledge of the neutralization and recovery processes of industrial and municipal waste - [k_w07].

Skills:
1.is able to obtain information from literature, databases and other sources related to circular systems technologies, also in a foreign language, integrate them, interpret them, draw conclusions and formulate opinions - [k_u01].
2. correctly uses in discussions nomenclature and terminology in the field of circular systemstechnologies, chemistry, technology and chemical engineering, environmental protection and related disciplines, also in a foreign language - [k_u05].
3. performs analyzes and verifies existing technical solutions in the field of circular systems technologies- [k_u11].

Social competences:
1. in every situation behaves professionally, takes responsibility for decisions made in connection with professional duties, acts in accordance with moral principles and the principles of professional ethics - [k_k01].
2. objectively assesses the level of his knowledge and skills, understands the importance of improving professional and personal competences adequately to the changing social conditions and the progress of science - [k_k05].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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The knowledge acquired during the lecture is verified by a 60-minute written test consisting of 3 to 5 questions. The pass mark is 50% of all points. In the case of introducing the remote learning mode, the credit will take the form of a test posted on the e-Kursy platform. The test will contain 10 to 20 single and multiple choice questions, open-ended questions, and true-false questions.

Programme content

1.Fundamentals of electrochemical mineralization of organic pollutants.
2. Electrode materials used in the processes of electrochemical oxidation of organic waste.
3. Pre-treatment processes preceding the electrochemical oxidation of organic pollutants.
4. Indirect and direct methods of electrochemical oxidation.
5.Types of used electrolytes.
6. Electrochemical oxidation of organic pollutants in the potential range related to the electrochemical decomposition of water.
7. Electrochemical oxidation of organic pollutants in the environment of chloride ions.
8. Electrocatalysts used in the degradation of organic pollutants.
9. Processes of indirect oxidation of organic pollutants with the use of persulfate ions.
10. Electrocoagulation processes in water purification.
11. Photoelectrochemical oxidation.
12. Fabrication of photoelectrode materials.
13. Electroreduction of organic compounds.
14. Designs solutions of electrochemical reactors and their influence on the course of electrochemical oxidation processes.
15.The use of reactors with a solid polymer electrolyte for dehydrohalogenationof organic pollutants.

Teaching methods

Lecture, problem lecture, didactic discussion.

Bibliography

Basic
1. Ch. Comninellis, G. Chen – Electrochemistry for the Environment, Springer Science & Business Media, 2010.
2. A. Ciszewski, Technologia chemiczna. Procesy elektrochemiczne, Wyd. Politechniki Poznańskiej, 2008.
3. F.C. Moreira, R.A.R. Boaventura, E. Brillas, V.J.P. Vilar, Electrochemical advanced oxidation processes: A review on their application to synthetic and real wastewaters, Applied Catalysis B: Environmental 202 (2017) 217–261.

4. L. Dąbek, Zastosowanie sorpcji i zaawansowanego utleniania do usuwania fenoli i ich pochodnych z roztworów wodnych, Annual Set The Environment Protection, Rocznik Ochrona Środowiska, Volume/Tom 17. Year/Rok 2015, 616–645.
Additional
1. R. Dylewski, Metody elektrochemiczne w inżynierii środowiska, Wydawnictwo Politechniki Śląskiej Gliwice 2000.
2. V. Katheresan, J. Kansedo, S. Lau, Efficiency of various recent wastewater dye removal methods: A review, Journal of Environmental Chemical Engineering, 6 (2018)4676–4697.
3.L. Szpyrkowicz, C. Juzzolino, S. Kaul, A comparative study on oxidation of disperse dyes by electrochemical process, ozone, hypochlorite and fenton reagent, Water Research, 35 (2001) 2129-2136.
4. Y. Kong, Z. Wang, Y. Wang, J. Yuan, Z. Chen, Degradation of methyl orange in artificial wastewater through electrochemical oxidation using exfoliated graphite electrode, New Carbon Materials, 26 (2011) 459-464.
5. J.M. Skowroński, P. Krawczyk,Improved electrooxidation of phenol at exfoliated graphite, Journal of Solid State Electrochemistry, 11 (2007) 223-230.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	38	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	37	1,50