COURSE DESCRIPTION CARD - SYLLABUS

Course name
Inorganic Chemical Technology - Synthesis and Functional Properties of Hybrid Materials

Course

Field of study
Pharmaceutical Engineering
Area of study (specialization)
-
Level of study
First-cycle studies
Form of study
full-time

Year/Semester
3/6
Profile of study
general academic
Course offered in
polish
Requirements
elective

Number of hours

Lecture
0
Laboratory classes
30
Other (e.g. online)
0
Tutorials
0
Projects/seminars
0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
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Faculty of Chemical Technology

Institiute of Chemical Technology and Engineering

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Responsible for the course/lecturer:
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Faculty of Chemical Technology

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Prerequisites

Student has knowledge of general and inorganic chemistry, physical chemistry and apparatus of chemical industry, knows the basic methods, techniques and tools used in chemical analysis (core curriculum of I and II year of the studies). Student can obtain information from literature, databases and other sources, can interpret the obtained information to draw conclusions and formulate opinions in the area of general and inorganic chemistry. Student is able to apply that knowledge in practice, both during the implementation work and the further education. Student is able to interact and work in a group. Student is able to properly identify the priorities used to perform a specific task. Student understands the need for further education.

Course objective

Acquiring basic knowledge in the field of inorganic materials technology. Understanding the basic industrial processes and operations related to the technology of materials dedicated to pharmaceutical applications. Ability to select / select chemical raw materials and intermediates. Understanding the methods of obtaining and modifying inorganic products that may find potential application in pharmacy, and identifying them. Indication of the possibility of using products manufactured in inorganic technology processes. The ability to create modern methods for the synthesis of inorganic materials.

Course-related learning outcomes

Knowledge

K_W1 - has stuctured general knowledge in the field of inorganic chemical technology as a field directly related to pharmaceutical engineering

K_W4 - has structured, theoretically founded general knowledge in inorganic chemistry and inorganic chemical technology enabling understanding, description and investigation of chemical phenomena and processes related to pharmaceutical engineering

K_W8 - knows the rules of environmental protection related to pharmaceutical technology and waste management, has the necessary knowledge about the risks associated with the implementation of chemical and pharmaceutical processes

K_W11 - knows the basics of kinetics, thermodynamics and catalysis of chemical processes

K_W13 - has knowledge of natural and synthetic raw materials, products and processes used in the pharmaceutical industry

K_W24 - has basic knowledge in the field of methods of searching for new substances used in pharmacy, including inorganic supports of farmaceutically active substances, and techniques used to characterize them with respect to physicochemical properties

Skills

K_U1 - is able to obtain information from literature, databases and other sources related to inorganic

chemical technology, also in a foreign language, integrate them, interpret and draw conclusions and formulate opinions

K_U2 - based on general knowledge, explains the basic phenomena associated with relevant processes, distinguishes between types of chemical reactions and has the ability to select them for chemical processes, can characterize various states of matter, structure of chemical compounds, using theories used to describe them, experimental methods and techniques

K_U3 - uses chemical and pharmaceutical terminology and chemical nomenclature correctly, also in a foreign language

K_U24 - has the ability to self-study

Social competences

K_K1 - is ready to critically assess his knowledge, understands the need for further training, supplementing specialization knowledge and raising his professional, personal and social competences, understands the importance of knowledge in solving problems.

K_K2 - can interact and work in a group.

K_K3 - is aware of the importance of non-technical aspects and effects of engineering activities, including their impact on the environment and the associated responsibility for the decisions taken.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratory - reports from laboratory exercises, colloquium, oral/written answer, presentation of theoretical and experimental material, solving scientific problems, assessment of student's activity in laboratory classes, evaluation of practical classes, evaluation of teamwork; criterion: 3 - basic theoretical and practical knowledge, preparation skills concerning reports from laboratories, basic participation in theoretical and practical classes without additional involvement; 4 - practical preparation supported by theoretical knowledge, the ability to formulate the right conclusions from the data obtained during the laboratory, active participation in classes supported by the desire to acquire additional practical and theoretical knowledge; 5 - complete preparation for classes, the ability to draw conclusions at an advanced level, and also posed defense, precise execution of entrusted tasks, independent search additional theoretical knowledge, coordination of work in a research team, an ambitious approach to the subject matter.

Programme content

• Basic processes and operations of inorganic technology

• Modern methods of synthesis of inorganic and hybrid materials (two- or multi-component oxide systems, hybrid systems based on inorganic matrix and selected biopolymers, additives for pharmaceutical materials)

- sol-gel process

- soft and hard template

- combined methods

• Methods of physicochemical characterization of modern inorganic and hybrid inorganic/organic materials dedicated for pharmaceutical engineering

- DLS / NIBS, ELS, laser diffraction

- TG / DTA / DSC

- contact angle

- electrokinetic potential and surface charge

- wettability / sedimentation

- elemental analysis

- FTIR UV-Vis

- low temperature sorption of nitrogen

Teaching methods

Laboratory - teaching materials for the laboratory in pdf files, practical exercises

Bibliography

Basic

1. K. Schmidt-Szałowski, J. Sentek, J. Raabe, E. Bobryk, Podstawy technologii chemicznej. Procesy w przemyśle nieorganicznym, Oficyna Wydawnicza Politechniki Warszawskiej Warszawa 2004

2. Jess Andreas, Chemical Technology: An Integral Textbook, Wiley 2012, ISBN13 (EAN): 9783527304462, ISBN10: 3527304460.

3. Moulijn Jacob A., Chemical Process Technology, Wiley-Blackwell 2013, ISBN13 (EAN): 9781444320251, ISBN10: 1444320254.

4. E.F. Vansant, P. van der Voort and K.C. Vrancken, Characterization and chemical modification of

the silica surface, Elsevier, Amsterdam 1995

5. J.A. Rodriguez, M. Fernandez-Garcia, Synthesis, properties and applications of oxide nanomaterials, John Wiley & Sons, New Jersey 2007

6. A.W. Adamson, A.P., Gast, Physical chemistry of surface, John Wiley & Sons, Toronto 1997

7. Ch. Kumar, Nanostructured oxides, Wiley-VCH, Weinheim 2009

8. Katja A. Strohfeldt (2015) Essentials of Inorganic Chemistry: For Students of Pharmacy, Pharmaceutical Sciences and Medicinal Chemistry; Wiley

9. Costas, Demestos (2016) Pharmaceutical Nanotechnology: Fundamentals and Practical Applications, Springer

Additional

1. G. Wypych, Handbook of fillers, 3rd ed., ChemTec Publishing, Toronto 2010

2. M. Xantos, Functional fillers for plastics, Wiley-VCH, New York 2011

3. Padma V. Devarajan, Sanyog Jain, Targeted Drug Delivery : Concepts and Design, Springer 2015

4. Nelson Duran, Silvia S. Guterres, Ostwaldo L. Alves, Nanotoxicology: materials, methodology and assessments. Springer 2014

5. Vijay K. Thakur, Manju K. Thakur, Michael R. Kessler, Handbook of Composites from Renewable Materials, Wiley 2017

6. Hermann Ehrlich, Extreme Biomimetics, Springer 2017

7. Scott E. McNeil, Characterization of Nanoparticles Intended for Drug Delivery, Springer 2011

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,0
Classes requiring direct contact with the teacher	30	1,1
Student's own work (literature studies, preparation for laboratory classes, preparation for tests) [1]	25	0,9

[1] delete or add other activities as appropriate