COURSE DESCRIPTION CARD - SYLLABUS

Course name
Polymeric materials in pharmacy [S1IFar1>MPwF]

Course

Field of study
Pharmaceutical Engineering

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

The student should have a basic knowledge of organic and general chemistry. Student should also be able to search information from literature, databases and other properly selected sources and be willing to cooperate as part of a team.

Course objective

Providing knowledge in the field of preparation, structure, properties and applications of polymers and polymeric materials, in particular in pharmacy. Mastering the skills of polymer synthesis, plastic processing and characteristics of their physicochemical properties.

Course-related learning outcomes

Knowledge:
1. student has ordered, theoretically founded general knowledge in the field of polymer chemistry, in particular the structure and reaction of obtaining polymers [k_w4]
2. student has the necessary knowledge in the field of synthetic and natural polymers used in the pharmaceutical industry [k_w13]
3. the student has the necessary knowledge in the field of polymer processing methods to obtain final

products in the pharmaceutical industry [k_w13]

Skills:
1. student has the skills to search information from literature, databases and other sources related to polymeric materials [k_u1]
2. student is able to synthesize polymeric materials for applications in pharmacy using basic laboratory techniques [k_u12]
3. the student is able to use experimental methods to control the course of polymerization reactions and has the ability to assess the physicochemical properties of polymer materials used in pharmacy [k_u11]

Social competences:
1. the student understands the need for further education and improving own professional competences [k_k1]
2. the student is able to work in a group and take responsibility for the effects of their own and team activities [k_k2]
3. the student is able to determine the priorities for the implementation of the tasks [k_k5]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lectures:
Knowledge acquired in the lecture is verified in the form of a written exam after the end of the lecture cycle. The exam consists of 30-40 test questions and 5-10 open questions. Passing threshold: 50% of points. Exam issues will be sent to students via e-mail using the university e-mail system.
In the case of remote lectures, the exam will be held on-line using the university infrastructure.
Laboratory:
The skills in the laboratory classes are verified on the basis of a test of theoretical issues, consisting of 3-5 questions. Theoretical issues for all exercises are passed on during the organizational meeting. Passing threshold: 50% of points. In addition, reports containing a description of the experiment and calculations are evaluated.

Programme content

Lectures:
1. Basic concepts in the science of polymers (monomer, polymer, mer, degree of polymerization, functionality). Polymer nomenclature.
2. Chain polymerization - mechanism and types. Chain polymerization stages - initiation, propagation and termination. Radical, cationic, anionic polymerization, living polymerization. Kinetics of polymerization reaction. Coordination polymerization. Copolymerization and types of copolymers.
3. Step polymerization. Polycondensation: types of polycondensation. Comparison of polymerization and polycondensation. Polycondensation reactions. Kinetics of the polycondensation process. Polyaddition - mechanism, examples of polymers obtained by polyaddition.
4. Crosslinking of polymers.
5. Polymer structure - forms of polymer chains (linear, branched, crosslinked), I, II, III-order structures - sequence of mers, cis-trans isomerism, tacticity, conformational forms, aggregation states, morphology of polymers, degree of crystallinity. Crystalline and amorphous polymers - properties.
6. Molecular weight of polymers - types of molecular weight, polydispersion, influence of molecular weight on properties, molecular weight calculations. Degradation, depolymerization and destruction.
7. Plastics - definitions and classifications. Blends and polymer composites. Plastomers, elastomers, thermoplastics, duroplasts. Physical states and characteristic temperatures of polymers, glass transition temperature. Viscoelasticity of polymers.
8. Basic mechanical properties of polymers: tensile strength, stress - strain relationship (and its dependence on physical states), impact strength, hardness, bending strength.
9. Research methods and analysis of polymers and plastics.
10. Basic methods of plastic processing - technological stages, extrusion, injection molding, pressing, thermoforming, calendering, spinning, rotomolding.
11. Properties and applications of selected polymers, in particular in the pharmaceutical, cosmetics and medicine industries.

12. Polymers as auxiliary materials in the production of medicinal preparations, as pharmacologically active substances, carriers of medicinal substances, systems of controlled release of active substances.
13. Applications examples of polymers in pharmacy, eg. superabsorbents and polymer gels, blisters, capsules, polymer microcapsules and polymer microspheres, nanocapsules, dragees, transdermal therapeutic systems, controlled release systems, drugs obtained by the "hot-melt extrusion" method, hydrogels, polymeric biomaterials used in pharmacy, macromolecular prodrugs, therapeutic systems - dosing or releasing a drug substance at a programmed rate for a specified time, polymers as drugs.
14. Recycling od polymers - material, recovery of compounds, and energy recovery.
As part of the laboratory classes, the following exercises are performed:
1. Polymer hydrogels: preparation and characterization of physicochemical properties.
2. Block polymerization of methyl methacrylate and gel effect testing.
3. Polycondensation of glycerin with dicarboxylic acid.
4. Polymorphism of high- and low-molecular compounds analysed by XRD and microscopic techniques.
5. Analysis of phase transitions in polymers by DSC method.
6. Identification of polymers.

Teaching methods

1. Lecture: multimedia presentation
2. Laboratory: practical classes using chemical reagents and research equipment

Bibliography

Basic
1. J. Pielichowski, A. Puszyński „Chemia Polimerów” TEZA, Kraków, 2004
2. J. Pielichowski, A. Puszyński „Technologia tworzyw sztucznych”, WNT, Warszawa, 1994
3. W. Szlezyngier, Tworzywa sztuczne, Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 1996
4. J.F. Rabek, Współczesna wiedza o polimerach, PWN, Warszawa 2008
Additional
1. Z. Floriańczyk, S. Penczek, Chemia Polimerów, t.I,II,III, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2001

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50