



ЦЕНТЪР ЗА ОБУЧЕНИЕ – БАН

1000 София
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Basic Information:

Course Title: **Functional polymeric materials from natural polymers with applications in biomedicine, agriculture, and environmental protection**

Lecturer: Prof. Olya Stoilova, PhD

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Total Teaching Hours: 30 lecture hours

Annotation (up to 150 words)

The course aims to provide comprehensive knowledge of natural polymers, their structure, properties, and classification, as well as modern approaches for the fabrication of functional polymeric materials based on them. Emphasis is placed on the preparation and characterization of different material forms, including films and coatings, micro- and nanospheres, electrospun fibrous materials, and gels. The course presents the relationships between the composition, structure, processing methods, and functional properties of these materials, highlighting their performance in selected applications in biomedicine, agriculture, and environmental protection, including water purification.

The course is primarily intended for PhD students in the fields of chemical sciences, materials science, polymer science, and related disciplines. Owing to its interdisciplinary nature, it is also suitable for graduate students, PhD students, postdoctoral researchers, and early-career scientists working in biopolymers, chemical technologies, biomedical engineering, pharmacy, biotechnology, agricultural sciences, environmental science, and ecology. The course is also relevant for researchers and professionals interested in the development and application of sustainable and bio-based polymeric materials.

Course content (brief description by topics or modules)

Module 1. Natural Polymers and Their Modification

Section 1. Main types of natural polymers – classification, structure, and properties.

Section 2. Methods for functionalization and modification.

Module 2. Biomedical Applications

Section 1. Polymeric biomaterials.

Section 2. Tissue engineering and regenerative medicine.

Module 3. Applications in Agriculture and the Environment

Section 1. Applications in agriculture.

Section 2. Environmental applications.

Teaching and assessment methods

Teaching – lecture presentations.

Assessment – test and oral examination.

Competencies acquired as a result of training (3–5 points)



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1. Acquisition of knowledge on the structure, properties, and classification of natural polymers and their derivatives.
 2. Acquisition of knowledge for selecting appropriate methods for the modification of natural polymers to obtain materials with desired functional properties.
 3. Development of skills for the design of functional polymer materials for applications in biomedicine, agriculture, and environmental protection.

Literature:

1. Dumitriu, S., Popa, V.I. (Eds.). Polymeric biomaterials. 2013. CRC Press.
2. Park, J.B., Bronzino, J.D. (Eds.). Biomaterials principles and applications. 2002. CRC Press.
3. Sikder, A., Pearce, A.K., Parkinson, S.J., Napier, R. and O'Reilly, R.K., 2021. Recent trends in advanced polymer materials in agriculture related applications. *ACS Applied Polymer Materials*, 3(3), 1203-1217.
4. Gonçalves, R., Serra, J., Reizabal, A., Correia, D.M., Fernandes, L.C., Brito-Pereira, R., Lizundia, E., Costa, C.M. and Lanceros-Méndez, S., 2025. Biobased polymers for advanced applications: Towards a sustainable future. *Progress in Polymer Science*, 162, 101934.