

Lecture 1.

Theme. The role of polymers in wildlife and their importance as industrial materials. Basic concepts and definitions of the chemistry of high-molecular compounds.

Aim: to generate the following learning outcomes:

- formulate the basic concepts and terms of polymer science;
 - explain the features of the molecular structure of polymers of polymers;
 - to identify the main features of the properties of polymers.
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Purpose:

To introduce students to the nature and structure of polymers, their roles in living organisms and industry, and to explain the main concepts and definitions of polymer chemistry.

Main Questions:

1. What are polymers and monomers?
 2. What types of polymers exist in nature and industry?
 3. What role do polymers play in living organisms?
 4. Why are polymers important industrial materials?
 5. What are the main types of chemical bonds and molecular structures in polymers?
 6. How are high-molecular compounds classified?
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Lecture content:

Basic concepts and definitions: polymer, oligomer, macromolecule, monomeric link, degree of polymerization, contour length of the chain.

The role of polymers in wildlife and their importance as industrial materials (plastics, rubbers, fibers and films, coatings, adhesives).

The subject and tasks of the science of high-molecular compounds (polymers).

The place of polymer science as an independent fundamental field of knowledge among other fundamental chemical disciplines.

Its role in scientific and technological progress and the main historical stages of its development.

Key Theses:

- Polymers are substances composed of repeating structural units (monomers) linked by covalent bonds, forming long molecular chains known as macromolecules.
 - A monomer is a small molecule capable of joining with others in polymerization or polycondensation reactions to form a polymer.
 - Natural polymers include proteins, nucleic acids (DNA, RNA), cellulose, starch, natural rubber, and chlorophyll. They play structural, catalytic, and informational roles in biological systems.
 - Synthetic polymers such as polyethylene, polypropylene, polystyrene, nylon, and polyesters are widely used in construction, medicine, packaging, textiles, and electronics.
 - Molecular structure types: linear, branched, and cross-linked. The structure determines the physical and chemical properties of the polymer.
 - Classification of polymers can be based on origin (natural, synthetic), synthesis method (polymerization, polycondensation), and chain composition (homopolymers, copolymers).
 - Properties of polymers depend on molecular weight, degree of crystallinity, intermolecular forces, and the chemical nature of monomer units.
 - In biological systems, polymers are fundamental: DNA stores genetic information, proteins act as enzymes and structural materials, and polysaccharides provide energy storage and support.
 - In industry, polymers are valued for their low density, durability, corrosion resistance, flexibility, and ease of processing.
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Control Questions:

1. Define the terms “polymer” and “monomer.”
 2. What are the main differences between natural and synthetic polymers?
 3. What roles do polymers play in living organisms?
 4. What types of molecular structures exist in polymers?
 5. Why are polymers important industrial materials?
 6. What are the main methods of polymer synthesis?
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References for lecture content:

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Internet resources:

12. <http://www.pslc.ws/index.htm>
13. <http://www.xumuk.ru/>
14. <http://www.hemi.nsu.ru/>