

M.Sc. Sem I, CC-2, Physical Chemistry

Types of Macromolecules

There are three main types of biological macromolecules, according to mammalian systems:

- 1) Carbohydrates
- 2) Nucleic acids
- 3) Proteins
- 4) Lipids

These are classified separately in different segments of a course. The principles that govern the organization of three-dimensional structure are the same for all of them; therefore, we could consider them together.

Carbohydrates

Carbohydrates are polymers of carbon, hydrogen and oxygen. They can be classified as monosaccharides, disaccharides and polysaccharides. Carbohydrates are found in starch, fruits, vegetables, milk and sugars. They are an important source of a healthy diet.

Nucleic Acids

The nucleic acids include DNA and RNA that are the polymers of nucleotides. Nucleotides comprise a pentose group, a phosphate group, and a nitrogenous base group. All the hereditary information is stored in the DNA. The DNA synthesised into RNA and proteins.

Proteins

Proteins are the polymers of amino acids. These include the carboxylic and the amino group. There would be no lipids or carbohydrates without proteins because the enzymes used for their synthesis are proteins themselves.

Lipids

Lipids are a hydrophobic set of macromolecules, i.e., they do not dissolve in water. These involve triglycerides, carotenoids, phospholipids, and steroids. They help in the formation of the cell membrane, formation of hormones and in the and as stored fuel.

Examples of Macromolecules

Following are the major examples of macromolecules:

Synthetic Fibres

Nylon, rayon and spandex consist entirely of macromolecules. These are created in certain steps:

- The monomers are reacted to make prepolymers or a liquid, primitive macromolecule.
- In the next step, the prepolymers are fed through a cell where it solidifies and attains the desired thickness. This process is called spinning.

Genetic Transfer

DNA is a genetic material that contains nucleic acids which code for genetic material. During meiosis, the DNA is no longer a whole, and the nucleotides that remain are responsible for transferring the genetic information to the gametes.

Monomers and Polymers

Macromolecules are basically polymers, long chains of molecular sub-units called monomers. Carbohydrates, proteins and nucleic acids are found as long polymers. Due to their polymeric nature and large size, they are known as macromolecules.

Industrial Applications of Macromolecules

There are three major groups of macromolecules that are essential in the industry, apart from biological macromolecules. These include plastics, fibres, and elastomers.

Elastomers are macromolecules that are flexible and stretchy. The elastic property lets these materials to be used in products like hair bands and elastic waistbands. These objects could be stretched, and they return to their original structure once released.

We wear fibre macromolecules. Nylon, Polyester, and acrylic fibres are used in everything from blouses, belts to shirts and shoes. Natural fibres include wool, cotton, and silk.

Hence, there are many objects that we use today are made up of macromolecules. Many types of plastics are made through a process known as polymerization, which is the joining of monomer units from plastic products.