

Types of Polymers

Definitions, Classifications, and Examples

1. Classification Based on Source

- **Natural Polymers**: These are polymers found in nature, either in plants or animals.

Examples include: Cellulose (cotton, wood), Starch (potatoes, rice), Proteins (wool, silk, keratin in hair), Natural rubber (latex from rubber trees), Chitin (in shells of insects and crustaceans).

- **Synthetic Polymers**: Completely man-made polymers synthesized using chemical processes.

Examples include: Nylon (used in ropes, parachutes, clothing), Teflon (non-stick cookware), Polythene (plastic bags, containers), Polystyrene (foam cups, packaging), Acrylic (plexiglass).

- **Semi-synthetic Polymers**: Derived from natural polymers but chemically modified to enhance properties.

Examples include: Cellulose acetate (used in photographic films), Vulcanized rubber (car tyres), Gun cotton (cellulose nitrate used in propellants).

2. Classification Based on Structure

- **Linear Polymers**: Straight chain molecules with high density and tensile strength.

Examples: High-density polyethylene (HDPE, bottles, pipes), Polyvinyl chloride (PVC, plumbing), Polytetrafluoroethylene (PTFE, Teflon coating).

- **Branched Polymers**: Chains with branches leading to less compact packing.

Examples: Low-density polyethylene (LDPE, plastic films), Glycogen (energy storage in animals), Amylopectin (a branched form of starch).

- **Cross-linked Polymers**: 3D network polymers with high rigidity.

Examples: Bakelite (used in electrical fittings), Melamine formaldehyde (kitchenware), Vulcanized rubber (car tyres).

3. Classification Based on Polymerization

- **Addition Polymers**: Formed by repeated addition of unsaturated monomers.

Examples: Polyethylene (bags, bottles), Polypropylene (ropes, containers), Polystyrene (thermocool, cups).

- **Condensation Polymers**: Formed with elimination of small molecules such as water or HCl.

Examples: Nylon-6,6 (ropes, textiles), Polyester (fabrics, bottles), Bakelite (electrical goods).

4. Classification Based on Molecular Forces

- **Elastomers**: Stretchable polymers with weak forces that allow flexibility.

Examples: Natural rubber (bands, tyres), Neoprene (wetsuits, hoses), Buna-S (synthetic rubber for tyres).

- **Fibres**: Polymers with strong intermolecular hydrogen bonding, giving strength.

Examples: Nylon (fabrics, ropes), Polyester (clothing, bottles), Kevlar (bulletproof vests).

- **Thermoplastics**: Soft on heating, hard on cooling, can be reshaped.

Examples: Polyethylene (LDPE, HDPE), Polypropylene (toys, pipes), PVC (plumbing, flooring).

- **Thermosetting Plastics**: Permanently hard after heating due to cross-linking.

Examples: Bakelite (electrical switches), Melamine (utensils, laminates), Urea-formaldehyde (adhesives).