

Unit-1st

INTRODUCTION OF POLYMERS :

POLYMER :

Definition : The word "polymer" is derived from the greek 'poly' $\rightarrow$ Many and 'meros' $\rightarrow$ parts

"A polymer molecule may be defined as a number of repeating units held together by chemical bonds"

or

A polymer may be defined as a high molecular weight compound formed by the combination of a large number of one or more types of molecules of low molecular weight.

In other words, polymers are giant molecules of high molecular weight, called macromolecules.

Monomers $\Rightarrow$ The simple molecules which combine together are called Monomers.

Polymerisation $\Rightarrow$

The reaction by which monomers combine to form polymers is known as polymerisation.

OR

In other words, polymerisation is the union of two or more smaller and simple molecules of similar or diff. types, with or without the elimination of water etc., leading to the

formation of new C-C bonds.

classification of polymers

S.No	Basis of classification	Polymer types
①	On the basis of origin.	(i) Natural polymers (ii) semisynthetic polymers (iii) Synthetic polymers
②	Thermal Response	(i) Thermoplastic polymers (ii) Thermosetting polymers
③	Made of formation	(i) Addition polymers (ii) Condensation polymers
④	Line structure	(i) Linear polymers (ii) Branched polymers (iii) cross-linked polymers
⑤	Application of physical properties	(i) Rubbers (ii) plastics (iii) Fibres
⑥	Tacticity	(i) Isotactic (ii) syndiotactic (iii) atactic
⑦	crystallinity	(i) Non crystalline (ii) semi crystalline (iii) Crystalline

⑧ On the basis of Composition	(i) Homo polymer. (ii) Co-polymer.
⑨ Basis of polarity	(i) Ionic polymer. (ii) Non ionic polymers.
⑩ Presence of Carbon in polymer	(i) Inorganic polymers (ii) Organic polymers.

① ON THE BASIS OF ORIGIN :

(i) Natural polymers $\Rightarrow$ They are available in nature.

and also known as biological polymers.

Exo: 1,4 Cis. isoprene, natural silk, cellulose, starch, proteins.

(ii) Semi synthetic polymer $\Rightarrow$ They are chemically modified natural polymers such as hydrogenated, halogenated or hydro-halogenated natural rubber, celluloses, i.e. esters and ethers or cellulose such as cellulose nitrate, methyl cellulose etc.

(iii) Synthetic polymers $\Rightarrow$ They are man made polymers prepared synthetically. polyethylene, polystyrene, polyesters, phenol formaldehyde resins.

② ON THE BASIS OF THERMAL RESPONSE :

(i) Thermoplastic polymers : These are the polymers which soften on heating and stiffen on cooling.

Ex: Such polymers are polyethylene, PVC, nylon and sealing wax.

(ii) Thermosetting polymers $\Rightarrow$ Thermosetting ~~plastic~~ polymers are those which change irreversibly into hard and rigid materials on heat. After cooling, if the set article is again heated, it will not soften again, hence it is irreversible.

They are permanent setting resins

Ex: Bakelite plastic, amino plastic, ebony etc.

* Thermosetting resin are usually, harder, stronger and more brittle than thermoplastic resins.

(3) ON THE BASIS OF MODE OF FORMATION $\Rightarrow$

(i) Addition polymers: These are the products formed when the monomer units are repeatedly added to form long chains without elimination of any by product molecules.

* The monomer units are generally unsaturated compounds usually derivatives of alkenes.

Ex: PVC, Polystyrene, polyethylene

* Addition polymerisation is also known as chain growth polymerisation.

(ii) Condensation polymers: When a monomer contains active functional group (generally two) which react together with the elimination of a simple molecule such as H_2O then the product formed is called condensation polymer.

Exa: Nylon 66, [Hexamethylene diamine + adipic acid]

* Condensation polymerisation is also known as step growth polymerisation.

(4) ON THE BASIS OF LINE STRUCTURE :-

(1) Linear polymer :- In which the repeating units are similar to the links in a very long chain.

A linear polymer usually has end groups which are different from the repeating unit because it is necessary in some way to terminate the polymerisation.

Although the end groups have no effect on the mechanical properties of a polymer, they may have profound effect on the stability, solubility and adhesive properties of the polymers.

Exa: $\sim A-A-A-A-A$, polyethylene

(2) Branched polymer $\Rightarrow$ In which some of the molecules are attached as side chains to the linear chains.

The branching may be random and at irregular intervals. The branching may occur at regular intervals with equal length of branches.

* Branched polymers are usually more readily soluble and fusible than linear polymers.

(3) Cross-linked polymers :- They can be represented by a network structure, diamond structure, graphite, zinc network, diamond.