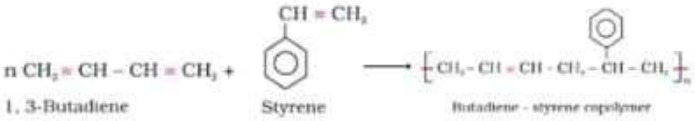
Polymers

Polymers are very large molecules having high molecular mass

Copolymerization

A mixture of more than one monomeric species undergoes polymerization



Rubber

Types

(i) **Natural Rubber**: Natural and manufactured from rubber latex.

It is a liner polymer of isoprene.

(ii) **Synthetic rubber** : Any vulcanisable rubber. These are homopolymers of 1,3 butadiene derivatives.

Molecular Mass of Polymers

- Expressed as an average
- Determined by Chemical and physical methods

Biodegradable Polymers

Contains functional groups similar to bipolymers (PHBV, Nylon 2-Nylon 6)

Classification

Based on Source

(i) **Natural polymers** : Found in plants and animals. (Proteins, rubber)

(ii) **Semi-synthetic polymers** : (Cellulose derivatives)

(iii) **Synthetic polymers** : Man-made. (Polythene, Buna -S)

Based on Structure of Polymers high density

(i) **Linear polymers** : Long and straight. (Polythene, PVC)

(ii) **Branched chain polymers** : Linear chains with branhces (low density polythene)

(iii) **Cross linked or network polymers** : Strong covalent bond between various linear polymer chains. (Bakelite, Melamine)

Based on mode of Polymerization

(i) **Addition polymers** : Repeated addition of monomers containing double or triple bonds. (Polythene from ethene.)

Homopolymer : Single monomeric species (Polythene)

Copolymer : Two different monomers (Buna-S, Buna-N)

(ii) **Condensation polymers** : Repeated condensation between two different bi-functional or tri-functional monomeric units. (Terylene, Nylon 6)

Based on Molecular Forces

(i) **Elastomers** : Rubber-like solids with elastic properties (Buna-S, Buna-N)

(ii) **Fibres** : Thread forming solids. (Nylon 6,6, Terylene)

(iii) **Thermoplastic polymers** : Linear or slightly branched long chain molecules capable of repeatedly softening on heating and hardening on cooling. (polythene, polystyrene)

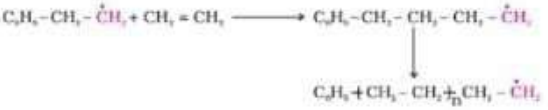
(iv) **Thermosetting polymers** : Cross linked or heavily branched molecules which on heating undergo extensive cross linking in moulds and become infusible. (Bakelite)

Types of Polymerisation Reaction

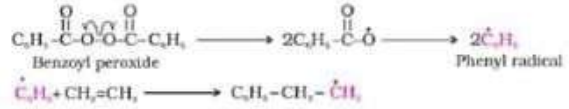
(i) **Addition/Chain Growth** :Molecules of the same/different monomers add together on a large scale.

Free radical mechanism :

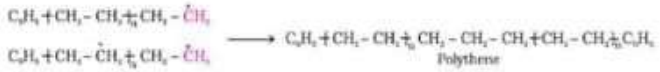
(a) Chain Initiation step:



(b) Chain Propogation step:



(c) Chain Termination step:



(ii) **Condensation/Step Growth : Repetitive condensation reaction between two bi-functional monomers. (Formation of terylene)**

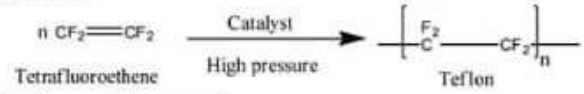
Preparation

Polythene

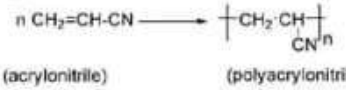
Low density : Polymerization of ethene under 1000-2000 atm at 350-570 K + catalyst

Higher density : Addition polymerization of ethene in a hydrocarbon solvent at 333-343 K and 6-7 atm + catalyst

Teflon

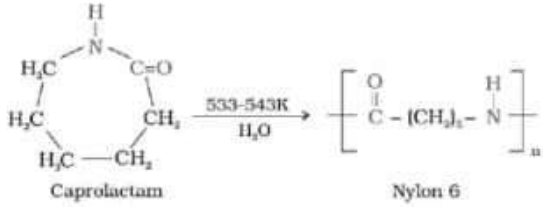


Polyacrylonitrile



Nylon 6,6:

Nylon 6:



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