POLYMERS

Poly –Many

Mer- Units

Polymer built up by linking together of large no of small molecules called Monomers

For eg. Polyethylene (Polythene) is the polymer formed by linking together large no of ethene molecules. (C_2H_4)

Thus small molecules which combine with each other to form polymer are termed as monomers and repeat unit in a polymer is called mer

The number of repeating units in chain formed in a polymer is known as the degree of polymerization (DP)

Most polymers usually fall into the 5000-200000 molecular mass range.

Classification of polymers

Classification based on the basis of sources

1) Natural polymer-: Which are found in nature in animals and plants for eg Starch (polymer of alpha D glucose)
   Cellulose (polymer of Beta D glucose)
   Protéines (polypeptide)
   Natural Rubber (polymer of CIS isoprene)
2) Synthetic polymer-: Man made polymer like Polyethylene(PE)

Polypropylene(PP) Poly styrene(PS) Polyvinyl chloride (PVC) nylon Backelite

Classification on the basis of structure

1) Linear polymer-: In which monomeric units are joined in the form of long straight chains. These polymer possess high mp, density and tensile strength due to close packing of polymer chains Eg high density polythene, nylon, polyester

2)Branched chain polymers: - They are linear in nature but also possess some branches along with the main chain. These polymers possess low MP, density and tensile strength compared to linear

polymers due to poor packing of polymer chains in presence of branches. (LDPE)

3) Three dimensional network polymers contain monomer molecules connected to each other only by covalent bonds. They are giant molecules in which movement of individual monomeric units is prevented by strong crosslinks. Because of strong cross links, they are hard and rigid and brittle and do not melt but burn on strong heating

Ex- Bakelite urea formaldehyde

Classification on the basis of their method of synthesis

1)Addition polymers: - Are obtained by addition polymerization method, which involves the repeated addition of monomers to yield long chains. Their empirical formula is the same as that of their monomers for eg polyethylene polypropylene polyvinyl chloride.

Condensation polymers: - are obtained by series of condensation reaction generally involving two monomers. The condensation reactions usually result in the loss of small molecules (Like HCL, H2O NH3etc) for eg nylon 66(adipic acid and Hexamethylenediamine) Bakelite Phenol and formaldehyde) Polyester (terephthalic acid and ethylene glycol)

Classification based on molecular forces

Thermoplastic polymer-: Linear long chain polymers which can be softened on heating and hardened on cooling reversibly i.e the hardness is the temporary property subject to change with rise and fall of temperature, thus they can be processed again and again.

Polyethylene(PE) Polypropylene(PP) polyvinyl chloride.

Thermosetting polymer-: Are those polymers which during molding (by heating) get hardened and once they have solidified, they cannot be softened. They are permanent setting polymers. Such polymers during molding acquire

three dimensional cross linked structure, with predominantly strong covalent bonds.

Elastomers: -is rubberlike elastic polymer, which can be stretched to at least thrice its length. But it returns to its original shape and dimensions as soon as stretching is released. The fact that in an unstressed condition elastomer molecular chain is in the form of coil.

And consequently it can be stretched like spring. The chains revert back to their original coiled state as deforming stress is released. Thus elasticity of an elastomer is caused by lengthening and stretching of their polymeric chain spring.

Fiber: -Polymer whose chains are held by strong intermolecular forces like hydrogen bonding. They are crystalline in nature and of high tensile strength due to strong intermolecular force for eg-nylon polyester

Thermoplastic polymers

- They soften on heating readily
- They are formed mostly by addition polymerization
- By reheating to suitable temperature they can be soften, reshaped and reused
- They are usually soft, weak and less brittle.
- These can be reclaimed from waste.
- Usually soluble in some organic solvents

Thermosetting polymers

- They do not soften on heating on prolong heating however they burn

- Their set molecules have three dimensional network structure joined by strong covalent bonds.
- They are formed by condensation polymerization.
- They retained their shape and structure even on heating hence they cannot be reshaped and reused.
- They are usually hard, strong and more brittle.
- They cannot be reclaimed from wastes
- Due to strong bonds and cross links they are insoluble in all organic solvents.