CLASSIFICATIONOFPOLYMERS

- Polymersaremainlyclassifiedintotwotypes,basedonthesourceand application.

Basedonthe‘source’,polymersarefurtherclassifiedintothreetypes.

- Theyare,
    1. Naturalpolymers
    2. Syntheticpolymersand
    3. Semi–syntheticpolymers

1. NaturalPolymers:

- Theseareareisolatedfromnaturalmaterialslikeplantsandanimals
- **Example:**Cellulose, RNA, DNA, proteins (polyamide), rubber, wool and starch, etc.,

2. Syntheticpolymers:

- Thesearesynthesizedfromlowmolecular weightcompoundsor materials.
- **Example:**Polyethylene,PVC,polystyrene,terylene,silicones,etc.,

3. Semi–syntheticpolymers:

- Thesearethederivativesofnaturalpolymers.
- **Example:**Celluloseacetate(Rayon),Cellulosenitrate(Guncotton),Ethyl cellulose, etc.,
- Basedonchemicalcomposition(naturalandsynthetic)polymersarefurther classified into two major categories.
- Theyare,
    i) Organicpolymers
    ii) Inorganicpolymers

i) Organicpolymers

- If the polymer backbone chain is essentially made of carbon atoms, it is termed an organic polymer.
- These polymers are containing hydrogen, oxygen, nitrogen and sulphur atoms, attached to the side valences of the carbon atoms

Example: Natural organic polymers – Cellulose, RNA, DNA, proteins, etc.,
Syntheticorganicpolymers–Polyethylene,PVC,polystyrene,etc.,

ii) Inorganicpolymers

- Ifmoleculesofpolymerscontainnocarbonatomintheirbackbone,such polymers are inorganic polymers.
- Thistypeofpolymerchainiscomposedofdifferentatomsjoinedbychemical bonds.

Example:

- Naturalinorganicpolymers –Rubber,claysilicates,etc.
- Syntheticinorganicpolymers–Glass,silicones,etc.

Basedonapplications,polymersarebroadlydividedintothreemaincategories.

1. Plastics(Resins)
2. Fibres(Rayon,terylene)and
3. Elastomers(Rubber)

1. Plastics:

- Plastics are high molecular weight organic materials which can be moulded or formed into stable shapes by the application of heat and pressure.
- Allthesyntheticpolymersareplastics.

2. Fibres

- When a polymer can be converted into long filament like material, it is calledfibre.
- **Example:**Rayonandterylene.

3. Elastomers

- Polymersexhibitinggoodstrengthandelongationarecalled elastomers.
- Example:Rubber(Naturalrubber,syntheticrubber,etc.,)

PLASTICS

- Plasticsarehighmolecularweightorganicmaterials, thatcanbemouldedintoanydesiredshapebytheapplicationofheatandpressureinthe presenceofacatalyst.

Advantages ofplastics

- Lightin weight.
- Possess lowmelting point.

- Easily mouldedand haveexcellentfinishing.
- Possess very good strength and toughness.
- Possess goodshock absorption capacity.
- Corrosionresistant and chemicallyinert.
- Theyhavelowco-efficientofthermalexpansionandpossessgoodthermal andelectricalproperty.
- Very goodwater-resistant and possessgood adhesiveness.

Disadvantagesofplastics

- Softness.
- Embrittlement at lowtemperature.
- Deformation underload.
- Lowheat-resistant and poor ductility.
- Highcombustibility.
- Degradeuponexposure to heat and uv-radiation.
- Non bio-degradable.

CLASSIFICATIONOFPLASTICS

1. Basedonusage
2. Basedonstructure

1. Classificationofplasticsbased onusage

(i) Generalpurposeplastics

- Generalpurposeplasticshavelowtomediummechanicalproperties.
- Theyareusedformanufactureofcommodity items.
- Theyaccountfor80-85%ofthetotal polymerproduction.

Propertiesofgeneralpurposeplastics

- lowusetemperaturethereforecannotbeusedathightemperature
- lowabrasionresistanceandpoordimensionalstability
- Theyaremostlycrystallinewithlowglasstransitiontemperature(T_g)(or)theyare glossy (or) amorphous polymer

2. Engineeringplastics

- Engineeringmaterialsareagroupmaterialsobtainedfromhighpolymer resin

- Theyaremainlyusedtoreplaceconventionalmateriallikemetal,wood,glass and ceramics.
- Not onlyengineeringplasticscanreplace metalsbuttheycanalsobeusedalong with metals.

POLYMERISATION

Polymerisation is a process in which large number of small molecule (called monomers) combine to give a big molecule (called a polymer) with or withoutelimination of small molecules like water.

Degree ofpolymerization

Thenumberofrepeatingunits(n)inapolymerchainisknownasthe***degreeof polymerisation.***

Example:

$$5CH_2{=}CH_2 \longrightarrow -CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}$$

In thisexample, fiverepeating unitsarepresentin the polymer chain. So the degree of polymerisation is 5.

Degreeofpolymersation=180/36=5.Sothedegreeofpolymerisationis5.

$$\text{Degree of Polymerisation (DP)} = \frac{\text{Molecular weight of the polymeric network}}{\text{Molecular weight of the monomeric unit}}$$

Basedonthemolecularweightordegreeofpolymerization, thepolymersareclassified into following types

(i) Oligo Polymers:

- Polymers with low degree of polymerisation are known as oligo polymers, theirmolecular weight ranges from 500-5000 Daltons.

(ii) HighPolymers:

- Polymers with high degree of polymerisation are known as high polymers, theirmolecular weight ranges from 10,000 - 2, 00,000 Daltons**.**