POLYMER SCIENCE class Notes

Applications of polymer in the field of electronics

- Gates, - Calculator, - Transistor, - Amplifier

Polymer is derived from "Greek" word

Poly - many Meros - Units

POLYMER :

→ It is a larger molecule formed by the repeated linkages of smaller molecules called monomers

FOR EXAMPLE :

$$CH_2 = CH_2 \xrightarrow[\text{At high temp}]{\text{Polymerization}} +CH_2 - CH_2+_n$$

Ethylene polyethylene

MONOMER :

→ The smaller molecules which undergoes repeated linkage to form a larger molecule are called monomer

Eg : $CH_2 = CH_2$

POLYMERISATION:

→ The process in which the smaller molecules undergo repeated linkage to form larger molecules is called as polymerisation

FOR EXAMPLE:

i) $n\,CH_2 = CH_2 \longrightarrow \{CH_2 - CH_2\}$ polyethylene

ii) $n\,CH_3 - CH = CH_2 \longrightarrow \{CH(CH_3) - CH_2\}$ polypropylene

iii) $C_6H_5 - CH = CH_2 \longrightarrow \{CH(C_6H_5) - CH_2\}$ polystyrene

styrene

iv) $HO-CH_2-CH_2-OH$ + HOOC–C$_6$H$_4$–COOH

Ethylene glycol terephthalic acid

↓

$$HO\left[CH_2-CH_2-O-OC-C_6H_4-CO\right]_n OH$$

polyethylene terylene + $(2n-1)H_2O$

v) $H_2N-(CH_2)_6-NH_2$ + $HOOC-(CH_2)_4-CO-OH$

Hexamethylene diamine Adipic acid

↓ condensation

$$H\left[N(H)-(CH_2)_6-N(H)-OC-(CH_2)_4-CO\right]_n OH$$

Nylon - 66

(1) Degree of polymerisation

→ The number of repeating units present in a polymer molecule

$$\text{Degree of polymerization} = \frac{\text{Molecular weight of polymer}}{\text{Molecular weight of repeating unit monomer}}$$

Two categories :

a) High polymer : The polymer with high degree of polymerization, molecular weight : $10^4 \rightarrow 10^6$

b) Oligomer : The polymer with low degree of polymerization, molecular weight < 10000, less than ten monomer

Functionality of monomer :

→ The number of reacting ~~skills~~ sites (or) functional groups present in a single molecule is called its functionality

→ Each monomer should have a functionality of atleast two. A molecule

can be considered as a monomer which

it has minimum two functional groups

(or) reaction sites

The following are examples of reactive functional

groups

$-OH$, $-COOH$, $-NH_2$, SH

Example for reactive sites are

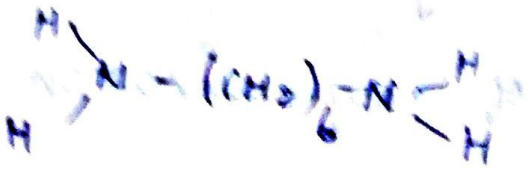
Covalent bonds $=$, $\equiv$

Moreover :

Amino acetic acid

1

Hexamethylene diamine



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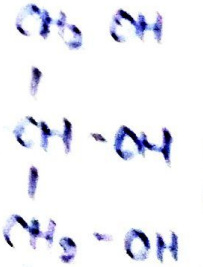
Glycerol



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(*) Significance of functionality:

→ A low molecular weight chemical compound should be atleast bifunctional to behave as a monomer

→ Functionality of monomer decides the nature of polymer formed in the polymerization process. If the functionality of monomer is 2. ie., bifunctional, linear (or) straight chain polymer is produced. If the functionality of monomer is 3 (or) more, three dimensional cross linked polymer is produced.

Stability:

→ Each monomeric unit in the linear polymer is held by strong covalent bonds (primary bond) where the straight chains are held together by weak vanderwaal's force of attraction (secondary bond). Therefore there is no reaction restriction

for movement of one chain over another. Such type of polymers have less strength, low heat resistance and they are soft and flexible

→ In case of cross linked polymer, the monomers are connected to each other by strong covalent bond. Hence the movement of chain is totally restricted.

→ Such polymers have high strength, hardness, heat resistance and are insoluble in organic solvents