

Maulana
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* The polymer are filtered or washed by the water to remove the water soluble stabilizer & then dry.

* The size of the monomer solvent droplets usually range b/w 0.1 to 5 mm diameter, and depend on (iv) point

Advantage ⇒

- * ① This tech. is designed to combine the advantages of both bulk & soln tech.
- ② Each monomer droplet is isolated & independent of other droplets.
- ③ The continuous aq. phase act as efficient heat transfer medium & hence exothermally is well controlled.
- ④ Since water is used as heat transfer medium the process is also economical, available at low cost, non-toxic nature, ease of storage and handling.
- ⑤ Polymerisation proceed to 100% Conversion i.e. from monomer to polymer.
- ⑥ Isolation of the product become easy by filtration of the beads & removal of the surface active agent and protective colloids by water washing.
- ⑦ water washed and dried product can be used as moulding purpose or can dissolved in suitable medium for use adhesives and coatings.

Disadvantage:

- ① continuous agitation is required
- ② contamination by stabilizer agent
- ③ washing and drying may required
- ④ It require longer duration for very high conversion.

USES →

- ① Expendable polystyrene beads (from which polystyrene foams are made), styrene-divinyl benzene co-polymer beads (for the preparation of ion exchange resins) and polyvinyl acetate beads are produced by the suspension tech, using free radical initiators.
- ii) Polyvinyl acetate beads convert into polyvinyl alcohol.

EMULSION - POLYMERISATION

Monomer water insoluble but do not form droplets

- ① This is tech in which addition polymerisation is carried out in a water soluble medium containing soap (emulsifier) & suitable initiator.
- ② The most interesting & useful polymers formed by this method. Exa: Synthetic rubber of Butatype.
- ③ In this tech, water is used as a medium
- ④ In this tech, reaction takes place within a small hollow sphere composed of a

- Name: _____
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- film of soap molecule is micelle
- ⑤ Monomer is dispersed in water not as droplets but as a uniform emulsion.
monomers diffused into this micelles
 - ⑥ ~~Monomer is dispersed in water not as droplets but as a~~
 - ⑦ Initiator $\Rightarrow$ Persulphate or hydrogen peroxide are water soluble & monomer is water insoluble
 - ⑧ The emulsion system is added with various types of ingredients to make the polymerisation possible.

Nine basic ingredients ~~have been~~ are

i. Basic phase $\Rightarrow$ This is usually water free from all inorganic impurities

Amount: 60-80%

ii. Main monomer $\Rightarrow$ The principle component of reaction (butadiene or vinyl chloride)
60-80% final polymer
15-30% emulsion

iii. Additional $\Rightarrow$ The monomer ~~in~~ which co-polymerised with the main monomer
Exa: vinyl acetate, styrene, acrylates, or acrylonitriles 5-15% of the emulsion systems.

Note $\Rightarrow$ By changing the ratio of main & additional monomer we can change the properties of polymer

iv. Emulsifying agent $\Rightarrow$

* Required for the production of colloidal dispersion.

* Selection of Emulsifying agent depend upon the reaction.

* Typical Emulsifying agent are soap & detergents.
Exa: Carboxylic acid & sulphonic acid soaps,
resin soaps, sulphonated long-chain
alcohols, amines.

→ The amount usually ranges from 0.2 - 2%.
→ emulsifier molecule or surfactant
molecule has two part.

Head (Polar) water soluble
Tail (Nonpolar) Long hydrocarbon chain
Insoluble.

✓ Emulsion stabilizer →

• It is used to protect the colloidal particles from precipitation. Emulsion stabilizers are known as protective colloids.

Exa: Carboxy methyl cellulose,
Polyvinyl alcohol, gelatine, starch.

* They are used in emulsion polymerisation not to control rates / degree of polymerisation but for the purpose to obtained and to prevent emulsion breakdown with progress of polymerisation.

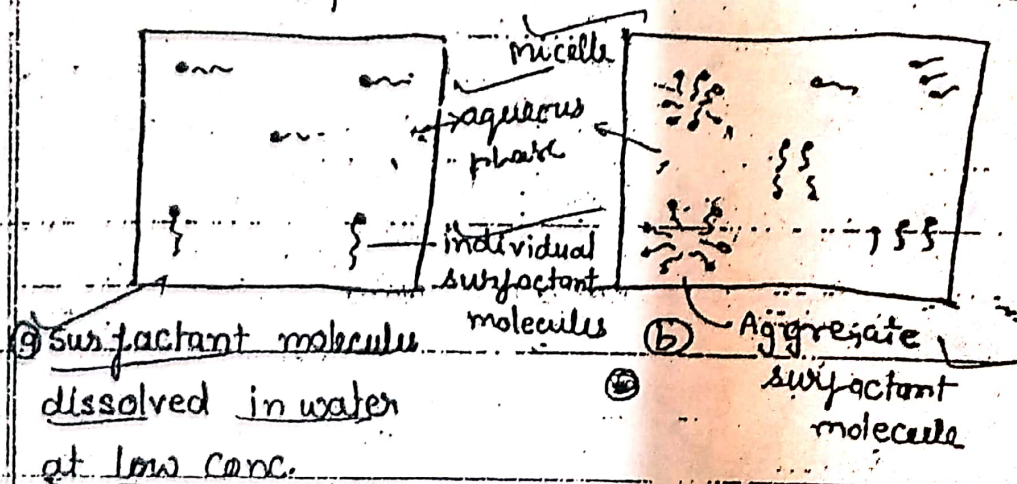
* (vi) Surface tension regulator (Surfactants) :
Exa: octanol, nonyl alcohol

Surfactants reduced the surface tension & give good emulsion of the monomer in water.

At low conc. surfactants are dissolved in aq. phase. But when their concⁿ is increased they form molecular aggregates known as (micelle)

The concn. beyond which micelle formation is possible is known as CMC.

Emulsifier molecule or surfactant molecule are made of two parts a polar group and a long non polar hydrocarbon chain



In the interior of micelle, monomers are present.

Initiators are ~~insoluble~~ soluble in monomer but soluble in water. so they are present in a aqueous phase.

The surface layer of micelle formed by the polar ends of the emulsifier