Class ⇒ B.Sc.(Hons.) Part - II
Subject ⇒ chemistry
Paper ⇒ III A (Physical Chemistry)
Chapter ⇒ Colloids (Group A)
Topic ⇒ Protection of colloids, Gold Number, Gels, Emulsions

Name ⇒ Dr. Amarendra Kumar
Deptt. of chemistry
Jain College, Ara.

Protection of colloids

Lyophobic colloids are sensitive and they are likely to coagulate in the presence of electrolytes. But they can be stabilized if a small amount of a lyophilic colloid like soap, gum, gelatine is added to them. This is called **protection of colloids**.

The lyophilic sol used to protect a lyophobic sol from precipitation is called **Protective colloid**.

e.g. If a little gelatin (Hydrophilic colloid) is added to a gold sol (Hydrophobic sol), the latter is protected. The protected gold sol is no longer precipitated on the addition of sodium chloride.

Explanation ⇒ The particles of the hydrophobic sol adsorb the particles of the lyophilic sol. Thus the lyophilic colloid forms a coating around the lyophobic sol particles. The hydrophobic colloid, therefore, behaves as a hydrophilic sol and is precipitated less easily by electrolytes.

Gold Number

The protective action of different colloids is measured in terms of Gold Number.

Gold Number is introduced by Zsigmondy.

⇒ The number of milligrams of a hydrophilic colloid that will just prevent the precipitation of 10 ml of a gold sol on the addition of 1 ml of 10% sodium chloride solution is called Gold Number.

The smaller the gold no. of a hydrophilic colloid, the greater is its protective power.

Gelatin has a small gold no. and is an effective ~~colloid~~ protective colloid. Starch has a very high value, which shows that it is an ineffective protective colloid.

⇒ The use of protective colloids to stabilise colloidal system.

In the preparation of Ice cream, gelatin is added to act as a protecting agent to the colloidal particles of Ice.

GELS

A gel is a jelly-like colloidal system in which a liquid is dispersed in a solid medium.

The process of a gel formation is called Gelation.

Gels are formed as a result of partial coagulation of a sol.

The coagulating particles combine

of these chains gives rise to a solid framework. The liquid part of the sol gets trapped in the solid frame work.

A sponge soaked in water is an example of gel structure.

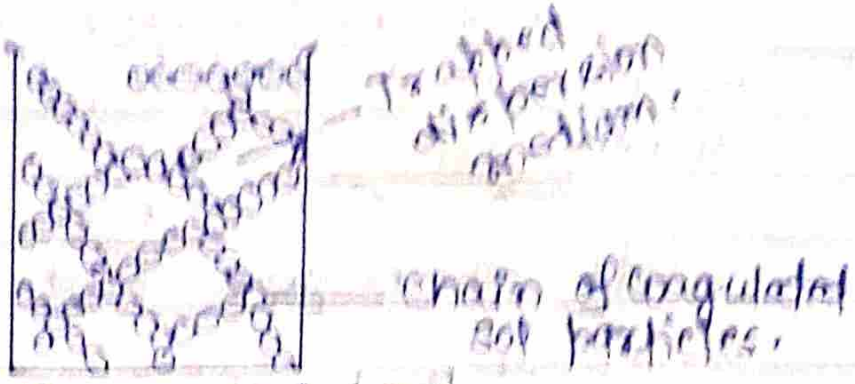


Fig: Structure of a Gel

Types of Gel

Gels are classified into two types.

(i) Elastic gel
(ii) Non-elastic gel

(i) Elastic gel

Gels which are elastic in nature are called elastic gel.

They change their shape on applying force and return to original shape when the force is removed.

e.g. Gelatin, Starch and Soaps are examples of substances which form elastic gel.

Elastic gels are obtained by cooling fairly concentrated lyophilic sols.

(ii) Non-elastic gel

Gels which are rigid and do not show elasticity are called non-elastic gel.

e.g. silica gel.

Silica gel is prepared by appropriate chemic reaction. Thus silica gel is obtained by adding concentrated hydrochloric acid to sodium silicate solution of the correct concentration. The resultin molecules of silicic acid polymerise to form silica gel.

Silica gels are linked by covalent bonds which give a strong and rigid structure.

Properties of gel

(1) Hydration
(2) Swelling
(3) Syneresis
(4) Thixotropy

Emulsions

Colloidal solutions in which the dispersed phase as well as dispersion medium are liquid are called Emulsions.

OR

A dispersion of finely divided liquid droplets in another liquid is called Emulsions.

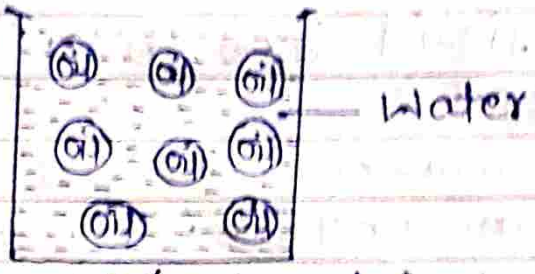
Types of Emulsion

Emulsions are of two types
(i) oil-in-water type (O/W type)
(ii) Water-in-oil type (W/O type)

(i) Oil in water Emulsion

Oil in water emulsions are those in which oil is the dispersed phase and water is the dispersion medium.

e.g. Milk (Tiny droplets of liquid fat are dispersed in water)

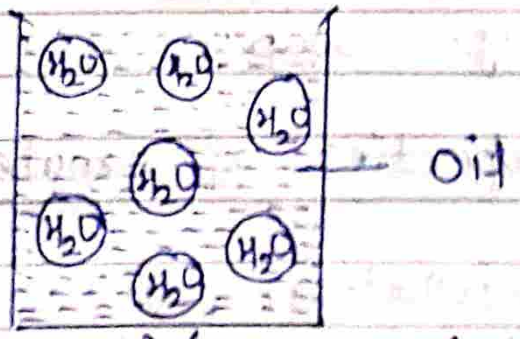


O/W emulsion

(ii) Water in oil Emulsion

Water in oil emulsions are those in which water is the dispersed phase and oil is the dispersion medium.

e.g. Butter, stiff greases, cod liver oil.



W/O Emulsion

*⇒ Dye test and conductance methods are used to distinction between oil-in-water and water-in-oil emulsions

Preparation of Emulsions

The dispersal of a liquid in the form of an emulsion is called **Emulsification**.

Emulsification is done by agitating a small proportion of one liquid with the bulk of the other. It is better accomplished by passing a mixture of the two liquid through a colloid mill known as **Homogenizer**.

The emulsions obtained simply by shaking the two liquids are unstable. To obtain stable emulsions small amount of a third substance called the **Emulsifier or Emulsifying agent** is added during the preparation. This is usually a soap, synthetic detergent or a hydrophilic colloid.

Role of Emulsifier

The emulsifier concentrates at the interface and reduces surface tension on the side of one liquid which rolls into droplets.

e.g. soap.

Properties of Emulsions

(1) **Demulsification** ⇒ The process of breaking emulsion to yield the constituents liquid is called demulsification.

e.g. seperation of cream from milk.

(2) **Dilution** ⇒ Emulsions can be diluted with any amount of the dispersion medium.

Micelles

The colloidal aggregates of soap or detergent molecules formed in the solvent are called micelles.

e.g. Sodium stearate ($C_{17}H_{35}-COO^- Na^+$)

Sodium dodecyl sulphate ($C_{12}H_{25}-SO_2O^- Na^+$)

Micelles are strong electrolytes which give a normal solution at low concentration but show colloidal nature at higher concentration.