General methods of preparation of colloids.

Lyophilic and lyophobic colloidal solutions (or sols) are generally prepared by different types of methods. Some of the common methods are as follows.

(1) **Preparation of Lyophilic colloids**

(i) The lyophilic colloids have strong affinity between particles of dispersed phase and dispersion medium.

(ii) These colloidal solutions are readily formed by simply mixing the dispersed phase and dispersion medium under ordinary conditions.

(iii) For example, the substance like gelatin, gum, starch, egg, albumin etc. pass readily into water to give colloidal solution.

(iv) They are reversible in nature become these can be precipitated and directly converted into colloidal state.

(2) **Preparation of Lyophobic colloids:** Lyophobic colloids can be prepared by mainly two types of methods.

(i) **Condensation method:**In these method, smaller particles of dispersed phase are condensed suitably to be of colloidal size. This is done by the following methods.

(a) By oxidation**:**A colloidal solution of sulphur can be obtained by bubbling oxygen (or any other oxidizing agent like HNO_3, Br_2 etc.) Through a solution of hydrogen sulphide in water.

$$2H_2S + O_2 \text{ (or any other oxidising agent)} \longrightarrow 2H_2O + 2S$$

(b) By reduction **:** A number of metals such as silver, gold and platinum, have been obtained in colloidal state by treating the aqueous solution of their salts, with a suitable reducing agent such as formaldehyde, phenyl hydrazine, hydrogen peroxide, stannous chloride etc. $2AuCl_3 + 3SnCl_2 \longrightarrow 3SnCl_4 + \underset{\text{Gold sol}}{2Au}$

$$2AuCl_3 + 3HCHO + 3H_2O \longrightarrow \underset{\text{Gold sol}}{2Au} + 3HCOOH + 6HCl$$

The gold sol, thus prepared, has a purple color and is called purple of cassius.

(c) By hydrolysis**:**Many salt solutions are rapidly hydrolyzed by boiling dilute solutions of their salts. For example, ferric hydroxide and aluminum hydroxide sols are obtained by boiling solutions of the corresponding chlorides. $FeCl_3 + 3H_2O \longrightarrow \underset{\text{Colloidal sol}}{Fe(OH)_3} + 3HCl$

Similarly silicic acid sol is obtained by the hydrolysis of sodium silicate.

(d) By double decomposition**:**A sol of arsenic sulphide is obtained by passing hydrogen sulphide through a cold solution of arsenious oxide in water.

$$As_2O_3 + 3H_2S \longrightarrow As_2S_3 + 3H_2O$$

(e) By excessive cooling**:**A colloidal solution of ice in an organic solvent like ether or chloroform can be prepared by freezing a solution of water in the solvent. The molecules of water which can no longer be held in solution, separately combine to form particles of colloidal size.

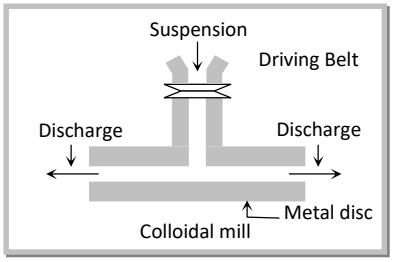
(f) By exchange of solvent **:** Colloidal solution of certain substances such as sulphur, phosphorus, which are soluble in alcohol but insoluble in water can be prepared by pouring their alcoholic solution in excess of water. For example, alcoholic solution of sulphur on pouring into water gives milky colloidal solution of sulphur.

(g) By change of physical state**:** Sols of substances like mercury and sulphur are prepared by passing their vapors through a cold water containing a suitable stabilizer such as ammonium salt or citrate.

(ii) **Dispersion methods:**In these methods, larger particles of a substance (suspensions) are broken into smaller particles. The following methods are employed.

(a) Mechanical dispersion

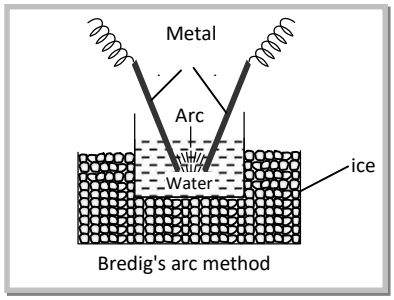
- In this method, the substance is first ground to coarse particles.
- It is then mixed with the dispersion medium to get a suspension.
- The suspension is then grinded in colloidal mill.
- It consists of two metallic discs nearly touching each other and rotating in opposite directions at a very high speed about 7000 revolution per minute.



- The space between the discs of the mill is so adjusted that coarse suspension is subjected to great shearing force giving rise to particles of colloidal size.
- Colloidal solutions of black ink, paints, varnishes, dyes etc. are obtained by this method.

(b) By electrical dispersion or Bredig's arc method**:** This method is used to prepare sols of platinum, silver, copper or gold.

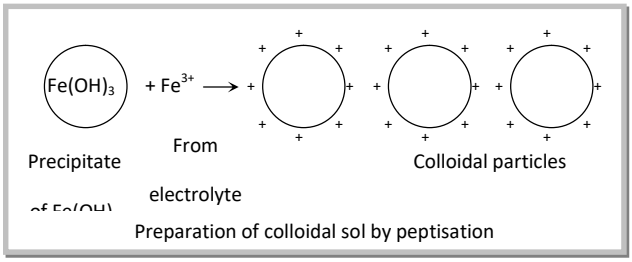
- The metal whose sol is to be prepared is made as two electrodes which immerged in dispersion medium such as water etc.
- The dispersion medium is kept cooled by ice.
- An electric arc is struck between the electrodes.



- The tremendous heat generate by this method and give colloidal solution.
- The colloidal solution prepared is stabilized by adding a small amount of KOH to it.

(c) By peptisation

- The process of converting a freshly prepared precipitate into colloidal form by the addition of suitable electrolyte is called **peptisation.**
- The electrolyte is used for this purpose is called **peptizing agent** or **stabilizing agent**.
- Cause of peptisation is the adsorption of the ions of the electrolyte by the particles of the precipitate.
- Important peptizing agents are sugar, gum, gelatin and electrolytes.
- Freshly prepared ferric hydroxide can be converted into colloidal state by shaking it with water containing Fe^{3+} or OH^- ions, viz. $FeCl_3$ or NH_4OH respectively.



Preparation of colloidal sol by peptisation

$$\underset{\text{Precipitat e electrolyte}}{Fe(OH)_3 + FeCl_3} \longrightarrow \underset{\text{Colloidal sol}}{[Fe(OH)_3\, Fe]^{3+}} + 3Cl^-$$

- A stable sol of stannic oxide is obtained by adding a small amount of dilute HCl to stannic oxide precipitates.
- Similarly, a colloidal solution of $Al(OH)_3$ and $AgCl$ are obtained by treating the corresponding freshly prepared precipitate with very dilute solution of HCl and $AgNO_3$ or KCl respectively.
- Gelatin stabilizes the colloidal state of ice-cream.
- Lamp black is peptized by gums to form Indian ink.

- If precipitate of CuS, $BaSO_4$ or Prussian blue are washed continuously with water, after sometime the precipitate are converted into colloidal state which thus pass through the fitter paper and thus can be detected in wash water.