Protection of colloids and Gold number.

(1) Lyophilic sols are more stable than lyophobic sols.

(2) Lyophobic sols can be easily coagulated by the addition of small quantity of an electrolyte.

(3) When a lyophilic sol is added to any lyophobic sol, it becomes less sensitive towards electrolytes. Thus, lyophilic colloids can prevent the coagulation of any lyophobic sol.
"The phenomenon of preventing the coagulation of a lyophobic sol due to the addition of some lyophilic colloid is called sol protection or protection of colloids."

(4) The protecting power of different protective (lyophilic) colloids is different. The efficiency of any protective colloid is expressed in terms of **gold number.**
Gold number: Zsigmondy introduced a term called **gold number** to describe the protective power of different colloids. This is defined as, "weight of the dried protective agent in milligrams, which when added to 10 ml of a standard gold sol (0.0053 to 0.0058%) is just sufficient to prevent a color change from red to blue on the addition of 1 ml of 10 % sodium chloride solution, is equal to the gold number of that protective colloid."
Thus, smaller is the gold number, higher is the protective action of the protective agent.

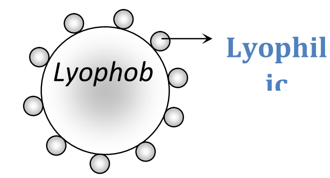
Protecti

Gold numbers of some hydrophilic substances

Hydrophilic substance	Gold number	Hydrophilic substance	Gold number
Gelatin	0.005 - 0.01	Sodium oleate	0.4 – 1.0
Sodium caseinate	0.01	Gum tragacanth	2
Hamoglobin	0.03 – 0.07	Potato starch	25
Gum arabic	0.15 – 0.25		

The protective colloids play very significant role in stabilization of the non–aqueous dispersions, such as paints, printing inks etc.

(5) **Congo rubin number: Ostwald** introduced congo rubin number to account for protective nature of colloids. It is defined as "the amount of protective colloid in milligrams which prevents color change in 100 ml of 0.01 % congo rubin dye to which 0.16 g equivalent of KCl is added."



Protection of colloids

(6) **Mechanism of sol protection**

(i) The actual mechanism of sol protection is very complex. However it may be due to the adsorption of the protective colloid on the lyophobic sol particles, followed by its solvation. Thus it stabilizes the sol via **solvation effects**.

(ii) Solvation effects contribute much towards the stability of lyophilic systems. For example, gelatin has a sufficiently strong affinity for water. It is only because of the solvation effects that even the addition of electrolytes in small amounts does not cause any flocculation of hydrophilic sols. However at higher concentration, precipitation occurs. This phenomenon is called **salting out.**

(iii) The salting out efficiency of an electrolyte depends upon the tendency of its constituents ions to get hydrated i.e, the tendency to squeeze out water initially fied up with the colloidal particle.

(iv) The cations and the anions can be arranged in the decreasing order of the salting out power, such an arrangement is called **lyotropic series.**

Cations: $Mg^{2+} > Ca^{2+} > Sr^{2+} > Ba^{2+} > Li^{+} > Na^{+} > K^{+} > NH_4^{+} > Rb^{+} > Cs^{+}$

Anions: $\text{Citrate}^{3-} > SO_4^{2-} > Cl^{-} > NH_3^{-} > I^{-} > CNS^{-}$

Ammonium sulphate, due to its very high solubility in water, is often used for precipitating proteins from aqueous solutions.

(v) The precipitation of lyophilic colloids can also be affected by the addition of organic solvents of non-electrolytes. For example, the addition of acetone or alcohol to aqueous gelatin solution causes precipitation of gelatin. Addition of petroleum ether to a solution of rubber in benzene causes the precipitation of rubber.