B.Sc. (Honours) Part-I

Paper-I

Topic: Protection of Colloid

UG

Subject-Chemistry

Dr. Laxman Singh
Asst. Professor
Department of Chemistry
R.R.S. College (PPU)
(Mokama, Patna)

Protection of colloids

- Lyophilic sols are more stable than lyophobic sols.
- Lyophobic sols can be easily coagulated by the addition of small quantity of an electrolyte.
- 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."

- 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 colour 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.

$$\text{Protective power} \propto \frac{1}{\text{Gold number}}$$

Table : Gold numbers of some hydrophilic substances

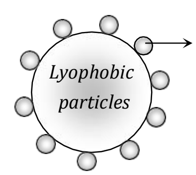
Hydrophilic substance	Gold number	Hydrophilic substance	Gold number
Gelatin	0.005 - 0.01	Sodium oleate	0.4 – 1.0
Sodium caseinate	0.01	Gum tragacanth	2
Hamoglobin	0.03 – 0.07	Potato starch	25
Gum arabic	0.15 – 0.25		

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 colour change in 100 ml of 0.01 % congo rubin dye to which 0.16 g equivalent of KCl is added.*"

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 stabilises the sol *via* ***solvation effects***.

Lyophilic protecting particles



Fi Protection of colloids

(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*.**

Synthetic protective colloids:

The protective value we propose gives the number of grams of a red gold sol which are just protected by 1 g. of the protective agent against flocculation by 1% NaCl solution. Gelatine has a protective value of 90, i.e., 1 g. of gelatine protects 90 g. of gold sol. Amphions are good protecting colloids. One of the ionic groups attaches the protecting agent to the colloidal particle, the other supplies the electrical charge. Synthetic protective colloids were prepared by introducing acidic groups into the basic polyethylenimine molecule, and by introducing basic groups into the polyacrylic acid molecule. With some synthetic protective colloids, the protective value can be increased as much as one hundred times by the action of heat and time. The interaction between the protecting agent and the sol to be protected requires a longer time than the 3 minutes previously recommended. We recommend that the reaction be allowed to go to completion. Good protecting colloids form stable complexes with the coagulating metal ions. The protective value changes strongly as the pH of the sol is varied within a narrow range. With some polyamphions the protective value, at a given sol pH, can be increased by shifting the isoelectric point (IEP). The protective values and gold numbers of some protecting agents are compared. A synthetic polyacrylic hydrazide had the highest protective value of 400. The protecting action of natural gelatine is at a minimum at the IEP, but that of the synthetic hydrazide of polyacrylic acid is greatest at this point. In this context the VW theory of Heller is discussed, and the distance between the ionic groups on the polymer chain is postulated as a further important factor contributing to the formation of the stabilizing layers.