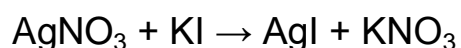


Surface Chemistry

The charge on the sol particles is mainly due to *preferential adsorption of ions* from solution. When 2 or more ions are present in the dispersion medium, preferential adsorption of the ion common to the colloidal particle takes place.

e.g. when AgNO_3 is added to KI, AgI is precipitated, which adsorbs iodide ions from the dispersion medium and thus get a negative charge.



But when KI is added to AgNO_3 , the precipitated AgI adsorbs Ag^+ ions from the solution and thus get a positive charge.

Due to the positive or negative charge in the sol particles, they attract the counter ions (opposite ions) from the medium. Thus a double layer of opposite charges is formed.

This is known as ***Helmholtz electrical double layer***. The layer in which the ions are directly adsorbed to the sol particles is termed as *fixed layer*. The second layer is mobile and is termed as *diffused layer*.

Due to the opposite charges on the fixed and diffused layers, there arises a potential difference between these layers. This *potential difference between the fixed layer and the diffused layer of opposite charges is called the **electro kinetic potential or zeta potential***.

The presence of similar charges on colloidal particles leads to repulsion between the particles and prevent them from coagulation when they come closer. So the charge on the sol particles is mainly responsible for the stability of colloidal solution.

1. Electrophoresis:

Since colloidal particles carry charge, they move under the influence of an electric field. This movement of colloidal particles is called *electrophoresis*. The positively charged sol particles move towards cathode (*cataphoresis*) and the negatively charged particles move towards the anode (*anaphoresis*).

If the movement of the sol particles is prevented by some suitable method, the particles of dispersion medium itself move under the presence of electric field. This

migration is termed as **electro-osmosis**.

2. Coagulation (precipitation or flocculation)

The process of settling of colloidal particles is called coagulation or precipitation of the sol. This can be done by different ways:

- i) By electrophoresis
- ii) By mixing two oppositely charged sols
- iii) By continuous dialysis
- iv) By boiling
- v) By the addition of electrolyte

When an electrolyte is added to the sol, the ions carrying opposite charge to that of the sol neutralize the charge and causes precipitation. *The ion of the electrolyte which causes the precipitation is called the coagulating ion or the flocculating ion.* A negatively charged ion causes the precipitation of positively charged sol and vice versa.

Generally, ***the greater the valency of the coagulating ion, the greater will be the coagulating power. This is known as Hardy – Schulze rule.***

Thus for the coagulation of a negative sol like As_2S_3 , the flocculating power of the +ve ions is of the order: $\text{Al}^{3+} > \text{Ba}^{2+} > \text{Na}^+$

Similarly for a +ve sol like ferric hydroxide, the flocculating power of the counter ion is of the order: $[\text{Fe}(\text{CN})_6]^{4-} > \text{PO}_4^{3-} > \text{SO}_4^{2-} > \text{Cl}^-$

Coagulating value: The minimum concentration of an electrolyte in millimoles per litre required for the coagulation of a sol within 2 hours is called coagulating value. The smaller the coagulating value, the higher will be the coagulation power.

Protection of colloids

Lyophilic sols are self stabilized, while lyophobic sols require some stabilizing agents. For this purpose, some lyophilic sols are added to lyophobic sols. These lyophilic sols are called protective colloids.

When a lyophilic sol is added to a lyophobic sol, the lyophilic particles form a layer around lyophobic particles and thus protect them from electrolytes.
