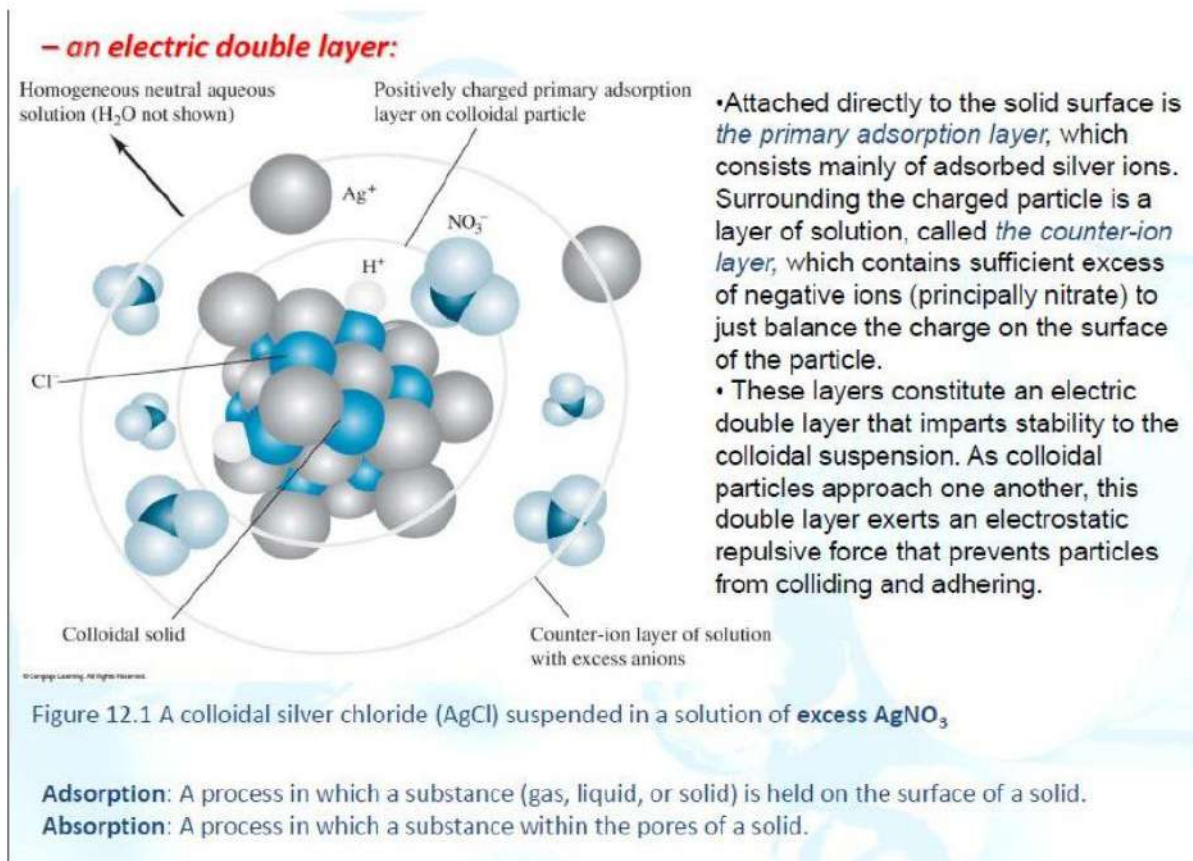


Coagulation of Colloids

Coagulation can be hastened by heating, by stirring, and by adding an electrolyte to the medium. To understand the effectiveness of these measures, we need to look into why colloidal suspensions are stable and do not coagulate spontaneously.

Colloidal suspensions are stable because all of the particles of the colloid are either positively or negatively charged and thus repel one another.

The charge results from cations or anions that are bound to the surface of the particles. We can show that **colloidal particles are charged** by placing them between charged plates where some of the particles migrate toward one electrode while others move toward the electrode of the opposite charge. The process by which ions are retained *on the surface of a solid* is known as **adsorption**.



Coagulation of a colloidal suspension:

When the charge on the colloidal particles is neutralized by the addition of an electrolyte or oppositely charged sol. The pptn takes place thus the process of ppting a colloidal sol. Is known as coagulation or flocculation

Factors governing coagulation:

- 1- A little amount of suitable electrolyte may bring coagulation .*
- 2- Coagulation is brought about by oppositely charged ions of the electrolyte*
- 3- Coagulation also takes place by mixing oppositely charged solution it is called mutual coagulation.*
- 4- Coagulation of a solution is more pronounced at high temp.*
- 5- The coagulation power of different electrolytes is not equal*

Coagulation can be caused by the following methods:

- 1- Electrophoresis*
- 2- Mutual pptn*
- 3- Prolonged dialysis*
- 4- Heating or cooling*

Peptization:

The process by which a coagulated colloid reverts to its original dispersed colloidal suspension state..

(When a coagulated colloid is washed, some of the electrolyte responsible for its coagulation is removed, therefore, the repulsive forces as well as the original colloidal state are reestablished.)

Solution: Use of Volatile electrolyte as washing solution, e.g., HNO₃, NH₄NO₃, to avoid peptization.

Practical Treatment of Colloidal Precipitates

Colloids are best precipitated from hot, stirred solutions containing sufficient electrolyte to ensure coagulation. The filterability of a coagulated colloid often improves if it is allowed to stand for an hour or more in contact with the hot solution from which it was formed. During

this process, which is known as **digestion**, weakly bound water appears to be lost from the precipitate. The result is a denser mass that is easier to filter

Digestion

is a process in which a precipitate is heated in the solution from which it was formed (the mother liquor) and allowed to stand in contact with the solution. **Mother liquor** is the solution from which a precipitate was formed.

Crystalline Precipitates

Crystalline precipitates are generally more easily filtered and purified than are coagulated colloids.

- Particle size of crystalline solids can often be improved significantly by minimizing Q (by using dilute solutions, and adding the precipitating reagent slowly, with good mixing) or maximizing S (precipitating from hot solution or by adjusting the pH), or both.
- Digestion improves the purity and filterability of both colloidal and crystalline precipitates.
- The improvement in filterability undoubtedly results from the dissolution and recrystallization that occur continuously and at an enhanced rate at elevated temperatures.
- Recrystallization apparently results in bridging between adjacent particles, a process that yields larger and more easily filtered crystalline aggregates. This view is supported by the observation that little improvement in filtering characteristics occurs if the mixture is stirred during digestion

Coprecipitation:

A process in which normally soluble compounds are carried out of solution by a precipitate. It may result in **impurities** within the desired precipitates. Coprecipitated impurities may cause either negative or

positive errors. There are four types of coprecipitation: surface adsorption, mixed-crystal formation, occlusion, and mechanical entrapment.

Surface Adsorption

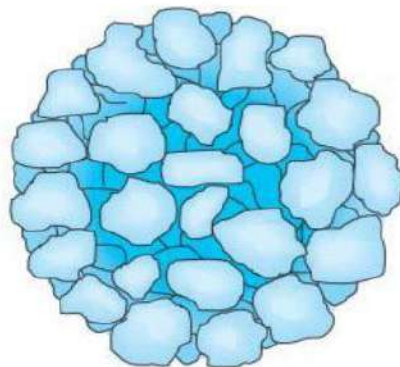
The impurity is chemically or physically adsorbed onto the surface of precipitates

➤ Adsorption is the major source of contamination in coagulated colloids but of no significance in crystalline precipitates.

Minimizing Adsorbed Impurities on Colloids Washing a coagulated colloid with a solution containing a volatile electrolyte
Digestion: during this process, water is expelled from the solid to give a denser mass that has a smaller specific surface area for adsorption.

Reprecipitation:

In this process, the filtered solid is redissolved and reprecipitated. The solution containing the redissolved precipitate has a significantly lower contaminant concentration than the original, and even less adsorption occurs during the second precipitation.



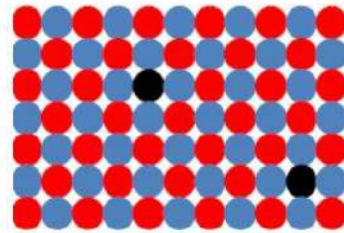
Mixed-Crystal Formation:

A type of coprecipitation in which a contaminant ion replaces an ion in the lattice of a crystal.

Ex

SrSO₄ in BaSO₄

MnS in CdS



Mixed-crystal formation may occur in both colloidal and crystalline precipitates

● Problem solving:

- Change to another more selective precipitating agent
- Reprecipitation

Occlusion:

A type of co-precipitation in which a compound (*foreign ions in the counter-ion layer*) is physically trapped within a precipitate during rapid precipitate formation.

Problem solving: Digestion

Digestion:

The process which has a waiting time to achieve desired outcome. (The **solubility-precipitation** is in a **dynamic equilibrium**, digestion ensures the occluded material is eventually exposed to the supernatant solution.)

