# Oleochemistry

# Colloid

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Chapter 9

# The students should be able to understand and relate:

- The classes and properties of the colloids to the Oleochemistry applications

# Introduction

• Colloidal system are the ones in which one of three states (solid, liquid and gas) is finely dispersed in another.

• Colloids were named first in the early 19th century by the Father of Physical Chemistry, Thomas Graham (1805-1869). In 1920's and 1930's, the importance of colloids to industrial processes and biochemistry changed everything making it a hot field.

• A colloidal system consists of an *internal phase (dispersion phase)*, which is the material of colloidal dimensions, and an *external phase (dispersion medium)* Similar to the terms *solute* and *solvent* used for simple solutions.

- Dispersion phase=solute
- Dispersion medium=solvent

# Suspension vs Colloid vs Solution

## Table 1: Characteristics of Suspension, Colloid and Solution

| | Properties | Suspension | Colloid | Solution |
|---|---|---|---|---|
| 1. | Particle size | >100nm | 1-100nm | <1nm |
| 2. | Separation<br>1)ordinary filtration<br>2) ultra filtration | <br>possible<br>possible | <br>not possible<br>possible | <br>not possible<br>not possible |
| 3. | Appearance | opaque | Generally clear | clear |
| 4. | Diffusion | Not possible | Diffuses slowly | Diffuses rapidly |
| 5. | Brownian motion | shows | shows | Not observable |

**Suspension** is a heterogeneous fluid containing solid particles that are sufficiently large for sedimentation. Usually they must be larger than 1 micrometer.

# Applications

Because of their various properties, colloidal systems have many applications in various industries like:

- Food industry (diary products, chocolate etc),
- Pharmaceutical and cosmetic industry (gels and emulsions),
- Photographic industry (films, carbon paper, ink etc),
- Electrical and electronic industry (liquid crystals, isolating materials etc),
- Paint industry
- Agrochemical industry.

# Classification of colloids

Colloids can be classified mainly by 3 ways;

- Classification Based on the STATE of the Dispersed Phase and Dispersion Medium
- Classification of Colloids Based on TYPE OF PARTICLES of the Dispersed Phase
- Classification Based on the NATURE OF INTERACTION Between Dispersed Phase and Dispersion Medium

# Classification: State

Classification Based on the STATE of the Dispersed Phase and Dispersion Medium

| Dispersion Medium | Dispersed phase | Type of colloid | Example |
|---|---|---|---|
| Gas | Liquid | Aerosol | Fog, clouds |
| Gas | Solid | Aerosol | Smoke |
| Liquid | Gas | Foam | Whipped cream, soda water |
| Liquid | Liquid | Emulsion | Milk, hair cream |
| Liquid | Solid | Sol | Paints, cell fluids |
| Solid | Gas | Foam | Pumice, plastic foams |
| Solid | Liquid | Gel | Jelly, cheese |
| Solid | Solid | Solid Sol | Plastic chair |

# Classification: Type of particles

**Classification of Colloids Based on TYPE OF PARTICLES of the Dispersed Phase**

a) Multimolecular colloids usually have lyophobic character.
Ex: gold and sulphur sols

b) Macromolecular colloids – resemble (like) true solutions
Ex: proteins, cellulose, starch and polymers such as polyethylene, nylon and polystyrene

c) Associated colloids - type of micelle it forms depends on the nature of solvent
Ex: soaps and synthetic detergents

# Lyophobic

- Characterized by a lack of attraction between the colloid medium and the dispersion medium of a colloidal system. Read more:
- (of a substance or surface) solvent rejecting; resistant to being wetted or solvated by the solvent present; the term comprehends hydrophobic when the solvent is water. Read more:

- Lyo= Dispersion;

  [From Greek lūein, to loosen, dissolve.]

# Classification: Nature of interaction

Classification Based on the NATURE OF INTERACTION Between Dispersed Phase and Dispersion Medium

**Table 3: Distingustion between lyophilic and lyophobic colloids**

| Property | Lyophilic sols (suspensoid) | Lyophobic sols (Emulsoid) |
|---|---|---|
| Viscosity | Much higher than that of the medium | Same as that of the medium |
| Reversibility | Reversible | Irreversible |
| Stability | More stable | Less stable |
| Hydration | Extensive hydration takes place | No hydration |
| Examples | Gum, gelatin, starch, proteins, rubber etc. | Metals like Ag and Au, hydroxides like $Al(OH_3)$, $Fe(OH)_3$ metal sulphides like $AS_2S_3$ etc. |

# Generally used methods to prepare colloidal systems

- Aerosol is formed by passing gas jet to a liquid spray.

- Emulsions are usually prepared by vigorously shaking the two constituents together, often with the addition of an emulsifying agent . The phase in which emulsifier is more soluble forms the outer layer. lyophobic colloids .

- Gels are often formed by cooling lyophilic sols that contain large linear molecules and have a much greater viscosity than the solvent.
  Elastic and Rigid gels.

- Foams are formed when gas and liquid are mixed together in a container and shaken along with a foaming agent.

# Purification of colloidal solutions

• Colloidal solutions prepared by the above methods contain some soluble impurities and
excess of electrolytes; these have to be removed to obtain pure sols.

•Generally a) Dialysis, b) ultra filtration and c) ultra centrifugation are the techniques used.

• Ultra filtration: colloidal sols are filtered through ultra-filtrers. pore size of filter paper is
decreased such that it will restrict the passage of colloidal particles.

• Ultra-centrifugation: Centrifugation is carried out at very high speeds such that the colloidal particles settle down at the bottom of the tube and the impurities remain in the
solution .

# Colloid properties

## a) Colligative Properties

The magnitudes of these properties for colloidal solutions are much smaller than those obtained for true solutions. They exhibit measurable osmotic pressures. This property isused for the determination of the average molecular masses of the colloids.

## b) Kinetic properties

liquid undergoes continuous chaotic and random motions. This motion of the particles is called Brownian motion. This Brownian motion is found to decrease by increase in
particle size or by increase in viscosity of medium.

## c) Electrical properties

Lyophobic sols carry charge, because of which they get repelled on approaching another particle avoiding their coagulation.

# Conclusion

- Colloid can be categorized into 3 classes
- Interesting properties of colloids have been used in various oleochemistry based application

# Chapter description

All pictures/photographs/diagrams/figures used in this chapter is subjected to common creative that for education purposes