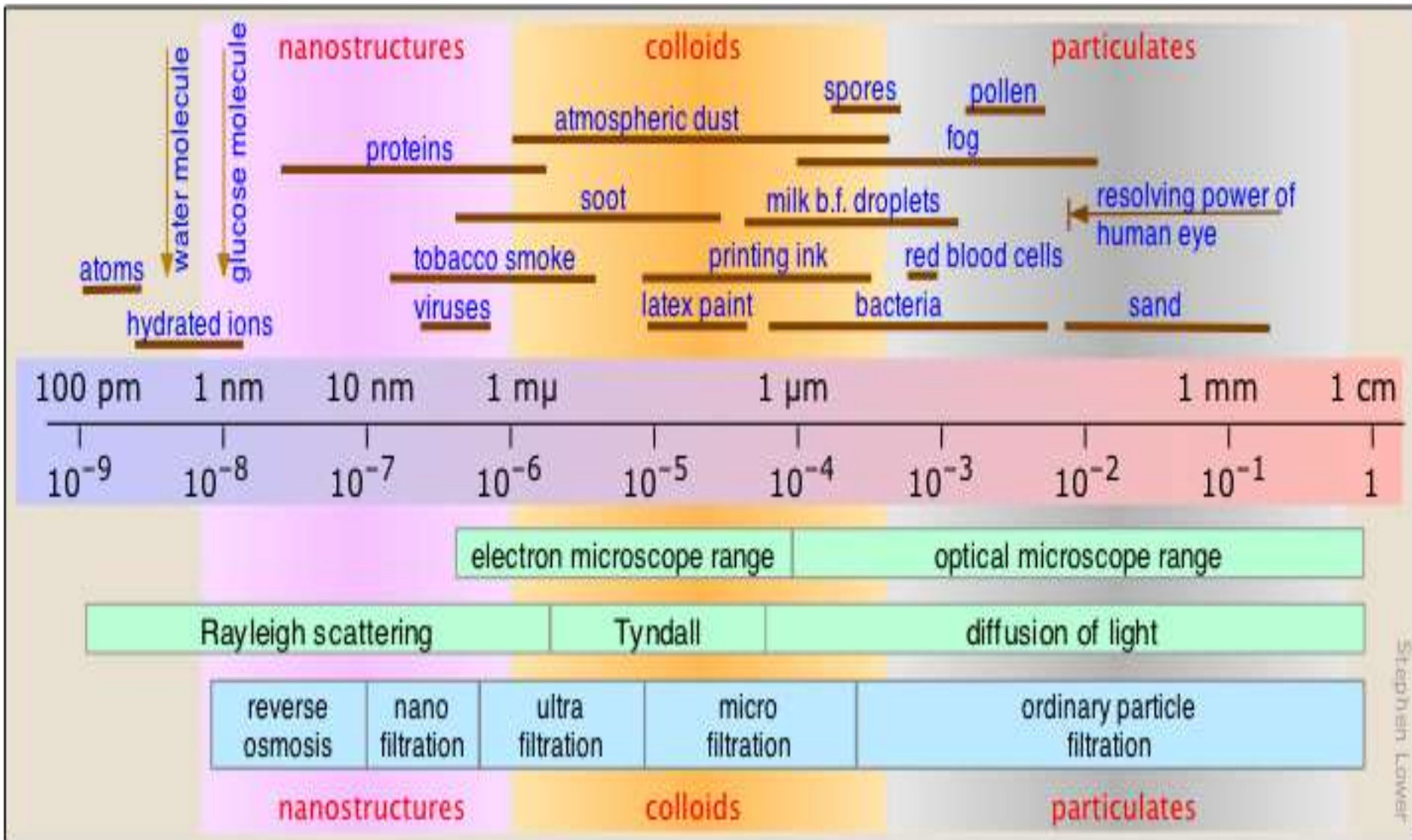




Applications of Colloid

Colloid





Pharmaceutical Application

Therapeutic Agent

- Silver colloid as Germicidal Agent
- Copper colloid as Anticancer Drugs
- Mercury colloid as Antisymphilis Preparation

Natural Colloid

- Proteins in muscle, bone and skin.
- Plasma proteins in drug-target site binding.
- Plant macromolecules in Drug.



Pharmaceutical Application

Synthetic Polymer

- Solid dosage coating
- Acid degradation
- Moisture Absorption



Pharmaceutical Application

Drug delivery system

- Hydrogels
- Microparticles
- Microemulsions
- Liposomes
- Micelles
- Nanoparticles
- Nanocrystals

Conventional Water Treatment Process



- **Coagulation**

Surface waters must be treated to remove turbidity, color and bacteria. The object of coagulation and flocculation is to turn the small particles of color, turbidity and bacteria into larger flocs, either as precipitates or suspended particles. These flocs are then conditioned so that they will be readily removed in subsequent processes. Technically, coagulation applies to the removal of colloidal particles. Coagulation as a method to alter the colloids so that they will be able to approach and adhere to each other to form larger floc particles.

- **Colloid Stability**

The colloids are suspended in solution and cannot be removed by sedimentation or filtration. The particles in the colloid range are too small to settle in a reasonable time period and too small to be trapped in the pores of a filter. For colloids to remain stable they must remain small. Most colloids are stable because they possess a negative charge that repels other colloids particles before they collide with one another.

Conventional Water Treatment Process



- **Colloid Destabilization**

Since colloids are stable because of their surface charge, in order to destabilize the particles, it must neutralize the charge. Such neutralization can take place by addition of an ion of opposite charge to the colloid. Since most colloids found in water are negatively charged, the addition of sodium ions (Na^+) should reduce the charge. Higher the concentration of sodium added, the lower the charge, and therefore the lower the repelling forces around the colloid. If, instead of adding a monovalent ion such as sodium, a divalent or trivalent ion is added, the charge is reduced even faster. In fact, it was found by Schulze and Hardy that one mole of a trivalent ion can reduce the charge as much as 30 to 50 moles of a divalent ion and as much as 1,500 to 2,500 moles of a monovalent ion.

Conventional Water Treatment Process



- **Coagulants**

The purpose of coagulation is to alter the colloids so that they can adhere to each other. During coagulation a positive ion is added to water to reduce the surface charge to the point where the colloids are not repelled from each other. A coagulant is the substance (chemical) that is added to the water to accomplish coagulation. There are three key properties of a coagulant :

- 1. Trivalent cation :**

As indicated in the last section, the colloids most commonly found in natural waters are negatively charged, hence a cation is required to neutralize the charge. A trivalent cation is the most efficient cation.

- 2. Nontoxic :**

This requirement is obvious for the production of a safe water.

- 3. Insoluble in the neutral pH range :**

The coagulant that is added must precipitate out of solution so that high concentrations of the ion are not left in the water. Such precipitation greatly assists the colloid removal process.

Conventional Water Treatment Process

The background image shows a laboratory or industrial setting. In the foreground, there is a clear glass beaker on a surface. To the right, a pipette with a yellow tip is positioned as if it has just finished dispensing liquid into the beaker. The background is slightly blurred, showing what appears to be a clean, white environment with some equipment or structures.

- **Coagulation/Flocculation in the Plant**

In wastewater treatment operations, the processes of coagulation and flocculation are employed to separate suspended solids from water. Finely dispersed solids (colloids) suspended in wastewaters are stabilized by negative electric charges on their surfaces, causing them to repel each other. Since this prevents these charged particles from colliding to form larger masses, called flocs, they do not settle. To assist in the removal of colloidal particles from suspension, chemical coagulation and flocculation are required. These processes, usually done in sequence, are a combination of physical and chemical procedures. Chemicals are mixed with wastewater to promote the aggregation of the suspended solids into particles large enough to settle or be removed.

Functions of colloidal systems in food products



Most colloids are stable, but the two phases may separate over a period of time because of an increase in temperature or by physical force.

They may also become unstable when frozen or heated, especially if they contain an emulsion of fat and water.

Main types of colloidal system

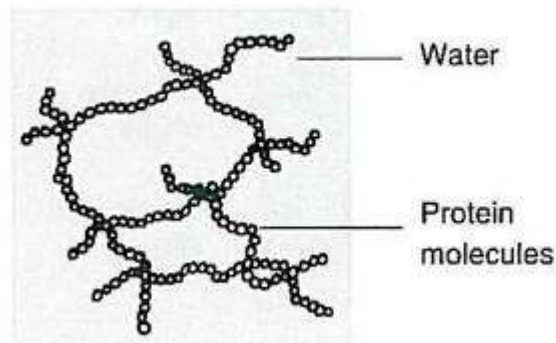
| System | Disperse phase | Continuous phase | Product |
|----------------|----------------|------------------|----------------------------------|
| Sol | Solid | Liquid | Uncooked custard, unset jelly |
| Gel | Liquid | Solid | Jelly, jam, blancmange |
| Emulsion | Liquid | Liquid | Mayonnaise, milk |
| Solid emulsion | Liquid | Solid | Butter, margarine |
| Foam | Gas | Liquid | Whipped cream, whisked egg white |
| Solid foam | Gas | Solid | Meringue, bread, cake, ice cream |

Sols and Gels

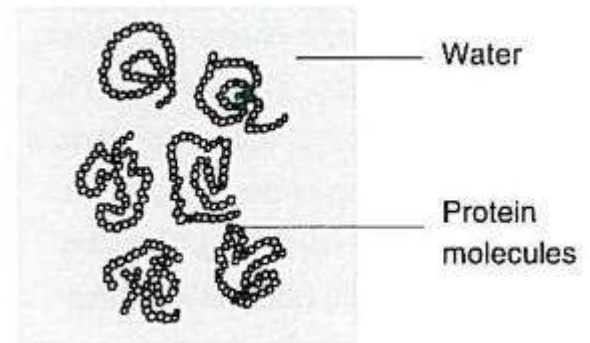
Sols and gels are both liquid loving (lyophilic) colloids. A sol is a liquid colloid or mixture in which solid particles are dispersed in a liquid phase. The disperse phase is attracted to molecules of the continuous phase.

Sometimes the mixture needs to be heated and stirred. When this solution cools, the sol changes into a gel, which resembles a solid rather than a liquid. Both protein and starch can be used in the formation of a sol or gel.

Gel



Sol



Sols and Gels

When a jelly is made, gelatine is dispersed into a liquid and heated to form a sol. As the sol cools, protein molecules unwind forming a network that traps water and forms a gel.

If cornflour is mixed with water and heated, the starch granules absorb water until they rupture, the starch then disperses in the water and the mixture becomes more viscous and forms a gel on cooling.



Other types of Gel

Other types of gel are formed with pectin and agar.

Pectin, a form of carbohydrate found in fruits, is used in the production of jam to help it set. However, for it to gel there must be at least 50% sugar and conditions should be acidic. Agar is a polysaccharide extracted from seaweed which is capable of forming gels.

If a gel is allowed to stand for a time, it starts to 'weep'.

This loss of liquid is known as syneresis.





Emulsions

When water and oil are shaken together, they form an emulsion. This emulsion is unstable. If left to stand, the oil will form a separate layer on top of the water, e.g. traditional French dressing.

The two liquids are immiscible (they will not mix together). A stable emulsion is formed when two immiscible liquids are held stable by a third substance, called an emulsifying agent.

Emulsions

An emulsion may be oil-in-water (o/w) in which case small oil droplets are dispersed through water, e.g. milk, or water-in-oil (w/o) in which case small water droplets are dispersed through oil, e.g. butter.



Foams

Foams are composed of small bubbles of gas (usually air) dispersed in a liquid, e.g. egg white foam. As liquid egg white is whisked, air bubbles are incorporated.

The mechanical action causes albumen proteins to unfold and form a network, trapping the air.

If egg white is heated, protein coagulates and moisture is driven off. This forms a solid foam, e.g. a meringue. Ice cream, bread and cake are other examples of solid foams.



Colloids in Paints



Paint is used to

- Protect the surface (e.g a crumbling wall, a metal that might corrode)
- Make it attractive
- Paint dries because

They are applied in thin layer
The solvent evaporates

Types of Paint:

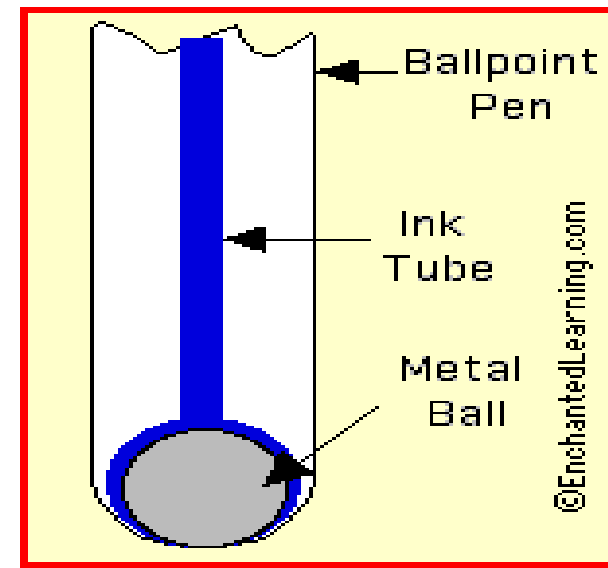
1. Emulsion paint
2. Oil paint
3. phosphorescent paint
4. Thermochromic paint

3 main parts to paint:

- Pigment: The substance that gives the paint its colour.
- Binding medium: sticks the pigments to the surface being painted.
- Solvent: thins the paint so it spreads more easily.

Colloids in Ink

Chemists view it as a colloidal system of fine pigment particles dispersed in a solvent. The pigment may or may not be coloured, and the solvent may be aqueous or organic. The most critical properties of inks relate to their drying and surface properties.



Colloids in Thickening agent



Thickening Agents

These are the agents which are used to increase the viscosity of molten bases and prevent sedimentation of suspended in solid bases.

Examples:

- Aluminium monostearate
- Colloidal silica
- Magnesium stearate
- Stearyl alcohol

ARTIFICIAL RAIN WITH COLLOIDS



SMOKE PRECIPITATION WITH COLLOIDS



TANNING OF LEATHER WITH COLLOIDS



Thank You