

Colloidal Dispersion: Gel and Magma

Isra Dmour, PhD

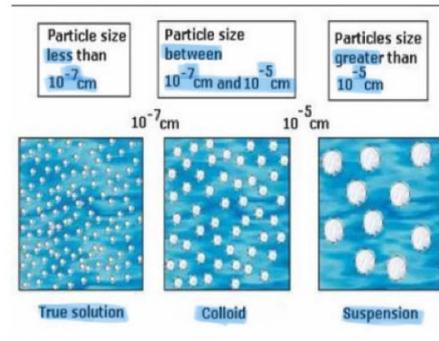


1

1

Colloidal Dispersion

- A *colloidal dispersion* is a system in which particles of colloidal size of any nature (e.g. solid, liquid or gas) are dispersed in a *continuous phase* of a different composition (or state).
- Dispersion containing particles in the colloidal range (falling between 1.0 nm and 0.5 μm), are termed *colloidal dispersions* such as *Magnas* and *gels*.
- If the disperse phase interacts appreciably with the dispersion medium, it is said to be **lyophilic**, meaning *solvent loving*.
- If the degree of attraction is small, the colloid is termed **lyophobic**, or *solvent hating*.



بشكل موزن ←
Good .. ←

Bad .. ←

2

2

* Lyo: Solvent ..

Colloidal Dispersion

- Terms such as *hydrophilic* and *hydrophobic*, which are more descriptive of the nature of the colloidal property, have therefore been developed to refer to the attraction or lack of attraction of the substance specifically to water * لياح بسمية أو phobic ↑

- **lyophilic colloidal**

- These systems are easier to prepare and have greater stability.
- These terms are more suitably used when reference is made to the specific dispersion medium, for a single substance may be lyophobic with respect to one dispersion medium and lyophilic with respect to another.

- For instance, starch is lyophilic in water but lyophobic in alcohol.

External phase هو الذي يحد إذا ، hydrophilic ، hydrophobic

المحب للماء هو الليophilic
تخفيفاً + أكثر استقراراً ..

3

3

Colloidal Dispersion

- **Lyophobic colloids**

- are generally composed of inorganic particles. When these are added to the dispersing phase, there is little if any interaction between the two phases.
- **lyophobic materials:**
- They do not spontaneously disperse but must be encouraged to do so by special individualized procedures.
- Their addition to the dispersion medium does not greatly affect the viscosity of the vehicle

Such as
→ Shaking

إذا تم خلطهم على وسط " dispersion " ما يثر على درجته اللزوجة بشكل كبير ..

Bentonite magma



4

4

Gels → protein → polypeptide → Amino Acid $\begin{cases} \text{COOH} \\ \text{NH}_3^+ \end{cases}$ Good interaction
 Gelling \leftarrow Swelling \leftarrow hydration \leftarrow (ما يكون بالي) *
 (increase viscosity)

Classification of colloidal system

Hydrophilic colloid

- ✓ Molecules have **affinity for water** and become hydrated when they are dispersed in water
- ✓ **Hydrated colloids swell and increase the viscosity of the system**

1. **improve stability** by **reducing interaction** between particles and their tendency to settle

2. If they possess a **net surface electrical charge** (that depend on **chemical properties** & **pH of the system**) they will **repel** other charged particles and thus **reduces the likelihood** that particles will adhere to one another and settle

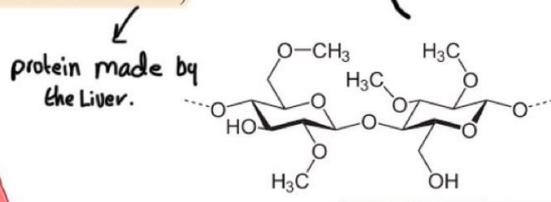
5

Charge أي تغير على لا
 Settling ← precipitate بطل
 viscosity enhance
 Suspension → suspended
 كمن كبري charge بطن في
 repulsion → بطن طحلت
 5
 Charge (2) بطن أي شي يليني لا
 Such as Cation
 Surface electrical charge

Classification of colloidal system

Hydrophilic colloid

- Examples:
- acacia
- Methylcellulose → derived from Cellulose.
- Proteins (gelatin & albumin)



6

6

Hydrophobic colloid

- Has **little or no affinity** for water molecules
- Produces **no change in system viscosity**
- The particles **may** carry a **charge**
- **They maintain their dispersion in the medium as a result of:**

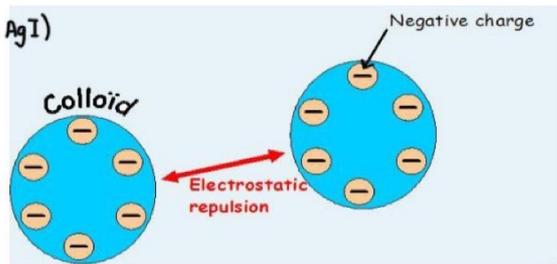


A. **mutual repulsion of like charges**

B. **Brownian movement**

• E.g. of hydrophobic colloids:

- **Silver iodide** → inorganic compound (AgI)
- **Sulfur**
- **Gold**



* يتحافظ على التشتت عند طريق:

increase in viscosity ←

تتغير قوامه ←

Brown Motion: ←
the random Motion of particles suspended in a Medium.

like this ↑

7

7

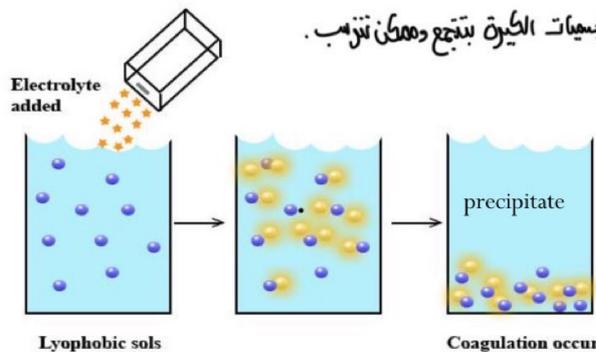
Hydrophobic colloids Charged particles

- Charged particles may be **neutralized by adding ions of the opposite charges to the dispersion medium**

- The neutralized particles **cling** together → larger particles aggregate → may precipitate

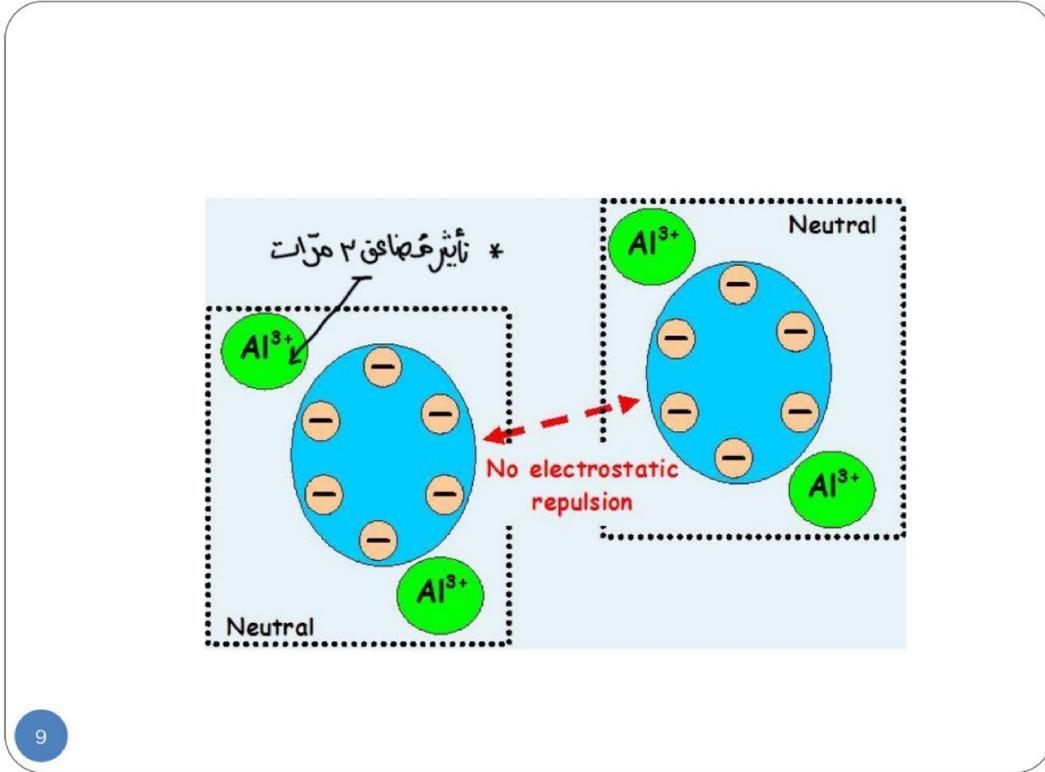
تتجمد

* الجسيمات الكيرة بتتجمع ويمكن تهريب.



8

8

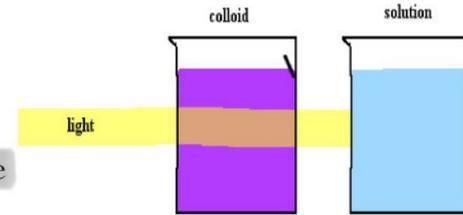


9

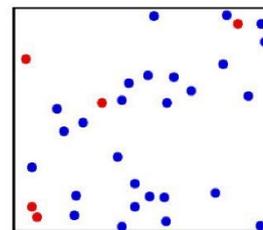
Properties of Colloids

موجات ليزر ← light

1. **Scattering of a light beam directed through the medium (Tyndall effect):**
 - a. its magnitude is a result of the size and number of particles present
 - b. Can be used to determine the molecular weight, size, and shape of the colloids
2. **Brownian movement: result from bombardment of the colloidal particles by molecules of the dispersion medium (< 5 microns)**



A beam of light shining toward the solution and the colloid. The light particles are suspended when passing through the colloid's large particles, but not when passing through the solution's smaller particles.



← شكله + استرخامه
عشان أحسب ال M.W
Shape + Size

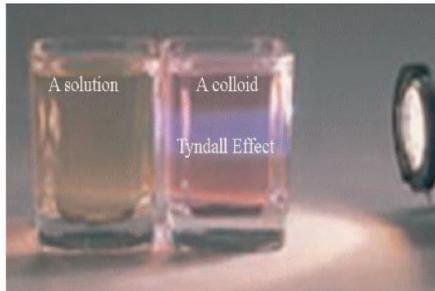
← حركة (تذبذب) ..

10

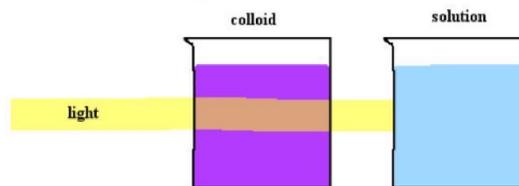
* أكبر من 5 ميكرون (5 م) *

10

The **Tyndall effect**, also known as **Tyndall scattering**, is **light scattering** by particles in a **colloid** or particles in a fine **suspension**. It is named after the 19th-century physicist **John Tyndall**



True solution (No scattering of light) Colloidal sol (Scattering of light)



A beam of light shining toward the solution and the colloid. The light particles are suspended when passing through the colloid's large particles, but not when passing through the solution's smaller particles.

11

11

اعتمادًا على الحجم

3. Electrophoresis:

The presence of a charge on the colloidal particles gives them **electrical properties**; thus when exposed to an **electrical potential** colloids can be forced to migrate toward the electrode of opposite charge (electrophoresis) → can be used to separate a mixture of **colloidal substances such as proteins**

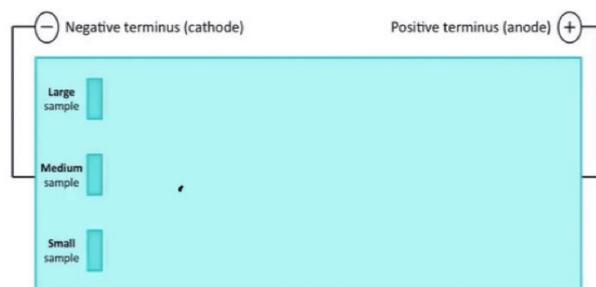
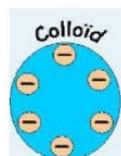
لما يتعرضن لجهد كهربائي هيك زنا يجرن بتحرك لاسخنة اليك وكما ، هين دل طريقة بتخدمها للفصل بال Colloidal protein * قبل لا

كل ما كان عليه سخنة أكثر حجم أكبر ← أبطأ
كل ما كان عليه سخنة أقل حجم أصغر ← أسرع

"عكسي مع الحجم" ..

* قبل ما أخذنا بالفصل الكهربائي لـ DNA

Electrophoresis:



12

12