تفريغ فيزيكال 2

محاضرة: Disperse system part 1

الصيدلاني\ة: Rahaf Zyoud

لجان الدُّفعات

Soul Academy

The Hashemite University
Faculty of Pharmaceutical Science

Physical Pharmacy II
Disperse systems

Dr. Areen Alshweiat

Areen.alshweiat@hu.edu.

objectives

At the conclusion of this chapter student should be able to:

- Differentiate between different types of colloidal systems and their main characteristics.
- Understand the main optical properties of colloids and applications of these properties for the analysis of colloids.
- Evaluate the stability of colloids.
- Understand and know the main types of colloidal drug delivery system, Suspensions and emulsions.

Disperse systems

Lyophilic (Solvent-loving) colloids

- Systems containing colloidal particles that readily interact with the dispersion medium

هي السبب

- Due to their affinity for the dispersion medium, such materials can easily form colloidal dispersions; simply by dissolving the material in the solvent being used.

تحضيرهم سهل
لانه بصير الهم
dispersion بسرعة

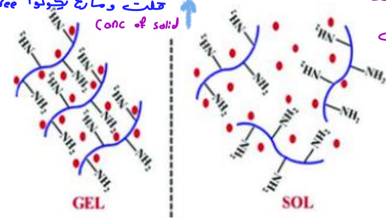
- Most lyophilic colloids are organic molecules, for example, gelatin, acacia, insulin, albumin, rubber, and polystyrene.

Disperse systems

Lyophilic (Solvent-loving) colloids

- Polysaccharides and other hydrocolloids, such as gelatin, have the capacity to exist in the *sol* and *gel* state.
- In the sol (solution) state, these hydrocolloids move freely in their medium with no chemical or physical bonding between them.
- The gel state is created when the hydrocolloids interact in different ways, for example, by forming a polymeric network interspersed with the liquid medium.
- This capacity to form a network of interconnecting macromolecules allows them to increase a medium's viscosity and to form the gel topical dosage form.

هون ال solid particel
مرتبين والمسافه بينهم
قلت ومارح يكونوا Free
Conc of solid ↑

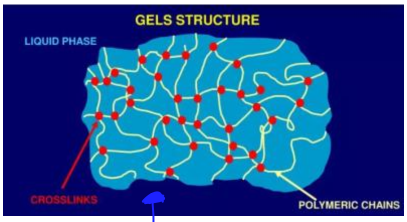


المسافة بين ال Solid Particel
كبيرة وبيكونوا Free عشان
هيك بتكون كا شكل Solution

Viscosity of gel > Viscosity of sol

ليش؟؟

① Conc ↑
② tem ↓



- هذا شكل ال gel
- بين ال Polymers فيه Cross-linkage

Sol vs. Gel Formation in Lyophilic Colloids

Factor	Sol State	Gel State
Temperature	Usually formed at higher temperatures	Often forms upon cooling يعني رح يكون rigid
Concentration	Low concentration → dispersed molecules	High concentration → polymer network formation
Intermolecular Interactions	Minimal bonding; molecules move freely	Strong interactions (entanglement or crosslinking)
Mobility of Molecules	High (liquid-like behavior)	Restricted (semisolid structure)
Physical Appearance	Fluid, pourable solution	Firm, retains shape

✅ **Key Insight: Gelation occurs when macromolecular interactions and sufficient concentration enable the formation of a 3D network, often triggered by cooling.**

Disperse systems

Lyophobic (Solvent-hating) Colloids

إذا كان في attraction أصلاً
رح يكون قليل

- Systems composed of materials that have little attraction, if any, for the dispersion medium
- It is necessary to use special methods to prepare lyophobic colloids.

إذا بدي إياهم يصيروا dispersion
ببعض لازم أخلي الـ
dispersed phase يحب الـ dispersed medium
مثل إستخدام الـ Surfactant

- They are generally composed of inorganic particles dispersed in water.
- Examples of such materials are gold, silver, sulfur, arsenous sulfide, and silver iodide.

Properties of colloids

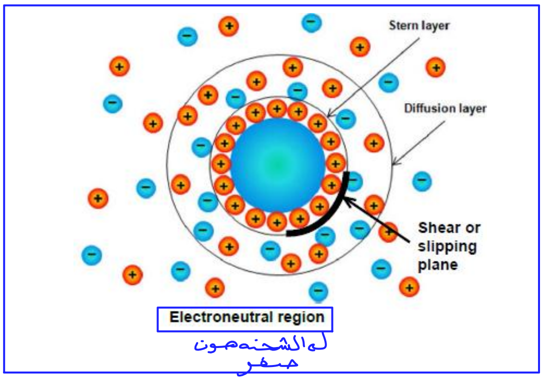
Electrical Properties

Electric Double Layer

- The electric double layer consists of Layer of ions bounded firmly to the surface called Stern layer, surrounded by oppositely charged ions that form a loose diffuse layer in the adjacent liquid phase.

مافتراضي

- The surface separating the two layers is called (shear or slipping plane). The region outside the double layer with equal distribution of anions and cations is called electroneutral region.



لهالشحنه هون صفر

Properties of colloids

Electrical Properties

Nernst and Zeta Potentials

فرق الشحنه بين ال Particel وال electronutral region

هاي الشحنه غير حقيقة بسبب ال double layer

- The *electrothermodynamic (**Nernst**) potential (E) is* the difference in potential between the actual surface and the electroneutral region of the solution.

فرق الشحنه بين ال stern Layer وال electronutral region

- The *electrokinetic (**zeta**) potential (1)* is the difference in potential between the surface of the stern layer and the electroneutral region of the solution.

يعني الجهاز رح يقيس شحنة ال stern لأنه ال electronutral region شحنتها صفر

- The zeta potential is measured to monitor and predict the stability of dispersion systems