

Colloidal Dispersion: Gel and Magma

حجم صغير / نيس المذيع

1nm - 5µm

Colloidal Dispersion

Gel and Magma

- 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).
ممكن dispersed يكون صلباً / سائلاً / غازات
- Dispersion containing particles in the colloidal range (falling between 1.0 nm and 0.5 µm), are termed colloidal dispersions such as Magmas 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.

درجته حب المذيب / dispersed phase

- lyophilic colloidal 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.

من السلايد الى برحت عليهم الدكتور

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.

ما بتفاعلا
آ نهم بکرا لودا
بچلن

- Unlike lyophilic colloids, lyophobic materials 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

lyophobic materials
ما بآئردا على لوزوجة
vehicle

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

Classification of colloidal system

Hydrophilic colloid

تصنيف

Hydrophilic

Molecules have affinity for water and become hydrated when they are dispersed in water

- Hydrated colloids swell and increase the viscosity of the system
- improve stability by reducing interaction between particles and their tendency to settle
- 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

استقرار أكثر
من خلال تقليل
التصاق جسيمات
مع بعضها
وحتى لا تترسب

تتنافس

بقليل التجمعات

Classification of colloidal system

Hydrophilic colloid

- **Examples:**
 - acacia
 - Methylcellulose
 - Proteins (gelatin & albumin)

النوع
التأخر

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 mutual repulsion of like charges and Brownian movement

يضلوا محليين بسبب الشحنات

والحركة العشوائية

- E.g. of hydrophobic colloids:

- Silver iodide

للجزيئات

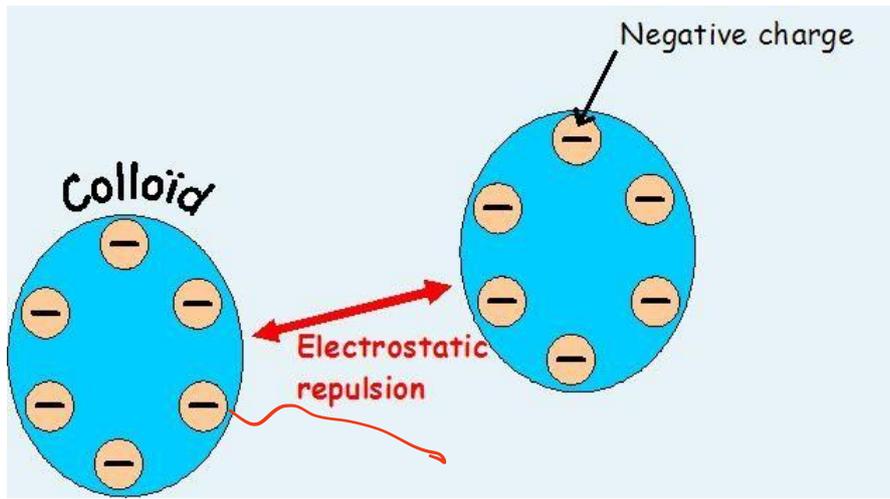
- Sulfur

ركز
إنها

- Gold

inorganic

سواد
غير عضوية



Hydrophobic colloids

فذلك قد يعادل الويل حتى لا تتجاذب الجزيئات

dispersion media

استقرار

يمكن الشحنات تعثره

يمكن

Charged particles

يكون في

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

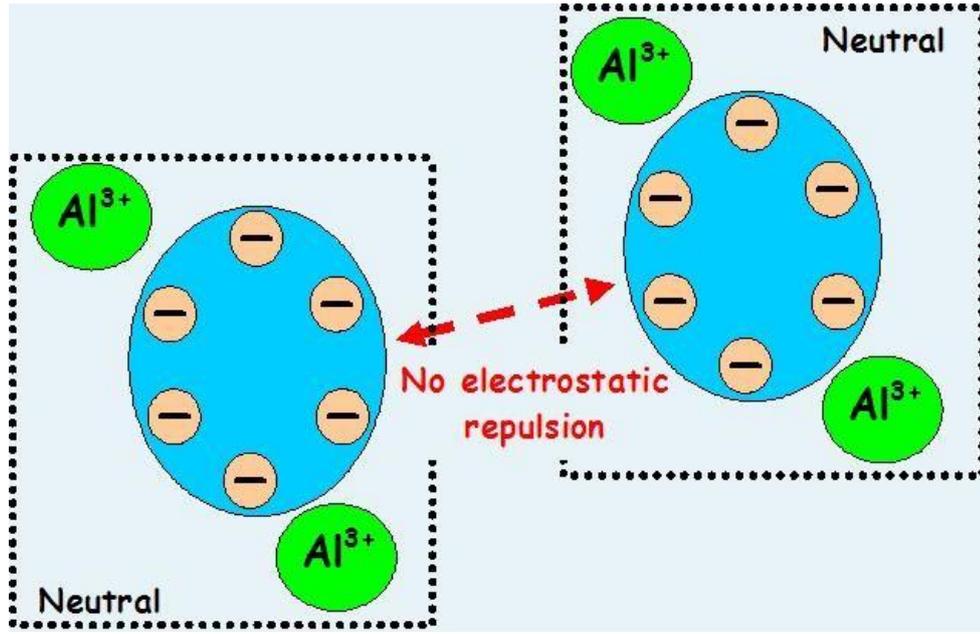
فرصة يتركوا

في القاع أو

على السطح

- The neutralized particles cling together larger particles aggregate may precipitate

إجابة /
توضح لماذا
تعاادل الشحنات



Properties of Colloids

نفاذية الضوء

دائرية

نفاذية

colloidal

systems

Scattering of a light beam directed through the medium (Tyndall effect):

حجم صغير

its magnitude is a result of the size and number of particles present

يستخدم لتحديد كتلة الجزيئات / حجمها / تركيب الجزيئات

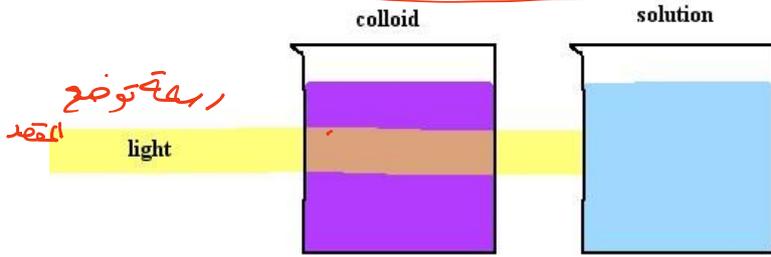
Can be used to determine the molecular weight, size, and shape of the colloids

خاصية اخرى

Brownian movement: result from bombardment of the colloidal particles by molecules of the dispersion medium (< 5 microns) *only small particles*

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

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



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.

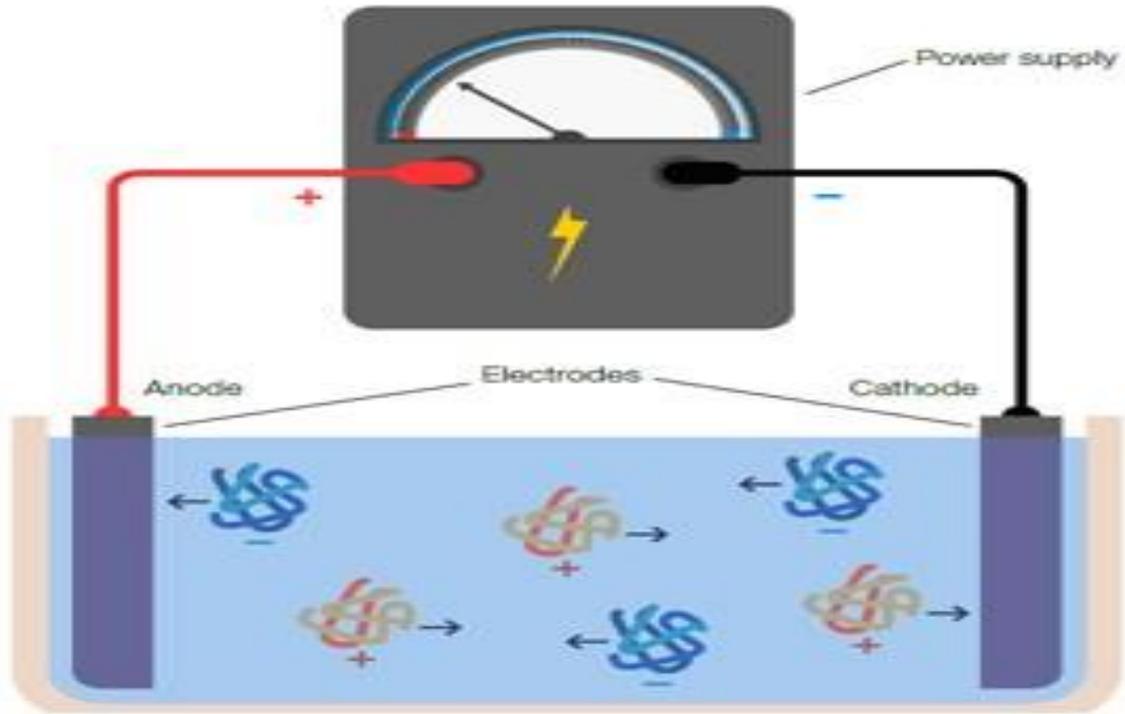
نمونه بین محلول کلاسی و کلوئیدی
system
من خلال
Tyndall effect



True solution
(No scattering
of light)

Colloidal sol
(Scattering of
light)

Electrophoresis:



Properties of Colloids

4. Colloids do not pass through a semi-permeable membrane:

لا تمر الجزيئات في الأوساط شبه المنفذ

الجزء مثال على أن colloids لا تنتقل عبر

semipermeable

when an albumin dispersion is placed into a cellophane sac and submerged into water, water molecules will enter the sac to dilute the albumin dispersion that cannot diffuse out

This principle explains the role of human serum albumin in maintaining the osmotic pressure of blood

This principle is in the kidney too: ions and small molecules are filtered while serum protein are retained

Gels

• Gels are defined as semisolid systems consisting of dispersions made up of either small inorganic particles or large organic molecules enclosing and interpenetrated by a liquid.

تتخلل

• Gels are also defined as semi-rigid systems in which the movement of the dispersing medium is restricted by an interlacing three-dimensional network of particles or solvated macromolecules of the dispersed phase.

أنظمة شبه صلبة

بحيث تكون حركة الوسط مقيدة

من خلال شبكة ثلاثية الأبعاد متشابكة

من الجزيئات أو الجزيئات الكبيرة

• Gels also are defined as a substantially dilute crosslinked system, which exhibits no flow when in the steady-state

كلمة

مميزة

لهذا

التعريف

Gels

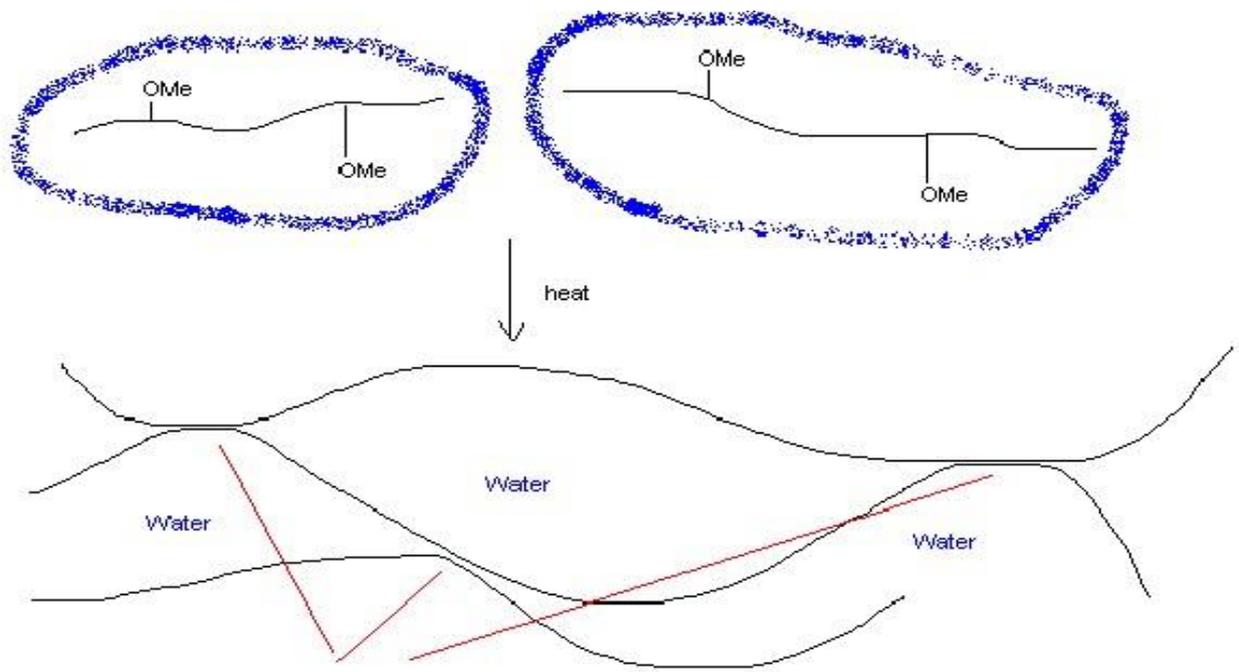
لأي مكان يمكن استخدامه

- Gels are useful as liquid formulations in oral, ophthalmic, nasal, topical, vaginal, and rectal administration
العين
خارجي
العين
- Are made by using substances called gelling agent
- Gelling agent undergo extensive cross-linking or enlargement when dissolved or dispersed in the dispersing medium
ارتباط متبادل
عند وضعه في الوعاء للمعدة
تضخم
- This cross linking increases the viscosity of the dispersing medium and also restricts its movement
يقلل

Gels

cross linking

لصواعق لهم



Hydrophobic interactions are favored at higher temperatures, thus forming junction zones, which produces a gel

interlocked *ربطها* *dispersion* *الوسيط*
داخل *medium*

Gelling agent



Gel's classification

تصنيف الجل

TABLE 14.4 GENERAL CLASSIFICATION AND DESCRIPTION OF GELS

CLASS	DESCRIPTION	EXAMPLES
Inorganic	Usually two-phase systems	Aluminum hydroxide gel Bentonite magma
Organic	Usually single-phase systems	Carbopol Tragacanth
Hydrogels	Organic hydrogels Natural and synthetic gums Inorganic hydrogels	Pectin paste, Tragacanth jelly Methylcellulose, sodium carboxymethylcellulose, Pluronic Bentonite gel (10%-25%), Veegum, silica
Organogels	Hydrocarbon type Animal, vegetable fats Soap base greases Hydrophilic organogels Polar Nonionic	Petrolatum, mineral oil/polyethylene gel (Plastibase) Lard, cocoa butter Aluminum stearate with heavy mineral oil gel Carbowax bases (PEG ointment)

single phase system
 كلمة واحدة
 آخر ننتهي من
 علاج

سور التمييز بين العجائن والرطبات

Gel's classification:

Two phase system = magma
milk

1/ Two Phase system

تكون العجائن هنا

inorganic

- When the gel mass consists of floccules of small, distinct particles, the gel is classified as a two-phase system and frequently called a *magma* or a *milk* (e.g. milk of magnesia, aluminum hydroxide gel, bentonite magma)

- Two phase systems are thixotropic (semi solid on standing but liquefy when shaken)

Gel's classification: لا تستعمل تمييز الحبات عن الوعاء

2. Single Phase system

- If the gel does not appear to have discrete particles it is called a one-phase system
- Single phase systems contain linear or branched polymer macromolecules that dissolve in water and have no apparent boundary with the dispensing medium
- Macromolecules are classified as natural polymers (e.g. tragacanth), semisynthetic cellulose derivatives (e.g. methylcellulose), or synthetic polymers (e.g. carbomer polymers)
- Single phase gels made from synthetic or natural macromolecules are called mucilages

More

familiar

مركبات

mucilage



Two phase system

Bentonite Magma, NF

Bentonite magma is a preparation of 5% bentonite, a native colloidal hydrated aluminum silicate, in purified water. It may be prepared mechanically in a blender with the bentonite added directly to the purified water while the machine is running, or it may be prepared by sprinkling the bentonite, in portions, upon hot purified water, allowing each portion to become thoroughly wetted without stirring before another portion is added. By the latter method, the mixture must be allowed to stand for 24 hours before it may be stirred. The standing period ensures complete hydration and swelling of the bentonite.

Aluminum Hydroxide Gel, USP

AntiAcid

- A gelatinous precipitate composed of insoluble aluminum hydroxide and the hydrated aluminum oxide
- To the gel, the USP permits the addition of peppermint oil, glycerin, sorbitol, sucrose, saccharin, or other flavorants and sweeteners as well as suitable antimicrobial agents.
- This antacid preparation is white and viscous.
- It is effective in neutralizing a portion of the gastric hydrochloric acid and by virtue of its gelatinous, viscous, and insoluble character, coats the inflamed

Refer to USP Monographs Aluminum Hydroxide Gel and perhaps ulcerated gastric surface, and is useful in

http://www.pharmacopeia.cn/v29240/usp29nf24s0_m2100.html the treatment of hyperacidity and peptic ulcers. The main disadvantage to its use is its constipating effects.



Two phase system

Single Phase Gel

JLp Fluocinonide Gel, USP, an anti-inflammatory corticosteroid,

JLp - Tretinoin Gel, USP, stimulates epidermal cell turnover, causes peeling, and is effective in the treatment of acne.

JLp - Erythromycin and benzoyl peroxide topical gel (Benzamycin Topical Gel, Dermik Laboratories)



gelling agent

Common gelling agents:

يعني ربح يعاود طبقة كبيرة على سطح الجل تصبح دخول الماء

common properties

- If the gelling agent is added to the dispersing medium too rapidly the agents tend to clump layer with a gelled surface that is more difficult for the medium to hydrate

عامل التجلط

الربط

بسرعة

العامل

تفيل

الطبقة الخارجية

سطح الجل

وهذا يجعل

ترطيب الربط

Some compounding techniques to minimize the problem:

زى ملحن البودرة

Sift the powders into the vortex of the rapidly stirring medium

Levigate the powder with a water miscible nonsolvent such as absolute alcohol or propylene glycol

تستخدم بعض

الأمور لتقليل حدوث

هذا الأمر

اذابة

wetting

زى

Agent

تذوب المادة في مذيب ليتميز بالماء فتخلف سطح البودرة

فيسهل دخوله الى

الجل

Common gelling agents:

- Use a blender to mix the powder and solvent homogenously ← امزجهم

common properties

2. Some gelling agents are more soluble in cold water than in hot water

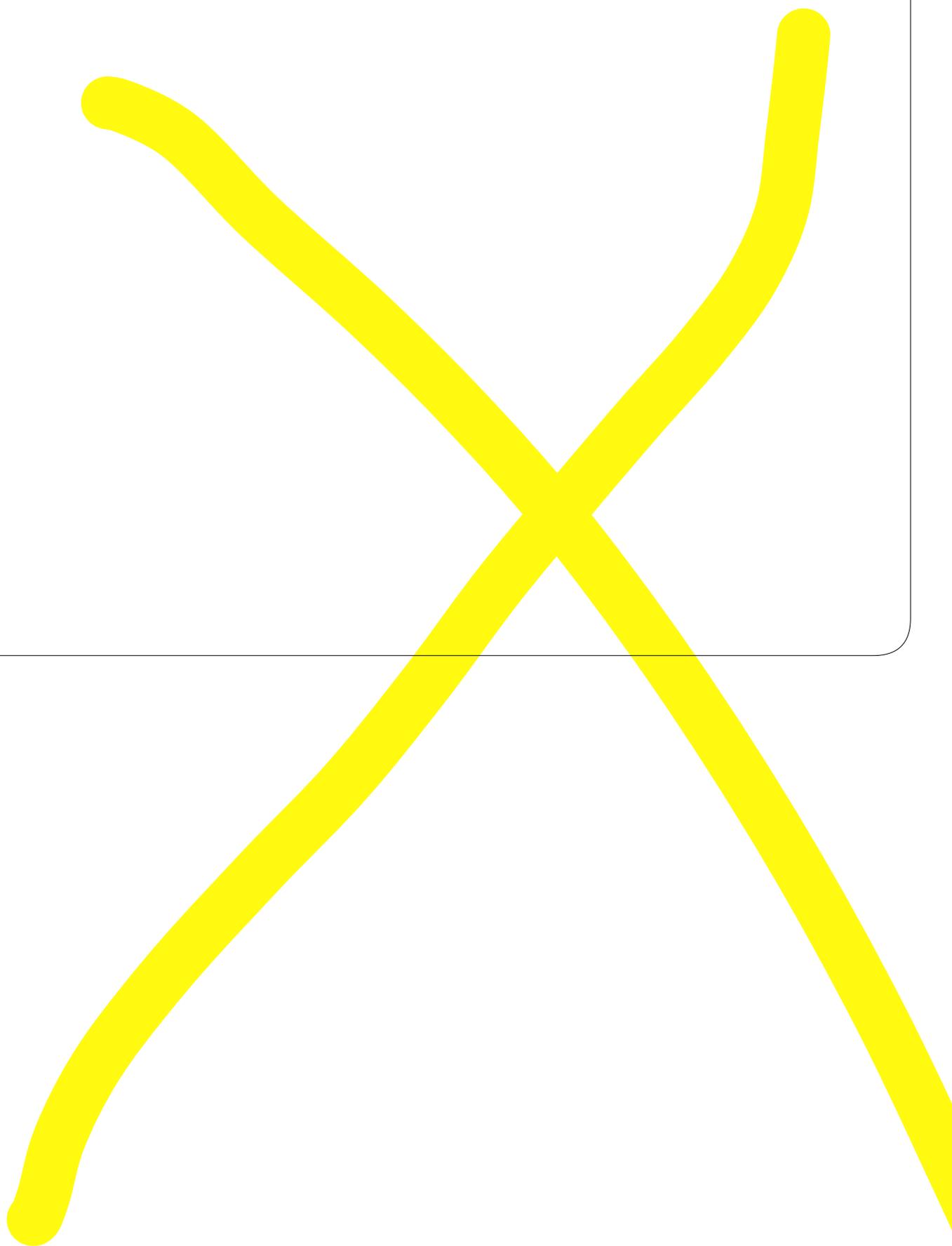
رجهه أنواع الجل يذوبوا

e.g.

في الماء البارد أكثر من الماء الساخن

- methylcellulose and poloxamers have better solubility in cold water
- Bentonite, gelatin, and sodium carboxymethylcellulose are more soluble in hot water
- Carbomers, tragacanth, and alginic acid gels are made with tepid water

Common gelling agents:



Common gelling agents:

common properties

3. Some gelling agents (e.g. carbomers) require a “neutralizer” or pH adjusting chemical to create the gel after the gelling agent has been wetted in the dispersing medium
4. Most gelling agents require 24 to 48 hours to completely hydrate and reach maximum viscosity and clarity
5. Gelling agents commonly are used in concentrations of 0.5-2% but some may be used up to 10%

كيفية عملية فقط

Common gelling agents:

أسهل أني أذوب المادة الفعالة في الماء، ودرجة عملها أضيقها للجيل

6. It is easier to add the active drug before the gel is formed if the drug doesn't interfere with the gel formation

Carbomers

- Carbomer is a generic name for a family of polymers known as Carbopol® *إي بيم التجلي*
- 1950
- They are dry powders with high bulk density
- *acidic solution* Form acidic aqueous solutions (pH around 3)
- Thicken at a higher pH (5 or 6) swell as much as 1,000 times their original volume
thickening and high pH

Common gelling agents:

- A neutralizer (e.g sodium hydroxide, triethanolamine) is added to increase the pH

Selected Carbomers:

الرقم
له
علاقة بالكثافة

Polymer Name	Viscosity*	Properties
Carbopol® 910	3,000 7,000	Effective in low concentrations and will provide a low viscosity formulation.
Carbopol® 934	30,500 39,400	Effective in thick formulations such as emulsions, suspensions, sustained-release formulations, transdermals, and topicals. Forms clear gels with water.
Carbopol® 934P	29,400 39,400	Same properties as 934, but intended for pharmaceutical formulations. "P" = highly purified product
Carbopol® 940	40,000 60,000	Effective in thick formulations, very good clarity in water or hydroalcoholic topical gels. Forms clear gels with hydroalcoholic systems.
Carbopol® 941	4,000 11,000	Produces low viscosity gels, very good clarity.

* 0.5% solution, pH 7.5

Common gelling agents:

Cellulose derivatives مشتقات السليلوز

- Methylcellulose, hydroxyethylcellulose, hydroxypropyl cellulose, hydroxypropylmethyl cellulose, and carboxymethyl cellulose)
- All of the cellulose derivatives except carboxymethyl cellulose maintain the viscosity of the gel over a wide pH range (3-11). CMC can maintain the viscosity between pH 7-9 carboxymethyl cellulose
- The addition of salts to medium reduces the ability of cellulose to hydrate

اضافة ملح للوسط يقلل ترطيب السليلوز

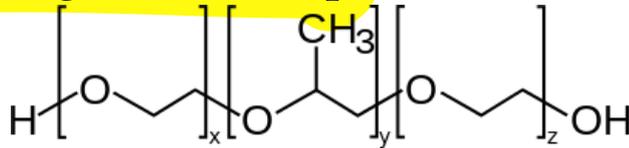
بجني حاد تكون المياه نقيه تجدر الإمكان

مدى عمل
السيلوز و مشتقاته
ماعداء المثال
المذكور

Common gelling agents:

Poloxamers

- **Pluronic®** الإسم التجاري
- Are copolymers of polyoxyethylene and polyoxypropylene يتكون نتيجة لهذا الصلبي
- They forms **reverse thermal gels** in conc. ranging from 15-20% ديتأثر بالحرارة و يكون سائل
- Liquids at cool temp and gels at room or body temp.
- PLO gel: look it up



إذا تم وضعه بدرجة حرارة باردة فإنه يتحول إلى سائل

تسبب الاحتضار

Packaging ^{ممنوع} freezing

• Gels generally are stored in tight containers at refrigerated or room temperature

مناسبة
(عقد)

• Patients prefer gels that appear clear, water washable, sparkle, water soluble, and greaseless

• Tubes, jars, squeeze bottles, pump dispensers

Observing formulations for evidence of instability:

حالات أن الجل غير قابل للإستخدام

instability:

- Gels should be observed for shrinkage, separation of liquid, discoloration, and microbial contamination

رغم ذلك على المدى

TABLE 11.2: COMMON PRESERVATIVES USED IN GELS

الأشياء المهمة

Preservative	Concentration (%)	Appearance
Benzalkonium chloride	0.01–0.1	clear – cloudy
Sodium benzoate	0.01–0.1	clear – cloudy
Methylparaben	0.18	clear
Propylparaben	0.02	clear
Thimerosal	0.01–0.1	clear

- Preservatives are recommended for gels

بما أنه في ماء لازم نحتفظ

- Carbomer polymers are quite hygroscopic store

لازم تجده عند الماء

عند التخزين