Pharmaceutical and Cosmetic Preparations

3rd Stage

College of Pharmacy

Lecture: 1- Emulsions (part 1)

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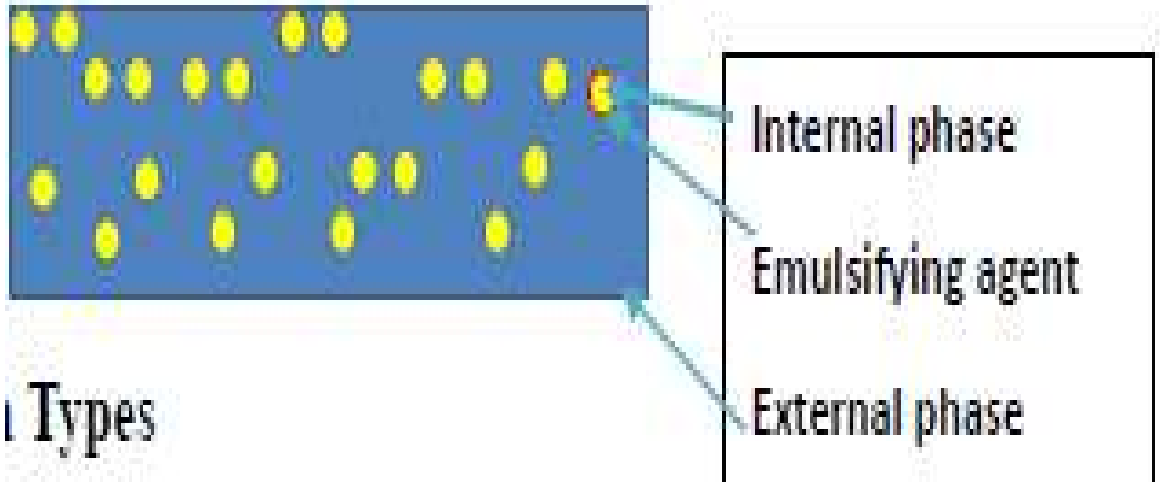
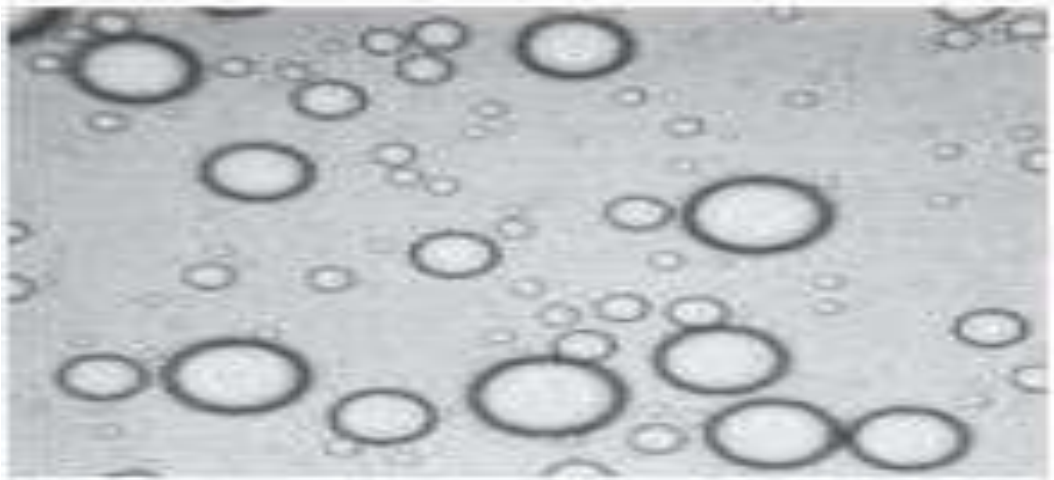
Emulsions

- An emulsion is a thermodynamically unstable disperse system consisting of two immiscible liquids, one of which is distributed throughout the other in minute globules (droplets).

➢ in emulsion terminology, the dispersed phase is the internal phase, and the dispersion medium is the external or continuous phase.

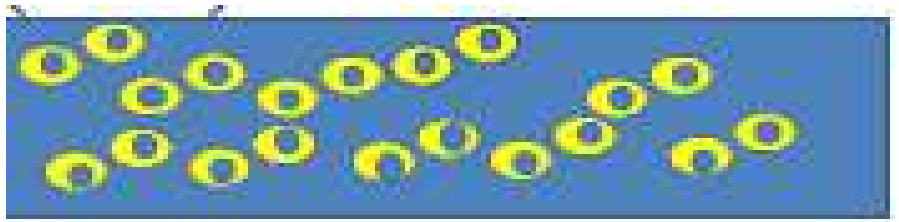
- Generally, to prepare a stable emulsion, a third phase, an **emulsifying agent**, is necessary.



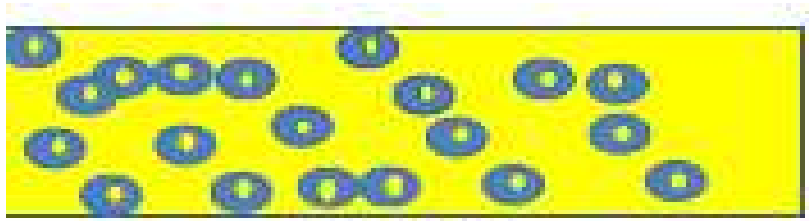


Emulsion Types

1. **Oil-in-Water (o/w) Emulsions:-**
   - In **o/w** emulsions, the internal phase consists of an oleaginous or oily component, dispersed within an aqueous external phase.
2. **Water-in-Oil (w/o) Emulsions:-**
   - In **w/o** emulsions, the internal phase consists of water or an aqueous component, dispersed within an oleaginous external phase.
   - Because the external phase of an emulsion is continuous :
     - An o/w emulsion may be diluted or extended with water or an aqueous preparation and a w/o emulsion, with an oleaginous or oil-miscible liquid.
3. **Multiple emulsions:**
   - Multiple emulsions have multiple layers of dispersed and continuous phases, including both oil-in-water-in-oil (o/w/o) and water-in-oil-in-water (w/o/w) structures.



W/O/W



O/W/O

Macroemulsions vs. Microemulsions

- Microemulsions can be formed spontaneously by agitating oil and water *phases with carefully selected surfactants*.
  - The **type of microemulsion** produced depends on the properties of the oil and surfactants used.
  - Microemulsions have significantly **smaller** droplets compared to macroemulsions, with diameters ranging from 100 Å to 1,000 Å.
  - In contrast, macroemulsions have larger droplets, around 5,000 Å in diameter.
  - Both o/w and w/o microemulsions can be formed based *on the oil and surfactant properties*.
- Microemulsions offer **advantages** in oral drug delivery, providing more rapid and efficient absorption compared to solid dosage forms.
- Microemulsions **enhance** transdermal drug delivery by facilitating increased diffusion into the skin.
  - The small droplet size of microemulsions promotes efficient absorption through the skin barrier

Macroemulsions vs. Microemulsions

Feature	Macroemulsions	Microemulsions
Droplet size	Large (~5000 Å)	Very small (100–1000 Å)
Formation	Requires energy/agent	Spontaneous with surfactants
Stability	Thermodynamically unstable	Thermodynamically stable
Appearance	White opaque	Cloudy – translucent or transparent

Determination tests of the emulsion type

1. Miscibility test

- **o/w** emulsion remain stable upon dilution with **water**, but will not remain homogenous upon addition of **oil** and vice versa

2. Staining test

- Addition of oil soluble stain to the emulsion of unknown type on a glass slide under microscope
  - Staining globules and colorless medium= o/w emulsion
  - Staining background and colorless globules = w/o emulsion

3. Conductivity test

- Water conduct electricity, hence an emulsion in which **water forms** the continuous phase acts as a conductor.
- Oil is a non-conductor and emulsion in which forms the external phase act as non-conductor.

Classification of emulsions according to the physical state

- Emulsions can be formulated as:
  - **Liquid**
  - **Semisolids**
    - **According to the route of administration**
- **Liquid emulsions may be employed**:
  - **Orally**: o/w for example, castor oil emulsion
  - **Topically**: for example lotion
  - **Parenterally**: (**I.V. o/w**) (I.M. and S.C. may be w/o)
- **Semisolid emulsions**
  - **Topically**: for examples, ***lotions, creams and liniments***

The choice between o/w and w/o emulsions depends on many factors such as:

1. The nature of therapeutic agents
2. Desired effects
3. The intended route of administration

Purpose and Benefits of Emulsions

- **Improved Drug Administration:**
  - Emulsification allows the pharmacist to create stable mixtures of two immiscible liquids, enabling the administration of a liquid drug in the form of minute globules (introducing of many ingredients in different phases as liquid dosage form).
  - ➢ **Orally administered emulsions**, are always in the form of **o/w** emulsions. They can **improve** the *palatability of drug administration by dispersing it in a sweetened, flavored aqueous vehicle (taste masking).*
  - **o/w** emulsion *act as carrier for lipophilic drugs*, enabling the oil soluble drug to dissolved in the dispersed phase and potentially **enhance oral bioavailability**
  - ➢ **Sterile I.V. o/w emulsions** are used for administration of nutritive oil and oil soluble vitamins to the patients unable to ingest food. *Intravenous Emulsions **Must** Be O/W*.
  - ➢ **Intramuscular and subcutaneous injections CAN BE** formulated as **w/o** emulsions. In such oily emulsions, the drug's effects are prolonged, as the drug must diffuse from the aqueous dispersed phase through the external oil phase to reach the tissue fluids.

- **Emulsions for topical** use can be either **o/w or w/o**, **depending** on the *nature of therapeutic agents, the desired effects, and skin conditions.*
  - An **o/w** emulsion is more *easily removed from the skin with water, making it suitable when easy removal is required*. Medicinal agents that irritate the skin generally are less irritating in the internal phase of an emulsified topical preparation than in the external phase.
  - **w/o** emulsions *are more softening to the skin, resisting drying and removal by contact with water.*
  - The diminished particle size of the internal phase in emulsions can enhance **percutaneous absorption** (absorption through the skin), making them a valuable choice for dermatological formulations.

The acceptable emulsion is characterized by the following:

1. The globules of dispersed phase must be remain uniformly distributed throughout the continuous phase
2. The formulation should have a pleasing appearance and texture
3. For oral administration, the flavor must be appropriate
4. For external application, the formulation must be easily spread over the affected area
5. Physically stable (shows no signs of flocculation, creaming, sedimentation and coalescence)
6. Absence of deterioration by microorganisms

Disadvantages of emulsions

1. Pharmaceutical emulsions, being thermodynamically unstable, require careful formulation to prevent the separation of their two phases.
2. Before measuring a dose, it is essential to shake the emulsion thoroughly. Even with efficient shaking, the accuracy of the dose is likely to be lower compared to solutions.
3. Storage conditions may affect the disperse system, potentially causing creaming or cracking
4. There is a possibility of microbial contamination, which can further lead to **cracking** issues
5. In comparison to solid dosage forms, liquid dosage forms, such as emulsions, tend to be more **bulky**

Gibbs free energy in an emulsion

$\Delta G = \Delta A \gamma$

A is the total surface area of dispersed particles

γ is the interfacial tension

- Stable emulsions must have a large "A" and a small "G" concurrently for consistent and uniform dosing. This is done by decreasing "γ," which will decrease "G," which will decrease self-attraction of dispersed phase particles

Theories of Emulsification

- There are many theories of emulsification:
  1. **Surface Tension Theory:**
     - All liquids tend to minimize their surface area by forming spherical shapes, which is the shape with the least surface area.
     - Surface tension measures this tendency and represents a force that resists the formation of smaller droplets when two immiscible liquids come into contact.
       - Emulsifying agents, often called surfactants or wetting agents, ***reduce*** *interfacial tension* ***and*** *diminish the liquids' attraction to their own molecules* (reducing the repellent force between the liquids and diminishing each liquid's attraction for its own molecules).
       - **This theory suggests** that ***emulsifiers*** *lower the interfacial tension between immiscible liquids, thus, the surface-active agents* ***facilitate the breaking up of large globules into smaller ones****, which then have a lesser tendency to reunite or coalesce*

Theories of Emulsification

2. Oriented-Wedge Theory:

- This theory is based on the idea that *emulsifying agents form monomolecular layers around the droplets of the internal phase*.
- The theory is based on the assumption that certain emulsifying agents orient themselves about and within a liquid in a manner reflective of their solubility in that particular liquid.
  - In a system containing two immiscible liquids, probably the emulsifying agent is preferentially soluble in one of the phases and is embedded more deeply in that phase than the other.
  - Because many molecules of substances have a hydrophilic or water-loving portion and a hydrophobic or water-hating portion, *the molecules position or orient themselves into each phase.*
- **Emulsifying** agents with a greater hydrophilic character tend to promote o/w emulsions, while those with a more hydrophobic character favor w/o emulsions.
- The phase in which the emulsifier is more soluble becomes the continuous phase of the emulsion.

Theories of Emulsification

3. Plastic or Interfacial Film Theory:

- This theory places **emulsifying agents** at the interface between the immiscible liquids, *forming a **thin film** adsorbed on the surface of internal phase droplets*.
  - The film acts as a barrier, preventing contact and coalescence of the dispersed phase.
  - The stability of the emulsion depends on the toughness and flexibility of this film.
  - The degree of solubility of the emulsifying agent in the two phases determines whether o/w or w/o emulsions are formed.

Preparation of Emulsions

Factors Affecting Emulsion Formation:

- The **stability and characteristics** of an emulsion are influenced by the following factors:
  - **Emulsifying agents**
  - **pH**
  - **The ratio of internal to external phases**.
  - The success of emulsions depends on the ***careful selection of emulsifying agents and understanding their properties***. The initial step in preparation of an emulsion is selection of the emulsifier.
  - **Criteria for Selecting Emulsifying Agents:**
    1. **Compatibility**:Emulsifying agents must be compatible with other formulation ingredients and should *not interfere with the stability* or efficacy of the therapeutic agent.
    2. **Stability**:Emulsifying agents should be stable and not deteriorate during the preparation or storage of the pharmaceutical product.
    3. **Safety:** Emulsifiers should be nontoxic and safe for consumption by the patient, and they should possess minimal odor, taste, or color.
    4. **Promotion of Emulsification:** A crucial role of emulsifying agents is to promote emulsification, *ensuring that the two immiscible phases are dispersed effectively*.

Common Types of Emulsifying Agents

1. Carbohydrate Materials:

- **Naturally occurring agents** like acacia, tragacanth, agar, chondrus, and pectin are used. These materials form hydrophilic colloids. They typically form o/w emulsions.
- **Acacia** is often used in *extemporaneous emulsions*.
- Tragacanth and agar are commonly employed as thickening agents in acacia-emulsified products.
- Microcrystalline cellulose is employed in a number of commercial emulsions as a viscosity regulator.

2. Protein Substances:

- Gelatin, egg white, and casein are examples of protein-based emulsifiers that produce **o/w** emulsions.
- **Gelatin**, *while effective, can lead to emulsions that become more fluid over time*.

Common Types of Emulsifying Agents

3. High Molecular Weight Alcohols:

- Substances like stearyl alcohol, cetyl alcohol, and glyceryl monostearate are primarily used as thickening agents and stabilizers for o/w emulsions in **external applications**.
- Cholesterol and cholesterol derivatives may also be employed in externally used emulsions to promote **w/o emulsions**

4. Surfactant::

- These agents are **amphiphilic molecules** having hydrophilic heads and lipophilic tails, staying at the interface, the hydrophilic heads may be anionic, cationic, or nonionic.
- **Anionic and cationic agents** tend to neutralize each other and are considered incompatible, while nonionic emulsifiers show no inclination to ionize.
- **Depending** on their individual nature, certain members of these groups form o/w emulsions and others w/o emulsions
  - **Anionic emulsifiers** include :
    - ❑ **various monovalent, polyvalent, Organic soaps**, such as triethanolamine oleate,
    - ❑ **Sulfonates**, such as sodium lauryl sulfate.
  - **Cationic emulsifier**, such as Benzalkonium chloride (known primarily for its bactericidal properties)
  - **Nonionic emulsifiers**, such as span and tween

Common Types of Emulsifying Agents

5. Finely Divided Solids:

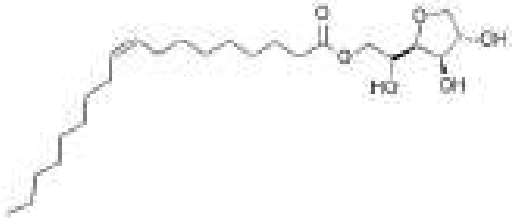
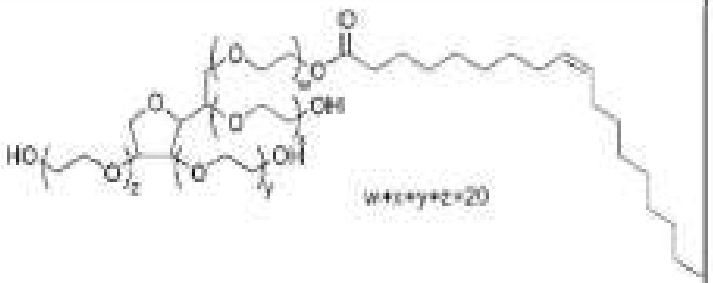
- **Colloidal clays** such as bentonite, magnesium hydroxide, and aluminum hydroxide can form oil-in-water (o/w) emulsions when the insoluble material is added to the aqueous phase, **provided** that the volume of the aqueous phase is greater than that of the oleaginous phase.
- If the powdered solid is added to the oil and the *oleaginous phase volume predominates*, a substance such as bentonite is capable of forming a **w/o emulsion**.
- The relative volume of internal and external phases is critical for their effectiveness.

Mechanisms of action of emulsifying agents

Type	Example	Mechanism of action
Monomolecular	Potassium laurate Tween	Coherent flexible film Lower interfacial tension stabilizes the emulsion
Multimolecular	Acacia Gelatin	Strong, rigid film formed by hydrocolloid, which produces O/W emulsion Stability due to the mechanical strength of the multi-molecular film at the interface, which prevents coalescence
Solid particles	Bentonite Magnesium hydroxide	A film formed by ionized solid particles that are small in size compared to droplets of the dispersed phase Particles are wetted by both phases to some extent to remain on the interface, forming an electrical barrier.

Table 1: Synthetic surface-active emulsifying agents

Class	Example	Structure	Emulsion type	Route of administration
Anionic				
Alkyl sulfates	Sodium lauryl sulfate	$C_{12}H_{25}OSO_3^-Na^+$	Oil in water	Topical
Monovalent salts of fatty acids	Sodium stearate	$C_{17}H_{35}COO^-Na^+$	Oil in water	Topical
Divalent salts of fatty acid	Calcium oleate	$(C_{17}H_{35}COO^-)_2Ca^{2+}$	Water in oil	Topical
Cationic				
Quaternary ammonium compounds	Cetrimide	$C_{16}H_{33}N^+(CH_3)_3$	Oil in water	Topical

Nonionic				
Alcohol polyethylene glycol ethers	Cetomacrogol 1000	$CH_3(CH_2)_n(OCH_2CH_2)_mOH$ n = 15 or 17; m = 20–24	Oil in water	Topical
Fatty acid polyethylene glycol esters	Polyethylene glycol 40 stearate	$CH_3(CH_2)_{16}CO(OCH_2CH_2)_{40}OH$	Oil in water	Topical
Sorbitan fatty acid esters	Sorbitan monooleate (Span 80)		Water in oil	Topical
Polyoxyethylene sorbitan fatty acid esters(polysorbates)	Polyoxyethylene sorbitan monooleate (Tween 80)		Oil in water	Topical Parenteral

Polymeric				
Poly oxy-ethylene–poly oxy-propylene block copolymers	Poloxamers (Pluronic F-68)	OH(C2H4O)a(C3H6O)b(C2 H4O)a	Oil in water	Parenteral
Fatty amphiphiles				
Fatty alcohols	Cetyl alcohol	C16H33 OH	Water in oil	Topical
Fatty acid	Stearic acid	C16H33COO−H+	Water in oil	Topical
Monoglycerides	Glyceryl monostearate		Water in oil	Topical

Emulsifying agents of natural origin

Class	Example	Emulsion type	Route of administration
Polysaccharide	Acacia	Oil in water	Oral
	Methyl cellulose	Oil in water	Oral
Phospholipids	Purified lecithin (egg yolk)	Oil in water	Oral parenteral
Sterol	Wool fat	Water in oil	Topical
	Cholesterol and its esters	Water in oil	Topical
Finely divided solid	Bentonite	Oil in water Water in oil	Topical
	Aluminum hydroxide	Oil in water	Oral

Mixing immiscible liquids

- All liquids have a tendency to assume a shape with the minimal surface area exposed.
- For a drop of a liquid, that shape is a sphere.
- It possesses internal forces that tend to promote the association of the molecules to resist the distortion of the sphere.
- When a liquid is in contact with a second liquid in which it is insoluble and immiscible, *the force causing each liquid to resist breaking up into smaller particles is called the interfacial tension*.
- Substances that **reduce** tension are surface active (surfactants) or wetting agents or some select categories of emulsifying agents.

Mixing immiscible liquids

- The mixing of two immiscible liquids requires the subdivision of one of the phases into globules, which are then distributed throughout the bulk of the fluid.
- The process usually occurs by stages during which the large globules are successively broken into smaller ones.
- Two primary forces come into play here:

  (a) the interfacial tension of the globules in the surrounding liquid

  (b) The forces of shear within the fluid mass.

  - The former tends to resist the distortion of globule shape necessary for fragmentation into smaller globules, whereas the forces of shear act to distort and ultimately disrupt the globules.
  - The relationship between these forces largely determines the final size distribution in the mixture.
  - Multiphase mixing generally involves the use of high shear and low flow to create droplets of one liquid in another.

Hydrophilic-Lipophilic Balance (HLB) System:

- Generally, each emulsifying agent has a hydrophilic portion and a lipophilic portion, with one or the other being more or less predominant and influencing in the manner already described the type of emulsion.
- A method has been devised whereby **emulsifying agent** may be **categorized** on the basis of their chemical makeup as to **their hydrophilic-lipophilic balance**, or **HLB**.
- By this method, each agent is assigned an HLB value or number indicating the substance's polarity (the numbers have been assigned up to about 40).
- The usual range is between **1 and 20**.
- Each surfactant have an HLB number representing the relative proportions of the lipophilic and hydrophilic parts of the molecule
  - Materials that are highly polar or hydrophilic have been assigned higher numbers than materials that are less polar and more lipophilic.
  - Materials with **HLB values** of 3 to 6 are **highly lipophilic** and favor **w/o** emulsions.
  - **HLB** values of about 8 to 18 correspond to emulsifying agents favoringo/w emulsions.

Activity	Assigned HLB
Antifoaming	1-3
Emulsifiers (w/o)	3-6
Wetting agents	7-9
Emulsifiers (o/w)	8-18
Solubilizers	15-20
Detergents	13-16

Hydrophile–lipophile balance values for some pharmaceutical surfactants		
Commercial name	Pharmacopoeia name	HLB value
Span 85	Sorbitan trioleate	1.8
Span 80	Sorbitan oleate	4.3
Span 60	Sorbitan monostearate	4.7
Span 20	Sorbitan monolaurate	8.6
Brij 98	Polyoxyethylene 10 stearyl ether	12
Tween 60	Polysorbate 60 (polyoxyethylene 20 sorbitan monostearate)	14.9
Tween 80	Polysorbate 80 (polyoxyethylene 20 sorbitan oleate)	15
Cetomacrogol 1000	Macrogol cetostearyl ether	15.7
Tween 20	Polysorbate 20 (polyoxyethylene 20 sorbitan monolaurate)	16.7
	Potassium oleate	20
	Sodium dodecyl sulfate (sodium lauryl sulfate)	40

Required HLB

- To ensure **emulsion stability**, it is necessary to select emulsifying agents having the same or nearly the same HLB value as the oleaginous phase of the intended emulsion.
- Certain emulsifying agents of a given HLB value appear to work best with a particular oil phase and this has given rise to the concept required HLB value for any oil or combination of oils.
- **All oils**, **waxes and other materials** likely to be incorporated into emulsions have an individual "**Required HLB**."
- For example, mineral oil has an assigned HLB value of **4** if a w/o emulsion is desired and a value of 10.5 if an o/w emulsion is to be prepared.
- **Hydrophilic-lipophilic balance (HLB) method** is used for *calculating the relative quantities of SAA (emulgents) that necessary for producing a physically stable emulsion*.

Blending Emulsifying Agents and Calculations in the HLB System:

- **Stability** is **achieved** by selecting ***emulsifying agents*** *with* ***HLB values similar to the intended emulsion.***
- Combining two or more emulsifiers may be necessary to achieve the required HLB value.
  - HLB values are additive, allowing the blending of surfactants to achieve the desired total HLB value.
- The HLB of a mixture of surfactants, for example, a mixture consisting of A and B surfactants:

  Total =1

  If fraction A = x

  Then fraction B = 1-X

  Total HLB= HLB_A (x) + HLB_B(1 - x)
- Calculation the HLB for a mixture of surfactants is assumed to be an algebraic summation of the two HLB numbers
  1. Multiply the HLB of each surfactant by its fraction.
  2. Add the obtained values to get the total HLB

  Total HLB = HLB_A (X) + HLB_B (1-X)

Example: In the Blending two surfactants, what is the ratio of each surfactant? Surfactant A with an HLB value of 8.0, surfactant B with an HLB value of 12.0 to achieve a **total HLB value** of 9.0.

If fraction **A = x**

Then fraction **B = 1-X**

Total HLB = HLB_A (X) + HLB_B (1-X)

9 = 8(X) + 12(1-X)

Fraction A = X= 0.75

Fraction B =1-X = 1- 0.75 =0.25

(3: 1)

Example:

A formulator is required to formulate an o/w emulsion of the basic formula:

Liquid paraffin 50 g

Emulsifying agents (required HLB 10.5) 5 g

Water to 100 g

Calculate the fraction of Tween 80 (HLB of 15) and Span 80 (HLB of 4.3) used to produce a physically stable liquid paraffin emulsion.

- If fraction of tween 80 =X
- Then fraction of span 80 =1-X

HLB mixture = HLB_A (X) + HLB_B (1-X)

10.5= 15 * (x) + 4.3 *(1-x)

X=0.58 fraction of A (tween 80)

1-0.58=0.42 fraction of B (span 80)

0.58* 5 g = 2.9 g of tween 80

0.42 * 5 g = 2.1 g of span 80

Summary of the lecture

What is an Emulsion?

- An **emulsion** is a **liquid dosage form** consisting of **two immiscible liquids** (usually oil and water), where **one liquid is dispersed as small droplets in the other**.

➢ The liquid present as droplets → **Dispersed (Internal) phase**

➢ The liquid surrounding the droplets → **Continuous (External) phase**

➢ Because oil and water do not mix naturally, a **third component (emulsifying agent)** is required.

● Emulsions are **thermodynamically unstable systems**, meaning they require careful formulation to remain stable.

Types of Emulsions

Oil-in-Water (o/w)

- Oil droplets in water.
- Can be diluted with water.
- Used orally, intravenously, and in lotions.

Water-in-Oil (w/o)

- Water droplets in oil.
- Can be diluted with oil.
- Used topically for skin softening, or in some injections.

Multiple Emulsions

- Complex structures like o/w/o or w/o/w.

Macroemulsions vs. Microemulsions

Feature	Macroemulsions	Microemulsions
Droplet size	Large (~5000 Å)	Very small (100–1000 Å)
Formation	Requires energy/agent	Spontaneous with surfactants
Stability	Thermodynamically unstable	Thermodynamically stable
Appearance	White opaque	Cloudy – translucent or transparent

Tests to Identify Emulsion Type

1. Dilution test

1. O/W → stable with water
2. W/O → stable with oil

2. Staining test

1. Oil-soluble dye stains oil phase
2. Stained droplets → O/W
3. Stained background → W/O

3. Conductivity test

1. O/W conducts electricity
2. W/O does not conduct

Advantages of Emulsions

- Allow administration of **oily drugs as liquids**
- improve **taste and palatability**
- Enhance **drug absorption**
- Permit **controlled or prolonged action**
- Useful in **nutrition (IV lipid emulsions)**

Disadvantages of Emulsions

- Physically unstable
- Must be **shaken before use**
- Risk of **microbial contamination**
- Bulky compared to solid dosage forms

Stability and Gibbs Free Energy

$\Delta G = \Delta A \gamma$ Where:

- **A** = surface area of droplets
- **γ** = interfacial tension

- To improve stability:
  - Reduce droplet size
  - Lower interfacial tension using emulsifiers

Theories of Emulsification

1. Surface Tension Theory

- Emulsifiers reduce interfacial tension→ easier mixing.
- Easier formation of small droplets

2. Oriented Wedge Theory

- Emulsifier orientation determines emulsion type
  - Hydrophilic emulsifiers → O/W
  - Lipophilic emulsifiers → W/O

3. Interfacial Film Theory

- Emulsifier forms a protective film around droplets → prevents droplet coalescence

Emulsifying Agents

Main Types

1.Natural agents

1. Acacia, tragacanth
2. Mostly O/W
3. Used orally

2.Proteins

1. Gelatin, casein
2. O/W emulsions

3.Surfactants

1. Anionic (e.g., sodium lauryl sulfate)
2. Cationic (e.g., cetrimide)
3. Nonionic (Span, Tween)

4.Finely divided solids

1. Bentonite
2. Can form O/W or W/O depending on conditions

5. High Molecular Weight Alcohols

- like stearyl alcohol
- be employed in externally to promote **w/o emulsions**

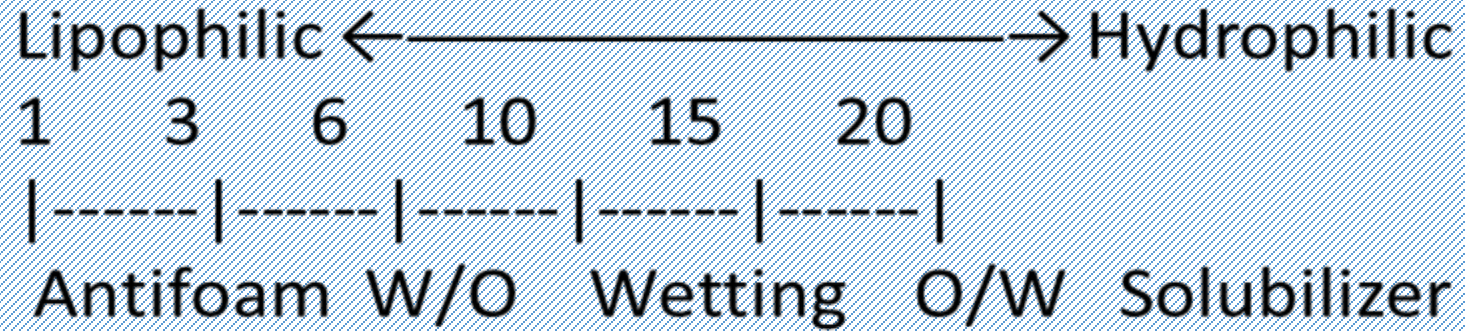
Formulation Tips

- An **emulsion** is a mixture of two liquids that don't normally mix (e.g., oil and water). To keep them stable, an **emulsifying agent** (surfactant) is added. Emulsions are **thermodynamically unstable** but can be stabilized by reducing **interfacial tension** and forming protective films around droplets.

- Choose emulsifier based on **compatibility, safety, stability**.
  - For oral/IV → use **o/w.**
  - For topical → can be **o/w** (easily washed) or **w/o** (more moisturizing).

HLB (Hydrophilic-Lipophilic Balance)

- **HLB** is a **numerical scale (1–20)** describing emulsifier behavior
- **Low HLB (3–6)** → promotes **w/o emulsions**.
- **High HLB (8–18)** → promotes **o/w emulsions**.
- Each oil has a **required HLB** for stable emulsification.
- You can **blend surfactants** to achieve the target HLB using the formula:
  Total HLB = (HLB_1 × $fraction_1$) + (HLB_2 × $fraction_2$).
- **Rule:**The emulsifier's HLB should match the **required HLB of the oil phase**



اسئله وزاریه

Which of the following emulsifying agents would be MOST suitable for preparing a water-in-oil (w/o) emulsion intended for topical use, considering its lipophilic nature?

a- Tragacanth
b- Acacia
c- Cholesterol
d- Sodium lauryl sulfate
e- None of them

Which of the following is related to the emulsifying agent polyoxyethylene 20 sorbitan monostearate?

a- It is cationic surface-active agent
b- Its HLB is lower than 7
c- It is nonionic SAA
d- It is span 80
e- It can form w/o emulsion

Gibbs Free Energy is more favorable when it is

a- high due to small globule size
b- high due to high interfacial tension
c- low due to high interfacial energy
d- low due to small globule size
e- low due to low interfacial energy

Microemulsions

A- are unstable to temperature changes
B- have droplet size larger than 100 µm
C- are transparent
D- need extensive energy to be formed
E- require freezing of the oil before production

Which theory of emulsification suggests that emulsifying agents form monomolecular layers around droplets of the internal phase?

a- Plastic Theory
b- Gibbs Free Energy Theory
c- Oriented-Wedge Theory
d- Surface Tension Theory
e- Interfacial Film Theory

Concerning Emulsifying agent, it must involve the following EXCEPT

a- Must be compatible with the other formula ingredients
b- Little odor, taste, or color
c- Non toxic
d- Not interfere with the stability and efficacy of the drug
e- High HLB value 3–6

Why o/w emulsions are the only emulsions that can be administered intravenously?

a- They are more stable than w/o emulsions.
b- They are less viscous than w/o emulsions.
c- They are miscible with blood plasma.
d- They are not sterilized than w/o emulsions.
E-They are more easly sterilized than w/o emulsions.

Concerning solid particles type of emulsifying agent

A- Emulsify the oil by forming an electrical barrier that aid in flocculation
B- Size of bentonite particles is larger than oil droplets
C- Forms a mechanical barrier due to large molecular weight of bentonite
D- Addition of high quantity will increase Gibbs free energy
E- Bentonite will always form O/W emulsion

Concerning the 3 tests to determine emulsion type

A- An intense color will appear upon staining O/W emulsion with a water soluble dye
B- An W/O emulsion will conduct electricity
C- Upon staining an O/W emulsion with a fat-soluble dye an intense color will be obvious
D- Milk is not miscible with water
E- Mayonnaise can conduct electricity

To identify the emulsion type, which of the following tests are used?

A- Dilution test
B- Dye test
C- Conductivity test
D- All the above
E- None of the above

Emulsion with (RHLB = 12) emulsified with a 5 g mixture of span (HLB = 6) and tween (HLB = 14) so, % of tween in the emulsifier phase will be

A- 85%
B- 25%
C- 75%
D- 80%
E- 50%

Emulsion is a mixture of

A- Solid in liquid
B- Gas in liquid
C- Liquid in liquid
D- Liquid in solid
E- None

Regarding surfactants, they can function as all of the following except,

A- Detergents
B- Antifoaming agents
C- Wetting agents
D- Viscosity enhancing agents
E- Solubilizing agent

In emulsions, Hydrophilic-lipophilic balance (HLB) method is used for calculating:

a- Degree of solubility of emulsifying agent
b- Quantities of emulsifying agents used
c- Ratio of internal to external phase
d- Quantities of oil phase and aqueous phase
e- Free energy of the emulsion

Which one of the following emulsifiers is used to stabilize the emulsion of W/O type?

a- Acacia
b- Tragacanth
c- Tween 20
d- Span 20
e- SLS

Liquid petrolatum (Required HLB 10.5) 50 g
Emulsifying agent, 3 g
Water qs 100 g

- Sorbitan monooleate (HLB 4.3), Polyoxyethylene 20 sorbitan monooleate (HLB 15.0)
- **The amount in gram of emulsifying agents is**

a- Sorbitan monooleate: Polyoxyethylene 20 sorbitan monooleate 1.18 : 1.74
b- **Sorbitan monooleate: Polyoxyethylene 20 sorbitan monooleate 1.26 : 1.74**
c- Sorbitan monooleate: Polyoxyethylene 20 sorbitan monooleate 1.8 : 1.26
d- Sorbitan monooleate: Polyoxyethylene 20 sorbitan monooleate 1.20 : 1.74
e- Sorbitan monooleate: Polyoxyethylene 20 sorbitan monooleate 1.24 : 1.8

The acceptable emulsion is characterized by the following:

a- The globules of dispersed phase must remain uniformly distributed throughout the continuous phase.
b- The formulation should have a pleasing appearance and texture.
c- For oral administration, the flavor must be appropriate.
d- Absence of deterioration by microorganisms.
e- All of the above.

which of the following point is True concerning sterile I.V emulsions

a- May be O/W or W/O type.
b- Must be W/O used for administration of oil soluble vitamins.
c- Must be W/O to prolong drug effect.
d- Must be O/W used for administration of oil soluble vitamins.
e- Must be o/w/o emulsion