

Experiment 5

Liquid dosage forms: Dispersed Systems Emulsions and Gels

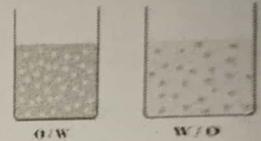
Emulsion

is a dispersion system consisting of two immiscible liquids, one of which (the disperse phase) is distributed throughout the other (the continuous phase) with the help of emulsifying agents.

- Pharmaceutical emulsions are prepared for:
Oral, external, parenteral and ophthalmic use as liquids or semisolids.

- Emulsions are generally divided into two types:

- ✓(1) Oil in water (o/w)
- ✓(2) Water in oil (w/o)
- ✓(3) Also there is a third type called multiple emulsion which available both as w/o/w or o/w/o.



The factors affecting the type of emulsion produced include the relative proportion of the two phases present and the type of emulsifying agent selected.

- Emulsions are prepared by dry gum method, wet gum method, or Forbes(bottle) method.

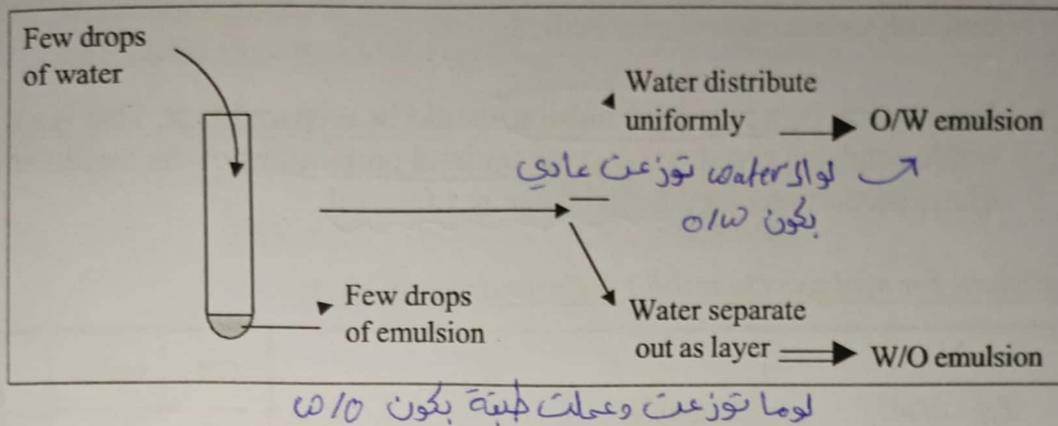
Differences between O/W and W/O emulsions

	Oil in water emulsion (o/w)	Water in oil emulsion (w/o)
1	Water is the dispersion medium and oil is the dispersed phase	Oil is the dispersion medium and water is the dispersed phase
2	They are non-greasy and easily removable from the skin surface	They are greasy and not water washable
3	They are used externally to provide cooling effect e.g. vanishing cream	They are used externally to prevent evaporation of moisture from the surface of skin e.g. Cold cream
4	Water soluble drugs are more quickly released from o/w emulsions	Oil soluble drugs are more quickly released from w/o emulsions
5	<u>Can be used for internal formulation especially for bitter taste drugs.</u>	They are preferred for formulations meant for <u>external use like creams.</u>
6	O/W emulsions give a positive conductivity test as water is the external phase which is a good conductor of electricity.	W/O emulsions do not give a positive conductivity test as oil is the external phase which is a poor conductor of electricity.

Very Important

↓ Determine the type of the prepared emulsion using Dilution test:

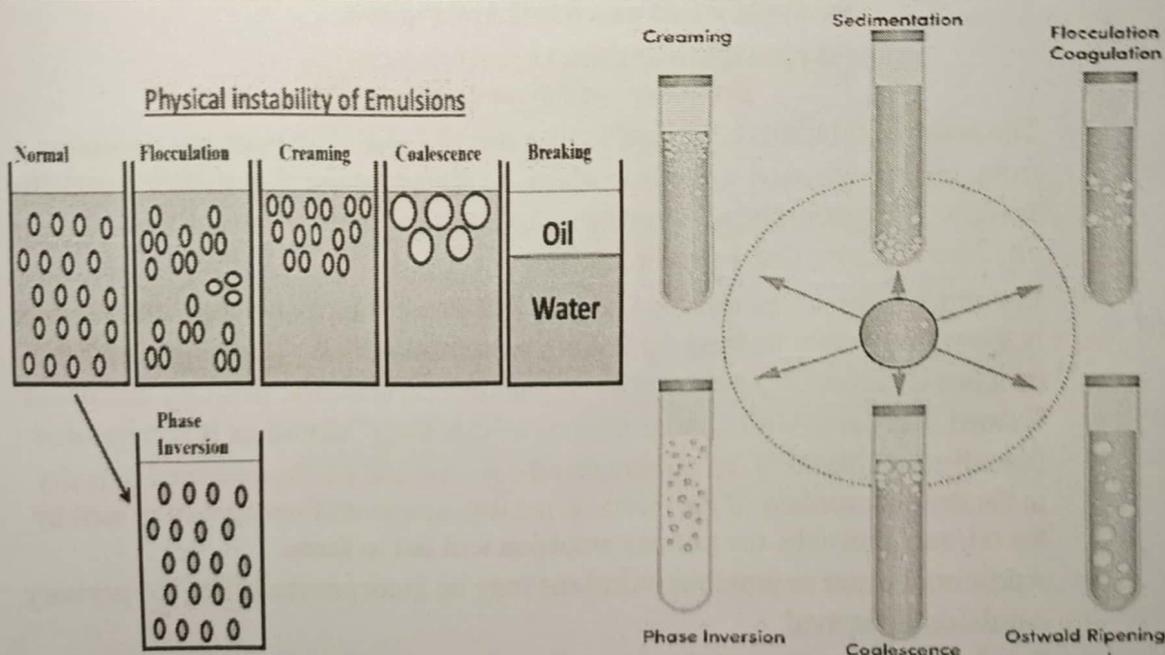
Oil in water emulsion can easily be diluted with an aqueous solvent whereas water in oil emulsion can be diluted with oily liquids.



↓ Packaging, Labeling and Storage of Emulsions

- Depending on the use, emulsions should be packed in suitable containers. Emulsions meant for oral use are usually packed in well filled bottles having an air tight closure. Light sensitive products are packed in amber colored bottles. For viscous emulsions, wide mouth bottles should be used.
- The label on the emulsion should mention that these products have to be shaken thoroughly before use. External use products should clearly mention on their label that they are meant for external use only. Emulsions should be stored in a cool place and freezing should be avoided as it can adversely affect the stability of preparation.

Self-reading: (Emulsion stability)



Oral emulsion preparation: dry gum and wet gum methods

↓ Emulsions for oral use

- **Acacia gum** is usually used when making **extemporaneous o/w emulsions** for oral use, unless otherwise specified.
- If using acacia, a **primary emulsion** should be prepared first. This is a thick stable emulsion prepared by using **optimal proportions of the ingredients**. These proportions vary with the nature of the oil.

Emulsions for oral use Quantities for primary emulsions

Type of oil	Examples	Oil	water	Gum (acacia)
		Parts by volume (ml)		Parts by weight (g)
Fixed <i>non-volatile</i>	Almond, arachis, cod liver, castor	4	2	1
Mineral (hydrocarbon)	Liquid paraffin	4	2	1

↓ Continental (Dry Gum, or 4:2:1) Method

Dry Gum Method / Continental Method

"4:2:1" Method

4 parts (volumes) of oils

2 parts of water

1 part of gum

In dry gum method **the oil is first triturated with gum & then water is added.**

- The continental method is used to prepare the initial or primary emulsion from oil, water, and a hydrocolloid or "gum" type emulsifier (usually acacia). The primary emulsion, or emulsion nucleus, is **formed from 4 parts oil, 2 parts water, and 1 part emulsifier.**
- In a mortar, the 1 part gum is levigated with the 4 parts oil until the powder is **thoroughly wetted**; then the 2 parts water are added **all at once**, and the mixture is **vigorously and continually** triturated until the primary emulsion formed is creamy white and produces a "cracking" sound as it is triturated (usually 3-4 minutes). **Make sure that the mortar and pestle are completely dry in the dry gum method.** If the mortar is not dry, **acacia will not be wetted well by the oil, and, probably, the primary emulsion will fail to form.**
- Additional water or aqueous solutions may be incorporated after the primary emulsion is formed.
- **Solid substances** (e.g., active ingredients, preservatives, color, flavors) are generally dissolved with water and added as a solution to the primary emulsion.
- **Oil soluble substance**, in small amounts, may be incorporated directly into the primary emulsion.

4 parts oil
↓
Powder
↓ wetted
add 2 parts of water at once

- Any substance which might reduce the physical stability of the emulsion, such as alcohol (which may precipitate the gum) should be added as near to the end of the process as possible to avoid breaking the emulsion.
- When all agents have been incorporated, the emulsion should be transferred to a calibrated vessel, brought to final volume with water, then homogenized or blended to ensure uniform distribution of ingredients.

Breaking
oil
water

↓ English (Wet Gum) Method

Wet Gum Method / English Method

4 parts (volumes) of oil
2 parts of water
1 part of gum

In wet gum method first gum triturated with water to form a mucilage & then oil added in small quantities.

- In this method, the proportions of oil, water, and emulsifier are the same (4:2:1), but the order and techniques of mixing are different.
- The 1 part gum is triturated with 2 parts water to form a mucilage; then the 4 parts oil is added slowly, in portions, while triturating. After all the oil is added, the mixture is trituated for several minutes to form the primary emulsion. Then other ingredients may be added as in the continental method.
- Generally speaking, the English method is more difficult to perform successfully, especially with more viscous oils, but may result in a more stable emulsion.

Difference Between Both Methods

→

Dry gum method	Wet gum method
Oil and water are added <u>at once</u>	Water is added to dissolve the gum then oil is added <u>dropwise</u> → very thick
If primary emulsion isn't formed, can't be corrected, therefore discard	If <u>ropy appearance</u> , stop oil addition and add few drops of water to maintain the emulsion

Formula (1):

Rx 100 ml mineral oil emulsion (Wet Gum method) U.S.P. 1980

$$F = \frac{100}{1000} = 0.1$$

Ingredients	Master formula	Scaled formula
Mineral oil (M.O.)	500ml	50 ml
Acacia	125gm	12.5 gm
Vanillin alcohol mixture	60 ml	6ml
Syrup	100ml	10 ml
Water up to	q.s. 1000ml	q.s. 100 ml

Procedure (Wet gum method):

To prepare the primary emulsion follow step 1-3

1. Put 12.5 gm (1 part) acacia in mortar, pour 25 ml (2 parts) of water, and triturate until a mucilage (sticky) is noticed.
2. Then pour 50 ml (4 parts) of oil portion-wise with vigorous unidirectional mixing.
3. Triturate until hearing the clicking sound and get a white emulsion (i.e., primary emulsion).

Then,

4. In a beaker, add the required volume of vanillin alcohol mixture, syrup, and few ml of water and mix well
5. Add the mixture in step 4 to the primary emulsion and mix.
6. Complete the volume with water in a measuring cylinder and mix with a glass rod.
7. Put it in a wide-mouth container.

Use of ingredients:

- (1) **Mineral oil:** laxative
- (2) **Acacia :** emulsifying agent (gum).
- (3) **Syrup :** sweetening agent
- (4) **vanillin :** flavoring agent.
- (5) **Alcohol:** preservative.
- (6) **Water:** aqueous phase, vehicle.

Labeling:

- Main label-:
- Auxiliary label:
Shake well before use, don't freeze

Storage:

Store in a cool, dry place (Avoid extreme temperatures). Store in a wide-mouthed container.
BUD 14 days if stored in cool and dry place, avoid freezing.

Use of preparation:

Laxative

Gels

Gel:

شفاف دهی

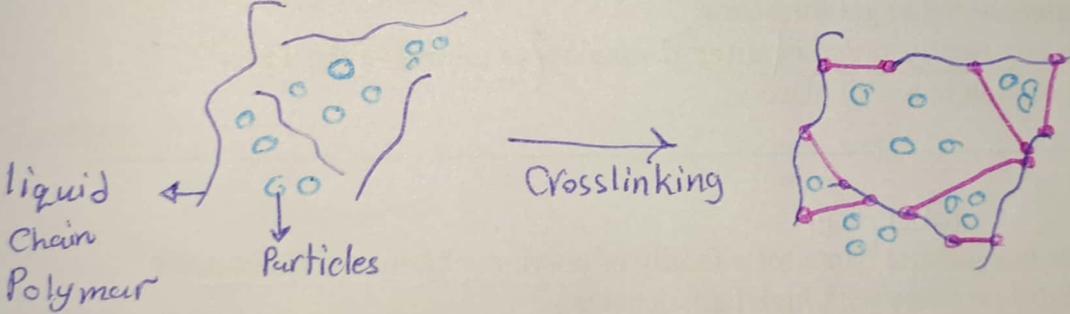
Is a transparent, translucent, non-greasy, semisolid preparation, applied externally.

- Gels are considered colloidal dispersion because they contain particles of colloidal dimension (1 micron - 100 microns)
- They are composed of small inorganic particles or large organic molecules in which the particles restrict movement of the dispersing medium by forming an interlacing three dimensional network of particles or solvated macromolecules
- Gels are made by using substances called gelling agent
- Gelling agent undergo extensive unfolding and enlargement when dissolved or dispersed in the dispersing medium
- This unfolding increases the viscosity of the dispersing medium and also restricts its movement
- Gels are useful as liquid formulations in oral, ophthalmic, nasal, topical, vaginal, and rectal administration
- By weight, gels are mostly liquid, yet they behave like solids due to a three-dimensional network within the liquid.
- It is the unfolding within the fluid that gives a gel its structure (hardness) and contributes to the adhesive stick.

dispersing Phase
interlacing 3D with dispersing medium

توسیع و تفکیک Soluable

بلاستی



Formula (2):

Rx. 25 gm Clindamycin Gel

Ingredients	Master formula	Scaled formula
Clindamycin	1gm	0.25 gm
Glycerol	20gm	5 gm
Isopropyl alcohol	20 ml	5 ml
Carbomer	0.8gm	0.2 gm
Triethanolamine (TEA)	0.8 ml	4 drops 0.2 ml
Water	q.s. 100gm	q.s. 25 gm

$$F = \frac{25}{100} = 0.25$$

$$1 \text{ ml} \rightarrow 20 \text{ drops}$$
$$0.2 \rightarrow 4 \text{ drops}$$

Procedure:

1. Weight ^{0.25} gm of clindamycin and dissolve it in ----- ml of water.
2. Weigh ----- g carbomer and add to the solution in step 2 in a portion wise. Mix until having a uniform dispersion.
3. Add isopropyl alcohol and mix
4. Add glycerin and mix
5. Add TEA drops and mix gently to avoid air bubbles.

Use of ingredients:

- (1) **Clindamycin:** antibacterial,
- (2) **Glycerin :** Humectant (emollient)
- (3) **Isopropanol:** preservative, co solvent, cleansing agent (organic solvent dissolve waxy layer on skin).
- (4) **Carbomer:** gelling agent, acidic and should be neutralized by a base (i.e. TEA)
- (5) **Triethanolamine (TEA):** neutralizing agent
- (6) **Water:** vehicle

Labeling:

- Main Label:
- Auxiliary label:
For external use only.

Storage:

Store in a cool place. Store in a wide-mouthed container or in proper tube.
Thirty days if stored in a cool and dry place.

Use of preparation:

For treatment of acne.