

Emulsion :-

Emulsion is a biphasic liquid dosage form it is mixture of two or more liquid that are normally immiscible with each other but using emulsifying agent. One liquid dispersed into other liquid as droplets.

ex: Milk (fat in water), Butter (water in oil), liquid paraffin (paraffin in water) etc.

* use of emulsion :-

(i) pharmaceutical application → Due to high bio-availability & absorption rate it is useful in the pharmaceutical industry. Mostly it is use for tropical preparations like cream, lotion etc.

(ii) paint industry → Emulsion paints & inks.

(iii) Cosmetic industry → There is huge application of emulsion in cosmetic industry.
ex: cream, lotion, etc.

(iv) Food industry → products like peanut butter, ice-cream etc are some examples of an emulsion which is used in food industry.

(v) Fire extinguisher → This is a high internal phase emulsion which is non-flammable so it is used as a fire extinguisher.

* Advantages:

- Helps in the masking of bitter taste of drug.
- Increase the bioavailability of the drug.
- Sustain release medication.
- Very cost effective.

* Disadvantages:

- Problem of creaming and sedimentation.
- phase inversion.
- problem of handling.

Classification of emulsion:

a) Simple emulsion \rightarrow In this droplet size increases from $0.2 \mu\text{m}$ to $100 \mu\text{m}$ & it is classified into two parts:

- (i) Oil in water emulsion (O/W)
- (ii) Water in oil emulsion (W/O)

b) Multiple emulsion \rightarrow It is of two types:-

- (i) Oil in water in oil (O/W/O)
- (ii) Water in oil in water (W/O/W)

c) Micro emulsion \rightarrow Size of droplet $10-200 \text{ nm}$ it is of two types:-

- (i) Oil in water micro emulsion (O/W)
- (ii) Water in oil micro emulsion (W/O)

Difference between oil in water (O/W) and water in oil (W/O) emulsion:-

O/W	W/O
<ul style="list-style-type: none"> For O/W emulsion, water is continuous phase and oil is dispersion phase. Less viscous and easily washable from the skin by water. 	<ul style="list-style-type: none"> For W/O emulsion, oil is continuous phase and water is dispersed phase. More viscous than O/W and not easily washable from the skin by water.

Dropule size of emulsion:

- 1) Macro emulsion droplet size usually extends 70 mm.
- 2) Mini emulsion droplet size usually 0.1 - 10 mm.
- 3) Micro emulsion droplet size usually 100 - 600 nm.
- 4) Nano emulsion droplet size usually 100 nm.

Classification of emulsion:

Based on route of administration:

- (i) Oral emulsion → castor oil, liquid paraffin.
- (ii) External emulsion → cream.
- (iii) Parenteral emulsion → vitamins.
- (iv) Rectal emulsion → Enemas.

Emulsifying agent:

The agent is a surface active substance to make an emulsion which is both fat and water soluble. It helps the dispersed phase to uniformly disperse in the continuous phase.

Ex: Natural emulsifying agent → Acacia, Tragacanth.
 Synthetic emulsifying agent → polysorbate 20, Sodium lauryl sulphate, polysorbate 80, Sorbitol Stearate, etc.

Classification of emulsifying agent:

1) Natural emulsifying agent:

a) vegetable source \rightarrow Agar, tragacanth, gum acacia, etc.

b) Animal source \rightarrow Wool fat, gelatins, etc.

2) Semi-synthetic emulsifying agent \rightarrow Methyl cellulose, sodium carboxymethyl cellulose.

3) Synthetic emulsifying agent:

a) Anionic emulsifying agent \rightarrow Sodium lauryl sulphate

b) Cationic emulsifying agent \rightarrow Benzal chloride.

c) Non-ionic emulsifying agent \rightarrow Glycerol ester

d) Inorganic emulsifying agent \rightarrow Milk of Magnesia

Method of preparation of emulsion:-

Evaluation of emulsion:

1) Dilution test: Important to know the solubility of the continuous phase of the emulsion.

Ex: In O/W emulsion a dilution test is done to know it is diluted with H_2O or not.

2) Conductivity test: Important to know which is a good conductor of electricity to find out the continuous phase.

Ex: In O/W emulsion H_2O is the continuous phase because water is a good conductor of electricity than oil.

3) Dye solubility test: It is done by mixing the emulsion with H_2O or an oil soluble dye and check under a microscope to know which is in a continuous phase or dispersed phase.

4) Fluorescence test: Oils have a property of fluorescence under UV light while H_2O doesn't. Therefore O/W emulsion shows a spotty pattern, while W/O emulsion fluoresces.