College of Pharmacy

PHARMACEUTICAL TECHNOLOGY II

Level 3

Second Semester

2022-2023

College of Pharmacy

PHARMACEUTICAL TECHNOLOGY II

Course code: 328

LCT : 3 LAB : 2 CNTCT : 5

Course Marks distribution

Midterm exam	**20 marks**
Practical exam	**14 Marks**
Quizzes & Report	**6 Marks**
Final exam	**60 Marks**
Total	**100 Marks**

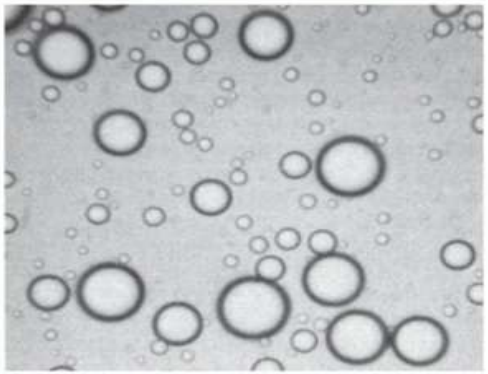
- **Report** should be delivered before 30 March 2023.
- **Quiz 1** (4 Marks) will be held on 11 March 2023.
- **Quiz 2** (4 Marks) will be held on 6 May 2023.

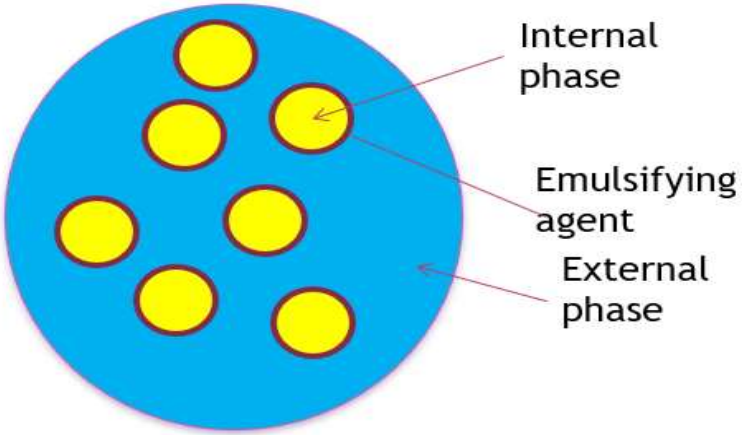
Contents

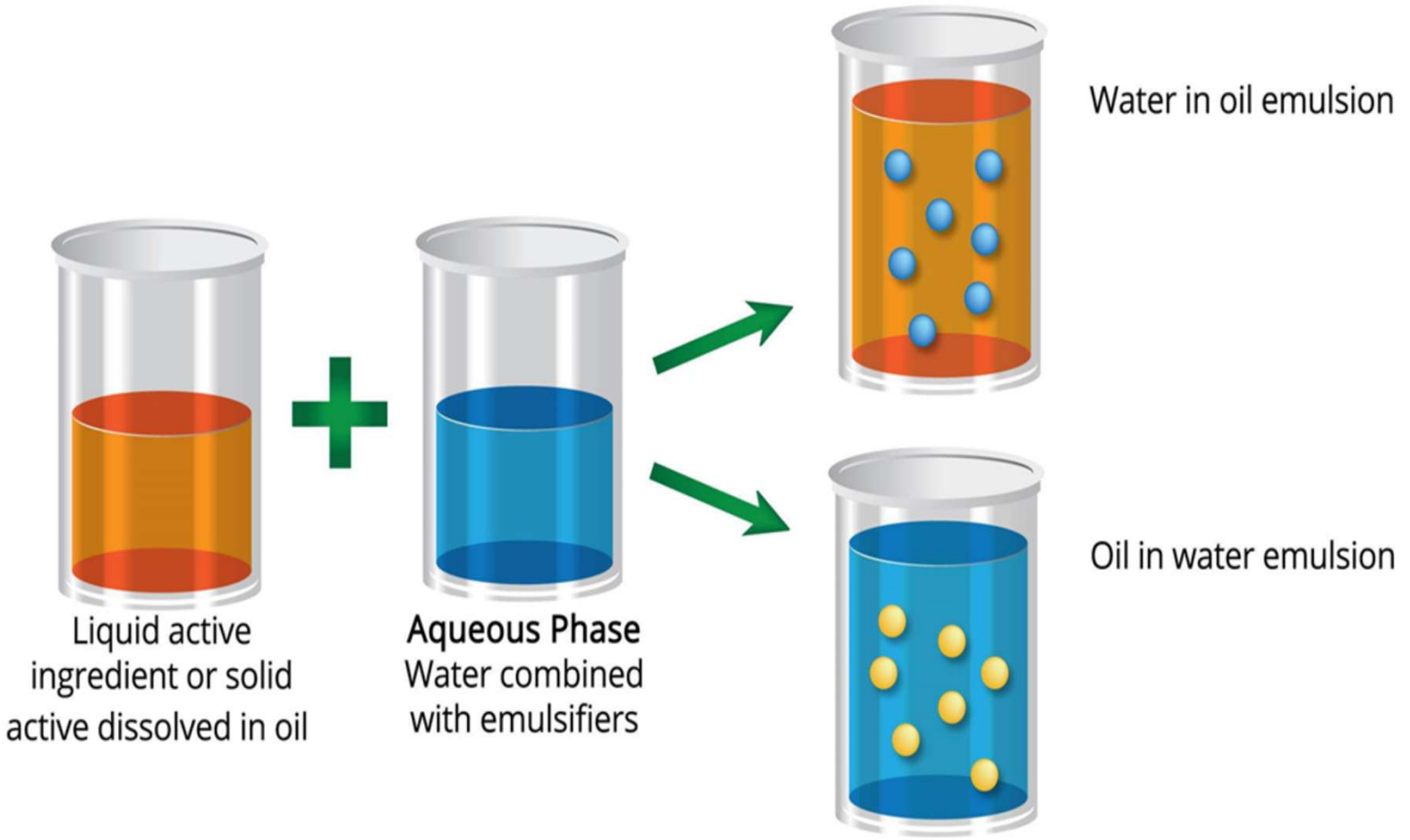
1. Emulsions.
2. Suppositories.
3. Powdered Dosage Forms.
4. Semisolid Dosage Forms.
5. Incompatibilities.

Emulsions

- An emulsion is **a thermodynamically unstable system consisting of at least two immiscible liquid phases one of which is dispersed as globules in the other liquid phase stabilized by a third substance called emulsifying agent.**
- The word "emulsion" comes from the latin Emulgere "to milk out", from *ex* "out" + *mulgere* "to milk".
- As milk is an emulsion of **fat** and **water** by colloidal **casein** micelles.



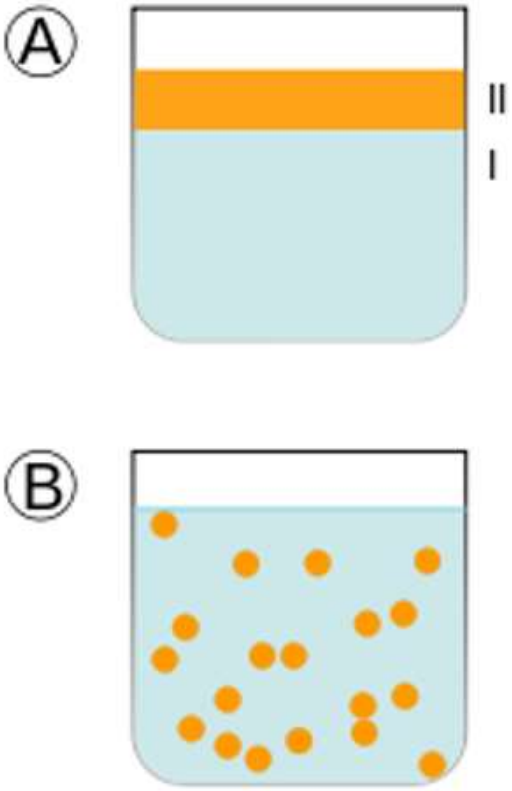



Water in oil emulsion
Oil in water emulsion
Liquid active ingredient or solid active dissolved in oil
Aqueous Phase
Water combined with emulsifiers

- The system is stabilized by the presence of an emulsifying agent.
- The dispersed liquid or internal phase usually consists of globules of diameters between 0.5 and 25 µm, which are distributed within the external or continuous phase.

- **Microemulsion**: Droplets size range is **1 – 500 nm**.
- **Macroemulsion**: Droplets size range is **more than 500 nm**.

- The **consistency** of emulsion system ranged from a **mobile liquid** to **semisolid**.



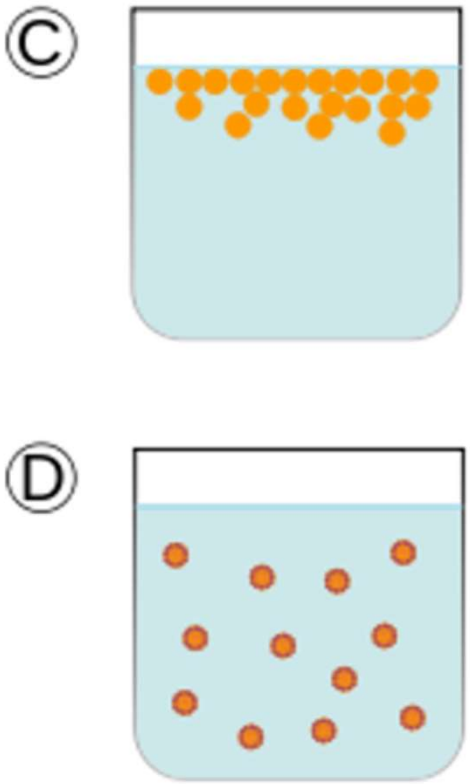
A.: Two immiscible liquids not emulsified.

B. An emulsion of phase B dispersed in Phase A.

C. Unstable emulsion slowly separates.

D. The emulsifying agent

(black film) places it self on the interface between phase A and phase B and stabilizes the emulsion.



- **Types of emulsion;**

1- Water in oil (w/o):

(water globules dispersed in oil phase)

2- Oil in water (o/w):

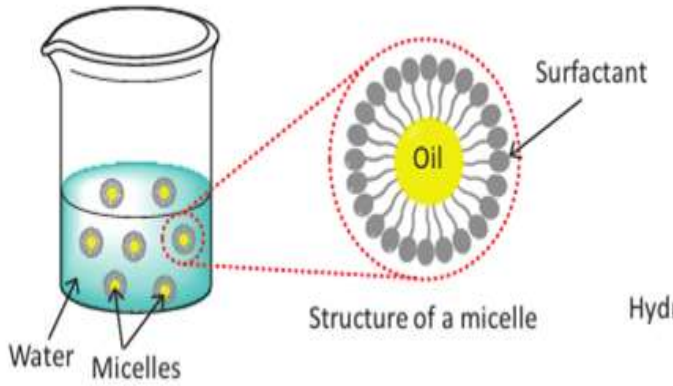
(oil droplets dispersed in water)

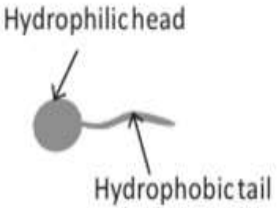
3- Multiple emulsion (w/o/w) or (o/w/o):

4- Micro emulsion: the dispersed globules (1 nm to 0.5 µm diameter), the preparation, is transparent.

	Internal phase (Dispersed phase)	External phase (Continuous phase)
O/W Oil in water	**Oil**	**Water**
W/O Water in oil	**Water**	**Oil**
W/O/W or **O/W/O**	**Multiple emulsion**	

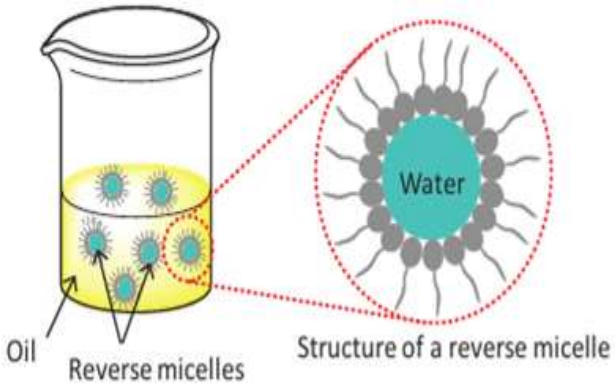
Oil in water microemulsion

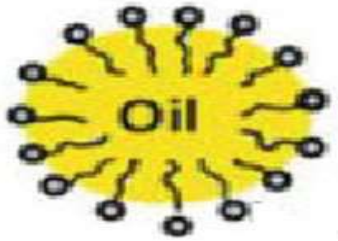




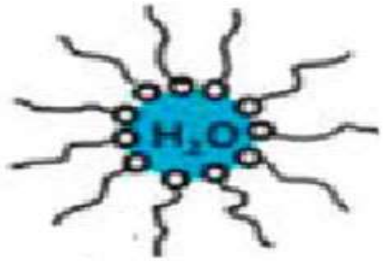
A surfactant molecule

Water in oil microemulsion

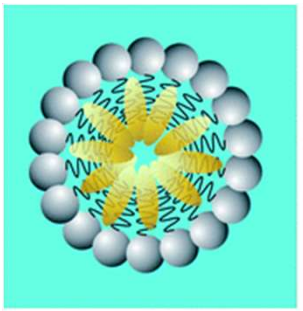




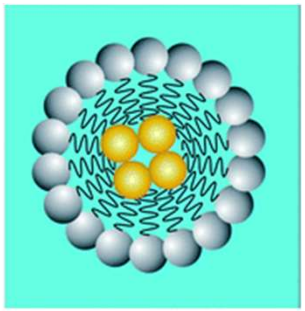
W/O microemulsion



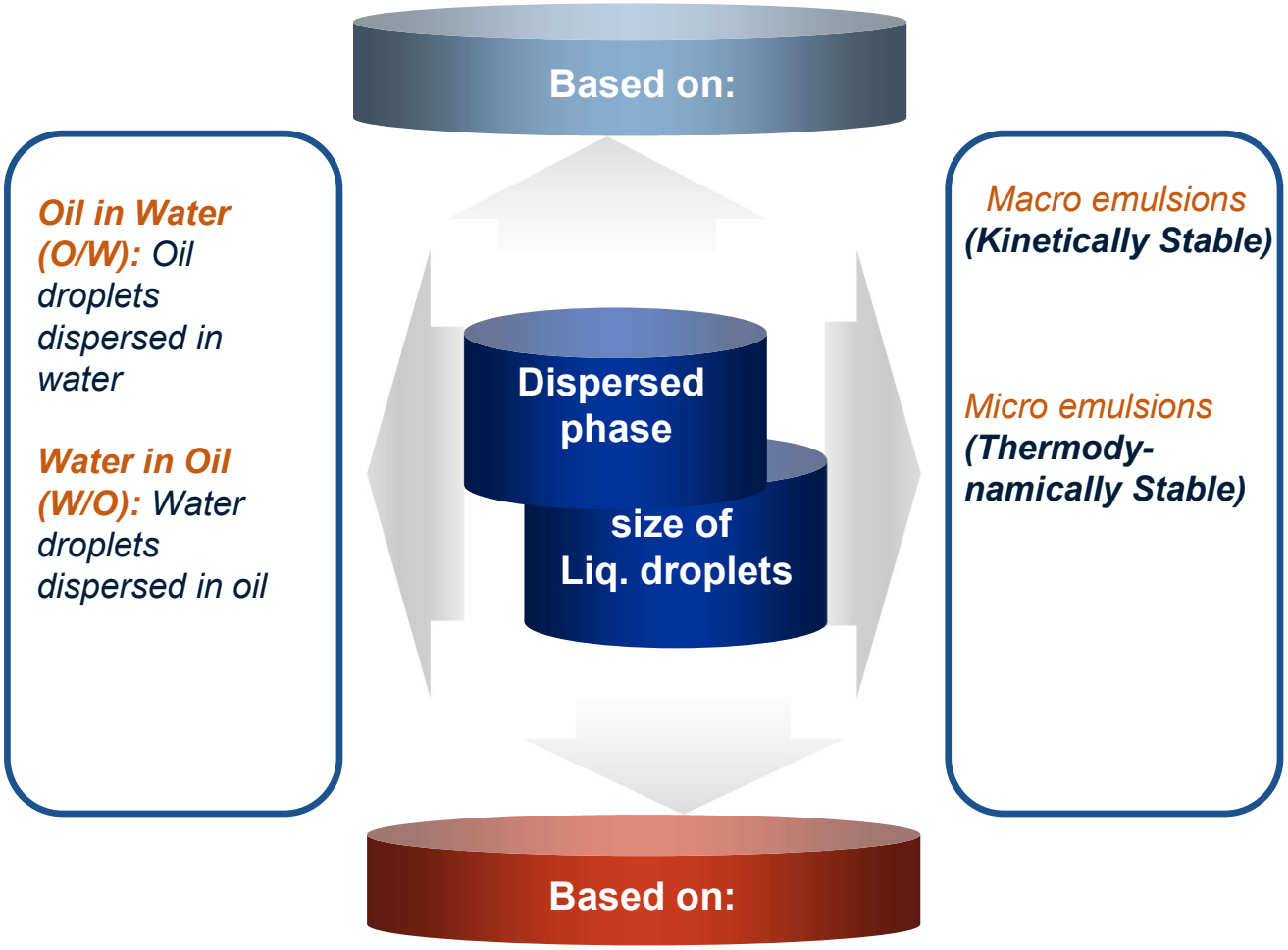
W/O microemulsion



Oil molecules incorporated between surfactant tails



Oil molecules incorporated as a hydrophobic core


Based on:
Oil in Water (O/W): Oil droplets dispersed in water
Water in Oil (W/O): Water droplets dispersed in oil
Dispersed phase
size of Liq. droplets
Macro emulsions (Kinetically Stable)
Micro emulsions (Thermody-namically Stable)
Based on:

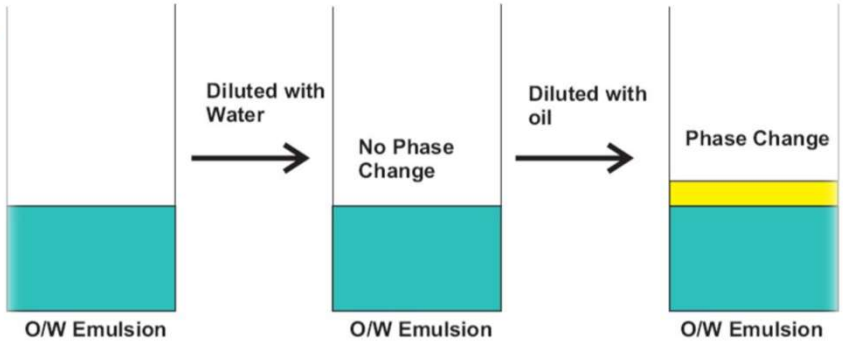
- **Phase-volume ratio:**

  is the **volume of the internal phase compared with that of the external phase.** The most stable emulsions have an internal phase occupying between 40 to 60 % and not more than 74% of the total volume of an emulsion.

Tests for identification of emulsion type:

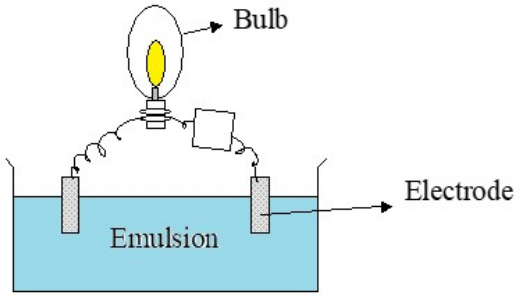
1- Phase dilution method: emulsion is miscible with liquids miscible with continuous phase.

Add few drops of water to the emulsion, if it mixes well, no separation i.e., o/w emulsion.



2- Electrical conductivity: aqueous continuous phase conduct electricity

- Conductivity i.e., o/w
- No conductivity i.e., w/o.

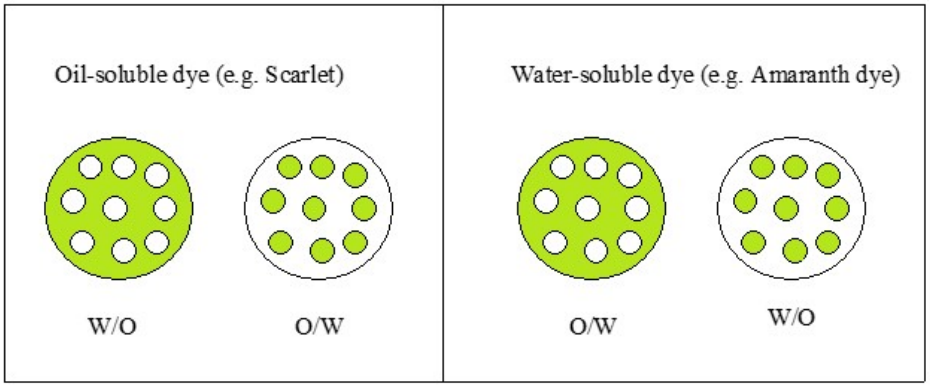


= Bulb glows with O/W
= Bulb doesn't glow with W/O

3- Dye method (microscopic examination): water or oil

soluble dyes are used. If the color spreads through the emulsion, the phase in which the dye is soluble is the continuous phase.

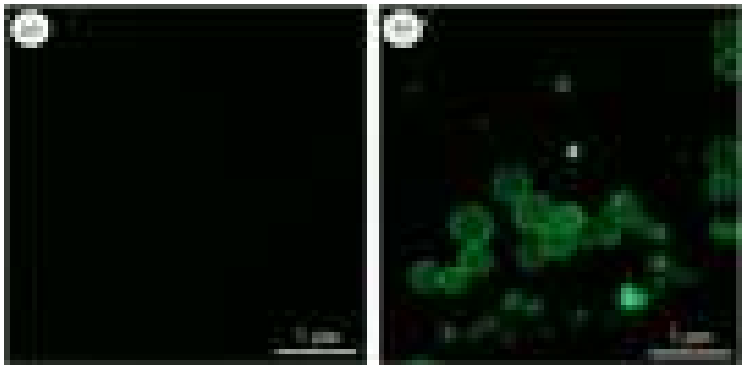
- Amaranth & methylene blue are water-soluble dye.
- Sudan III is oil soluble one.



4- Fluorescence Method: oils fluoresce under UV light.

- Under fluorescent light microscope, if the whole filed fluoresces i.e. w/o emulsion.

If an emulsion on exposure to ultra-violet radiations shows continuous fluorescence under microscope, then it is w/o type and if it shows only spotty fluorescence, then it is o/w type.



5- Wetting of filter paper method:

- if the emulsion wets the filter paper and the liquid spreads rapidly i.e., o/w emulsion, if no spreading i.e., w/o.

Determination of the type of emulsion

- **The phase volumes**

The **larger the volume of the phase** will be considered as the continuous phase.

- **(Rule of Bancroft)**

The **phase in which the emulsifying agent is more soluble** will become the continuous or external phase of the emulsion.

Micro emulsion	Macro emulsion Coarse emulsions Ordinary emulsions
1-500 nm (swollen micelle)	**More than 500 nm**
Cloudy –Translucent or Transparent -Homogeneous (Tyndall effect)	**White opaque** appearance
Thermodynamically **stable**	Thermodynamically **unstable**
Forms spontaneously Need a **2nd surfactant called Co-surfactant** to lower the interfacial tension	**Needs large input of energy** (high shear) for production Higher cost
Very low interfacial tension	**High interfacial tension**

Microemulsions

- Microemulsions are liquid dispersions of water and oil that are made homogeneous, transparent and stable by the addition of relatively large amounts of a **surfactant** and a **co-surfactant**.
- An essential requirement for their formation and stability is the attainment of a very low interfacial tension.
- Both o/w or w/o microemulsion may formed spontaneously by agitation of oil and water phase with carefully selection of surfactant.
- O/W microemulsions administered by the percutaneous, oral or parenteral route.
- The diameter of droplets in microemulsion may be **1 – 500 nm**.
- SAA commonly used are **polysorbate 60** and **polysorbate 80**.

Advantages of microemulsions

- Rapid oral absorption
- Enhance the drug diffusion into skin for topical preparation.

Pharmaceutical applications of emulsions:

Emulsions have a wide range of uses, including:

1. Oral emulsions (o/w emulsion);

- To enhance palatability.
- To increase absorption of oils and oil-soluble drugs through intestinal walls. E.g., griseofulvin suspended in oil in an o/w emulsion.

2. Intramuscular injections (w/o emulsion)

- e.g., water-soluble vaccines to provide slow release and therefore a greater antibody response and longer-lasting immunity (depot therapy).

3. Intravenous injections (o/w emulsifier).

- emulsions are used to deliver oily nutrients intravenously to patients, using non-toxic emulsifying agents, such as lecithin.

■Only a few emulsifying agents, E.g. **lecithin, gelatin, serum albumin, methyl cellulose and polysorbate 80 (Tween 80)** are used for I.V o/w emulsions.

■The globule size must be kept **below 1µm** to avoid the formation of emboli.

4. Topical application

Emulsions for external use are o/w or w/o,

■The o/w emulsions are less greasy, easily washed off the skin and more cosmetically acceptable than w/o emulsions.

■The w/o emulsions, have an emollient effect, which hydrates upper layers of skin.