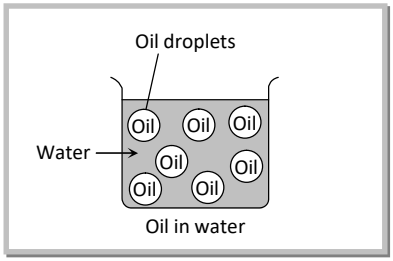
Emulsion.

"The colloidal systems in which fine droplets of one liquid are dispersed in another liquid are called emulsions the two liquids otherwise being mutually immiscible." **or**
"Emulsion are the colloidal solutions in which both the dispersed phase and the dispersion medium are liquids."

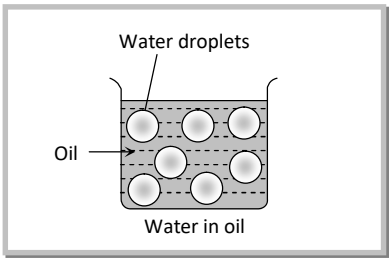


A good example of an emulsion is milk in which fat globules are dispersed in water. The size of the emulsified globules is generally of the order of 10^{-6} m. Emulsion resemble lyophobic sols in some properties.

(1) **Types of Emulsion:**Depending upon the nature of the dispersed phase, the emulsions are classified as;

(i) **Oil-in-water emulsions** (O/W)**:**The emulsion in which oil is present as the dispersed phase and water as the dispersion medium **(continuous phase)** is called an oil-in-water emulsion. Milk is an example of the oil-in-water type of emulsion. In milk liquid fat globules are dispersed in water. Other examples are, vanishing cream etc.

(ii) **Water-in-oil emulsion** (W/O)**:**The emulsion in which water forms the dispersed phase, and the oil acts as the dispersion medium is called a water-in-oil emulsion. These emulsion are also termed **oil emulsions. Butter** and **cold cream** are typical examples of this types of emulsions. Other examples are cod liver oil etc.



Note:The emulsion can be inter converted by simply changing the ratio of the dispersed phase and dispersion medium. For example, an oil-in-water emulsion can be converted to water in oil emulsion by simply adding excess of oil in the first case.

(2) **Preparation of Emulsions**

(i) Emulsions are generally prepared by vigorously agitating a mixture of the relevant oil and water by using either a high speed mixer or by using ultrasonic vibrators.

(ii) The emulsions obtained by simple mechanical stirring are unstable. The two components (oil and water) tend to separate out.

(iii) To obtain a stable emulsion, a suitable stabilizing substance is generally added.

(iv) The stabilizing substance is called **emulsifier of emulsifying agent.** The emulsifier is added along with the oil and water in the beginning. For Examples : substances which can act as emulsifiers are soaps, detergents, long chain sulphonic acid, lyophilic colloids like gelatin, albumin, casein etc.

(3) **Nature of emulsifier:**Different emulsifiers may act differently in the case of a particular emulsion.

For example,

(a) Sodium oleate is used to prepare oil-in-water (O/W) emulsions.

(b) Magnesium and calcium oleates are used to prepare water-in-oil (W/O) emulsions. When calcium oleate is added to an emulsion stabilized by sodium oleate, the stability of the system decreases. At a certain ratio of $Na^+ : Ca^{2+}$, the oil-in-water emulsion becomes unstable. If the Ca^{2+} ions concentration is increased further very quickly, then the reversal of the emulsion type occurs, that is the oil-in-water emulsion gets converted into a water-in-oil type.

(4) **Identification of emulsions:**Several methods are available to find out whether an emulsion is of the oil-in-water type or of the water-in-oil type emulsion. An emulsion can be identified as follows.

(i) **Dilute test:** Add water to the emulsion. If the emulsion can be diluted with water this means that water acts as the dispersion medium and it is an example of oil-in-water emulsion. In case it is not diluted, then oil acts as dispersion medium and it is an example of water-in-oil emulsion.

(ii) **Dye test**: An oil soluble suitable dye is shaken with the emulsion. If color is noticed on looking at a drop of the emulsion, it is oil-in-water type emulsion. In case the entire background is colored, it is an example of water-in-oil type.

(iii) **Conductivity test:**Add small amount of an electrolyte (e.g. KCl) to the emulsion. If this makes the emulsion electrically conducting, then water is the dispersion medium. If water is not the dispersed phase.

(5) **Properties of emulsion**

(i) Emulsions show all the characteristic properties of colloidal solution such as Brownian movement, Tyndall effect, electrophoresis etc.

(ii) These are coagulated by the addition of electrolytes containing polyvalent metal ions indicating the negative charge on the globules.

(iii) The size of the dispersed particles in emulsions in larger than those in the sols. It ranges from 1000 Å to 10,000 Å. However, the size is smaller than the particles in suspensions.

(iv) Emulsions can be converted into two separate liquids by heating, centrifuging, freezing etc. This process is also known as **demulsification**.

(6) **Applications of emulsions**

(i) Concentration of ores in metallurgy

(ii) In medicine (Emulsion water-in-oil type)

(iii) Cleansing action of soaps.

(iv) Milk, which is an important constituent of our diet an emulsion of fat in water.

(v) Digestion of fats in intestine is through **emulsification**.