

HOMOGENIZATION

Definition :

- Homogenization is the process in which a coarse emulsion is converted into a colloidal state of uniform composition by reducing the size of the particles so that each measured dose should have same composition.
- Homogenization is defined as an intensive mixing of mutually insoluble phases to obtain a suspension or emulsion.
- This process is used for the preparation of suspensions, emulsions etc.
- Various types of machines are used for the homogenization of emulsions which are described as follows:

Type of Homogenizers (Emulsifiers)

Homogenizers are based on the principle that when large globules in coarse emulsion are passed, under pressure, through a narrow orifice are broken into smaller globules having a greater degree of uniformity and stability.

1- Hand homogenizer:

2- Knewood mixer

3- Silverson mixer- emulsifier

4- Ultrasonic emulsifier

5- Colloid mills

1- Hand homogenizer:

- ❖ The emulsifier is the most commonly used hand homogenizer on laboratory scale.
- ❖ It consists of a hopper, small orifice, handle and a heavy base.
- ❖ The pre-formed emulsion which is prepared by using a pestle and mortar is placed in the hopper of the emulsifier.
- ❖ The emulsion is then forced to pass through a narrow orifice. By up and downward movement of the handle which reduces the size of the oil globules.
- ❖ This reduction in size increases with the speed of pumping.



Hand homogenizer



2- Knewood mixer:

- ❖ The knewood mixer is very effective mixing machine which has many household uses and is quite suitable for making small batches of emulsions.
- ❖ By this machine the mixing action is quite effective because both the beaters as well as the axis on which they are fixed rotates which produces a planetary action due to which whole of the liquid in the mixing vessel is affected and not just the central portion, which generally occurs with ordinary stirrers.
- ❖ Different types of beaters and whisks (e.g. coiled wire) are available with the machine which can be easily exchanged by a simple locking arrangement.
- ❖ In some cases the container may be fitted with a jacket so that heating or cooling of the contents may be carried out.



Knewood mixer

3- Silverson emulsifier:

- This machine consists of an emulsifying head to which blades are attached, surrounded by a fine mesh such a way that it is immersed in the liquids to be emulsified.
- The head is rotated by means of a small motor which rotate the blades at a very high speed.
- The liquids to be mixed are sucked through the fine mesh into the base of the emulsifying head where they are subjected to vigorous mixing by high speed rotation of the blades.
- The mixed material is then expelled with a great force through the sieve band.
- This sucking in and forcing out of the liquid continuously goes on which sets up a pattern of circulation.
- In this way whole of the liquids to be mixed are made to pass repeatedly through the emulsifying head by which the large size globules. are effectively reduced to small size globules.



Silverson Mixer

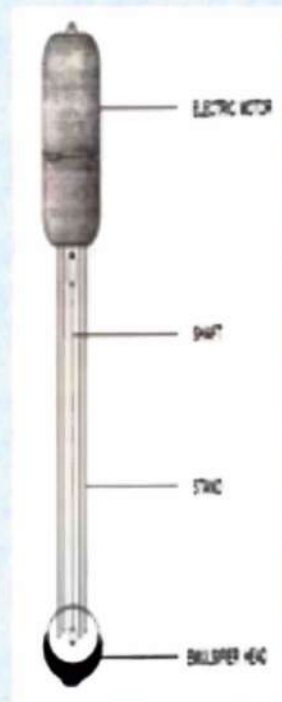


Fig. 35.1

4- Ultrasonic emulsifier:

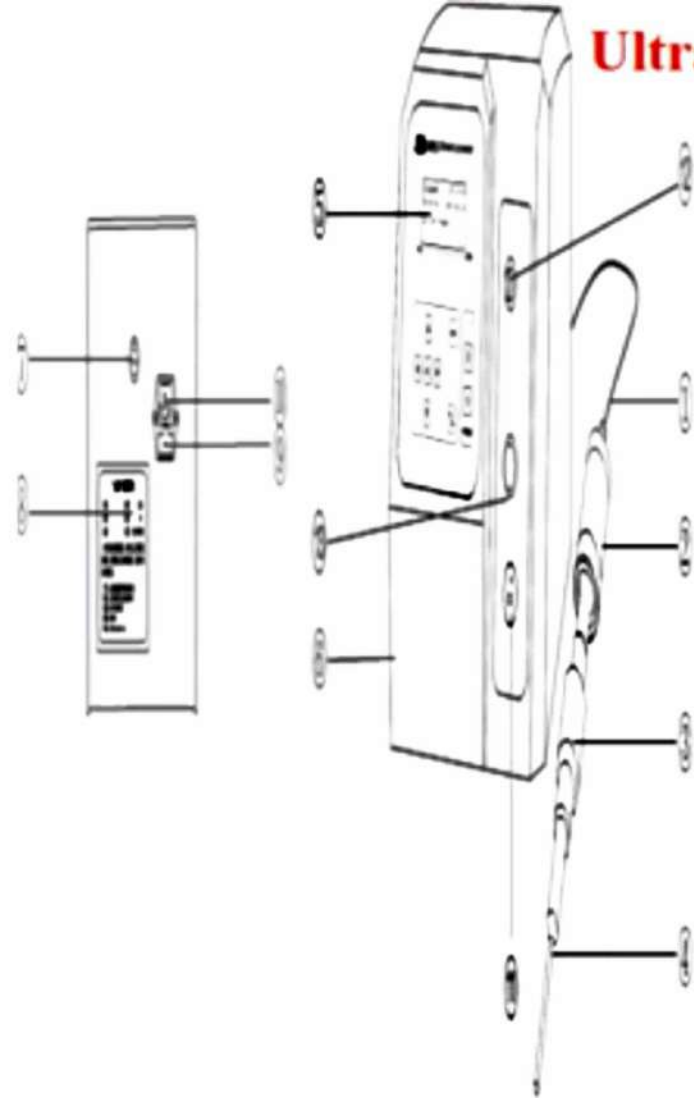
There are three main components of a laboratory Ultrasonic Homogenizer;

- 1. An electronic generator which provides the power,**
- 2. A transducer which converts the signal to mechanical energy**
- 3. A horn or probe where the processing takes place.**

4- Ultrasonic emulsifiers:

- ❖ Ultrasonic emulsifiers works on the principle that when a liquid is subjected to ultrasonic vibrations alternate regions of compression and rarefaction are produced which leads to the formation of cavities in the rarefaction region.
- ❖ Later on these cavities collapse with a great force which produces emulsification of immiscible liquids.
- ❖ These devices are useful only with liquids of low viscosity;
- ❖ They are not practicable for large scale production of emulsions.

Ultrasonic emulsifier



5- Colloid mills:

- ❖ The principle of operation of the colloid mill is the passage of the mixed phases of an emulsion formula between a stator and a high speed rotor revolving at speeds of 2000 to 18,000 rpm.
- ❖ The clearance between the rotor and the stator is adjustable, usually from 0.001 inch upward.
- ❖ The emulsion mixture, while passing between the rotor and the stator, is subjected to a tremendous shearing action, which effects a fine dispersion of uniform size.
- ❖ The shearing forces applied in the colloid mill usually raises the temperature within the emulsion.

- ❖ It ensures a breakdown of agglomerates or in the case of emulsions to produce droplets of fine size around 1 micron.
- ❖ A coolant is used to absorb the excess heat.
- ❖ Continuous mixing process is possible.
- ❖ The material to be processed is fed by gravity to the hopper or pumped so as to pass between the rotor and stator elements where
- ❖ it is subjected to high shearing and hydraulic forces.
- ❖ The material is discharged through a hopper whereby it can be recirculated for a second pass.

Colloid mills

