C. Mixing of immiscible Liquids

Carried mainly in the **manufacture of emulsions**, and the equipment used for the preparation of an emulsion is known as emulsifier. Also known as homogenizer as it results in fine emulsion.

Fine emulsion is prepared in 2 stages.

In 1st stage coarse emulsion is prepared by using one of the following process:-

- Wedge wood
- Mechanical blender
- Hand homogenizer
- Porcelain mortar and pestle
- Milk shake mixer
- Propeller in a baffled tank

Some times the above equipment directly gives fine emulsion.

Otherwise coarse emulsion is subjected to homogenizer in the 2nd stage to get fine emulsion by using following process:-

- Silverson emulsifier
- Colloidal mill
- Rapisonic homogenizer

Factors influencing selection of an emulsifier

1. **Quantity of emulsion to be prepared:** batch wise or continuous operation
2. **Flow properties of liquids:** Newtonian, plastic, pseudo plastic or dilatant.
3. **Temperature maintenance:** mixing will be effective at high temperatures provided the material is stable.
4. **Desired rate of cooling:** if elevated temperatures are applied

Equipment

- Silverson emulsifier
- Colloidal mill
- Rapisonic homogenizer

Silverson mixer -Emulsifier

Principle:

- It produces intense shearing forces and turbulence by use of high speed rotors.
- Circulation of material takes place through the head by the suction produced in the inlet at the bottom of the head.
- Circulation of the material ensures rapid breakdown of the dispersed liquid into smaller globules.
- It consists of long supporting columns and a central portion. Central portion consists of a shaft which is connected to motor at one end and other to the head.
- Head carries turbine blades.
- Blades are surrounded by a mesh, which is further enclosed by a cover having openings.

Uses:

- Used for the preparation of emulsions and creams of fine particle size.

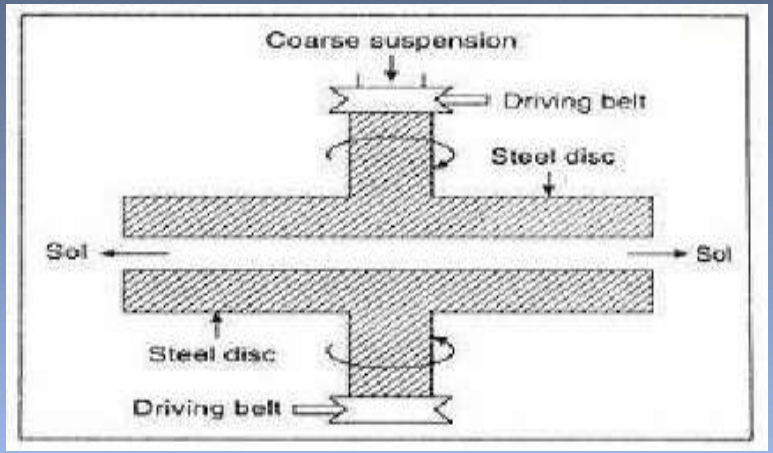
Advantages:

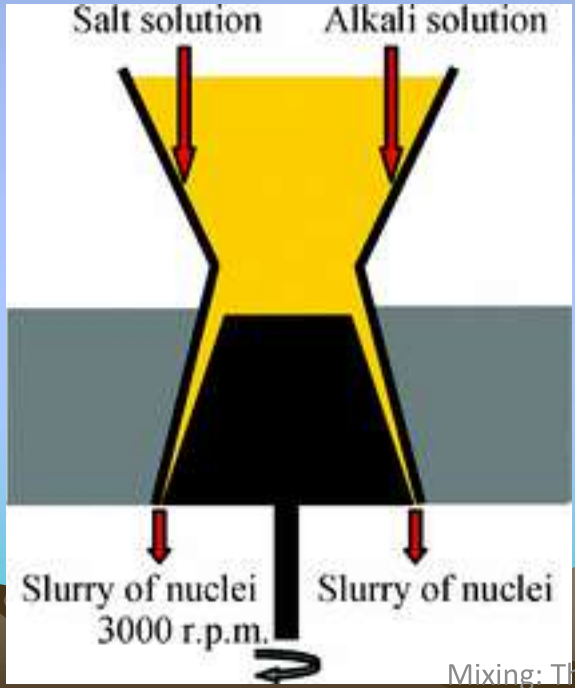
- Silver son mixer is available in different sizes to handle the liquids ranging from a few milli liters to several thousand liters.
- Can be used for batch operations as well as for continuous operations by incorporating into a pipeline, through which the immiscible liquids flow.

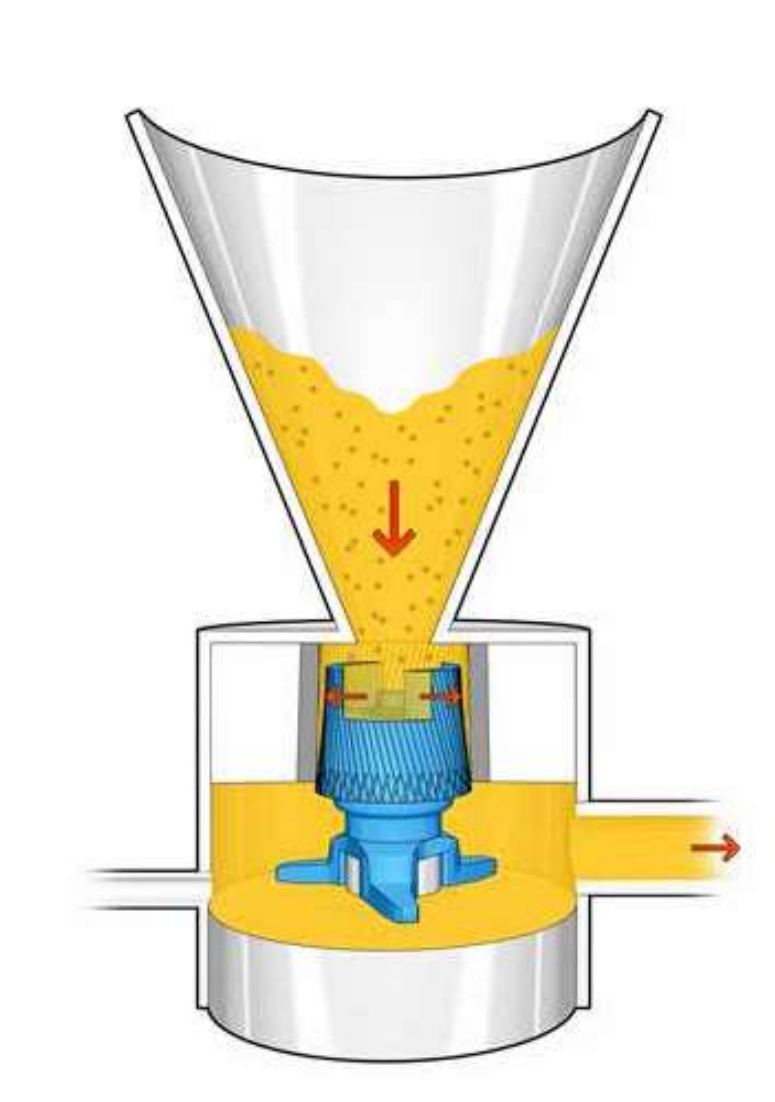
Disadvantages:

- Occasionally, there is a chance is clogging of pores of the mesh.

Colloid mill







Ultrasonic Emulsifiers – Rapisonic homogenizer

Principle:

- When a liquid is subjected to ultrasonic vibrations alternate regions of compression and rarefaction are produced in the liquid.
- Cavities are formed in the regions of rarefaction which subsequently collapse in the regions of compression. Which results great forces for emulsification.

Construction:

- It consists of a pump driven by a motor. It is connected to inlet tube and an out let tube.
- Head consists of a flat jet for liquid inlet. Facing the jet, a thin blade is present which vibrates at its natural frequency.

Advantages of rapisonic emulsifier:

- Can be used for batch process (by placing it in a tank) or for continuous process (by placing it in a pipeline).
- It has the capacity to produce dispersed globules of one micron size.
- As this method is highly efficient to decrease globule size, reduced concentration of emulgents is sufficient.
- Its capacity of mixing liquids ranges from 20 - 500 liters per minute.
- It is suitable for thermolabile substances since heat is not generated during mixing.

Disadvantages of rapisonic emulsifier:

- It is useful only for low viscous liquids.

D. Mixing of semisolids

- Semi solids dosageforms include ointments, pastes, creams, jellies, etc., while mixing such dosageforms , the material must be brought to the agitator or the agitator must move the material throughout the mixer.
- The mixing action include combination of low speed shear, smearing, wiping, folding, stretching and compressing.
- A large amount of mechanical energy is applied to the material by moving parts. Sometimes a part of the supplied energy appears as heat.
- The forces required for efficient mixing are high and consumption of power is also high. Hence the equipment must be rugged constructed to tolerate these forces.
- Some semisolids exhibit dilatant property i.e., viscosity increases with increase in shear rates. Therefore, mixing must be done at lower speeds.
- The speed must be changed accordingly to thixotropic, plastic and

Classification of equipment

- Agitator mixers:

  e.g.:- Sigma mixers and Planetary mixer.

- Shear mixers:

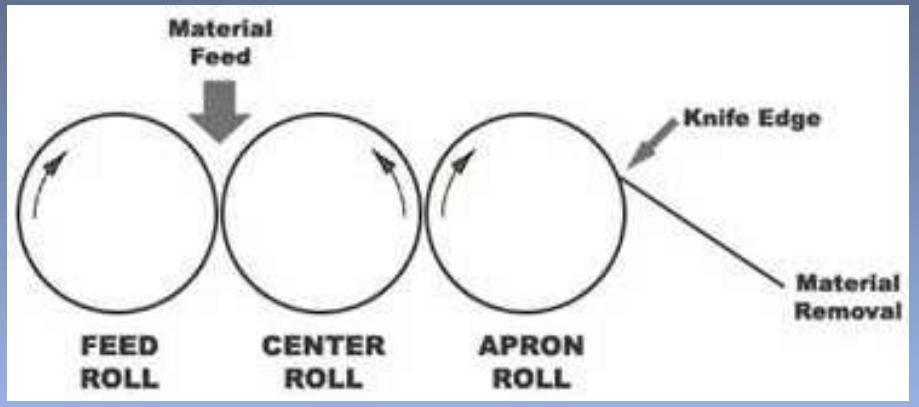
  e.g.:- Triple roller mill and Colloidal mill.

Selection of mixing equipment for semi solids

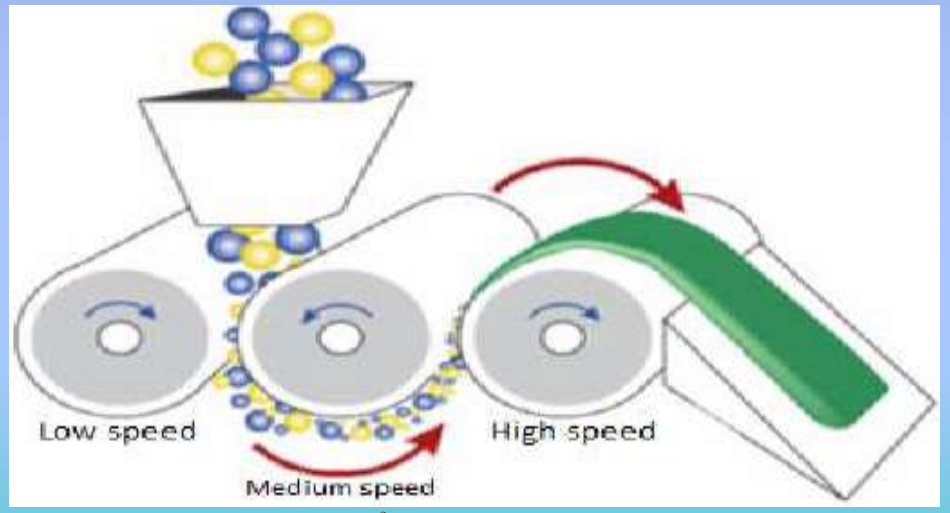
- Physical properties of the materials – density viscosity and miscibility.
- Economic considerations regarding processing – time required for mixing and power consumption.
- The cost of equipment and its maintenance.

Triple roller mill

Principle:- **High shear** , which causes crushing of aggregates, particles and also distributes the drug uniformly throughout the semi solid base.



- It consists of 3 parallel rollers of equal diameters made up of stainless steel.
- These are mounted on rigid frame work horizontally.
- The gap between the first 2 rollers is more than that of the gap between the last two.
- A hopper is placed in between the first two rollers.
- A scrapper is attached to the last roller.
- First roller rotates at lower speed compared to the 2nd similarly 2nd roller speed is less than the 3rd roller.



Advantages of triple roller mill

- **From the small to the large batch -** Three roll mills are ideally suited for processing the smallest and also very large quantities.
- **Excellent temperature control -** Three roll mills enable excellent control of the product temperature, since the product is processed as a thin film on the roller. This way, the product can be warmed or cooled off depending on your requirements.
- **Avoid contamination -** Through the selection of materials for the rollers and scraper knives, which are available in a broad spectrum of chrome-plated steel, aluminium oxide, zirconium oxide, and silicon carbide, it is possible to avoid product contamination due to metal abrasion.
- Extremely **uniform dispersion** is obtained.
- low material loss.
- easy cleaning.

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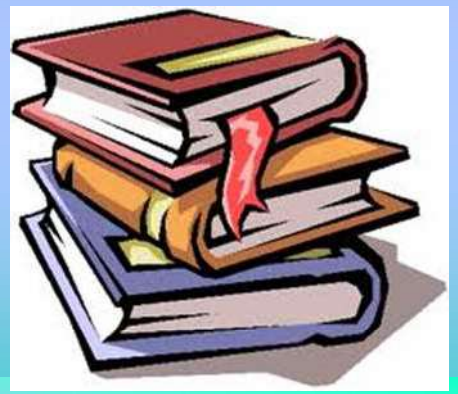
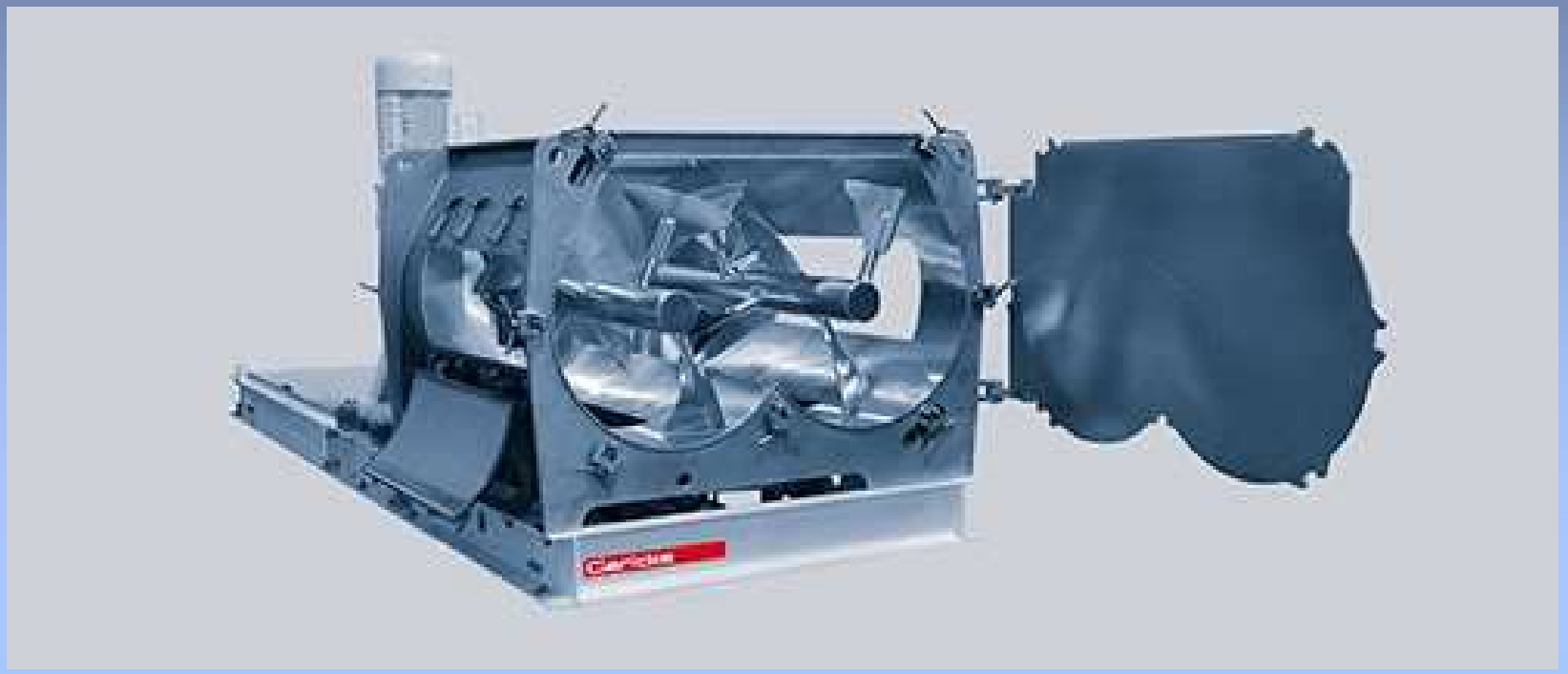


Any Query.?




Thank You