MIXING AND HOMOGENISATION

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Introduction

Mixing may be defined as a unit operation in which two or more components, in an unmixed or partially mixed state, are treated so that each unit (particle, molecule etc.) of the components lies as nearly as possible in contact with a unit of each of the other components.

IMPOTANCE OF MIXING

1. **To make simple physical mixture**

   In the production of tablets, capsules, sachets and dry powders two or more powders or granules are mixed.

2. **Physical change**

   Mixing may aim at producing a change that is physical, for example the solution of a soluble substance. In case of dissolving a solid in a solvent mixing will take place by diffusion but the process will be slow. In this case agitation makes the process rapid.

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3. Dispersion

In case of emulsions and creams two immiscible liquids are mixed where one liquid is dispersed into other. In suspension and pastes solid particles are dispersed in a liquid by mixing.

4. Promotion of reaction

Mixing encourages and controls a chemical reaction, so ensuring uniform products

Objective of Mixing

- ✓ To ensure uniformity.
- ✓ To initiate or to enhance the physical or chemical reactions e.g. diffusion, dissolution etc.
- ✓ To make the following products:

Tablets

Suspensions

Emulsions

Pastes

Creams

Factors affecting Mixing-

- Particle size
- Particle shape
- Surface area
- Density
- Porosity
- Volume
- Flow property and charge
- Mixing mechanism
- Mixing time

Types of Mixers

There are 3 types of mixtures:

1. Positive mixtures:

Formed from materials such as, gases or miscible liquids.

The materials mix spontaneously and irreversibly by diffusion

No input of energy if time of mixing is unlimited, although time will be shorten if energy is supplied.

Generally, these materials do not show any problems during mixing.

2. Negative mixtures

Materials have the tendency to separate out from each other.

Energy needs to be supplied to keep components adequately dispersed.

Some separate faster, while for others, the separation is slower.

For example, a) In a suspension, there is the dispersion of solid in the solution (fast separation)

b) Emulsions, creams and viscous suspension have a slow separation.

c) Are more difficult to be formed and require high degree of mixing efficiency.

3. Neutral mixtures

Are static in behavior.

Neither mixing nor de-mixing occurs, unless acted upon by an external system of forces.

Examples are: a) Mixed powders b) Pastes c) Ointments.

Mixing of Semi-solid

If the solid is not too coarse, the liquid is not too viscous and the percentage of solids is not too great, solids can be suspended in liquids by the use of a propellers or a flat-bladed turbine in a cylindrical container.

Apparatus used:

- Planetary mixers and sigma blade mixers used as agitator mixers
- Triple roller mills used as shear mixers-size reduction

Planetary Mixers

- Planetary mixers are one of the most widely used mixers in the pharmaceutical industry. In the pharmaceutical industry, the planetary mixer is often used for basic operations of mixing, blending, and low-shear granulation. This machine is also used in other industries like cosmetics and personal care products, food, glass, cements, ceramics, met al industry etc.

Planetary mixer

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- The Planetary Mixer have two blades which rotate on their own axes, while they orbit the mix vessel on a common axis.
- The blades continuously advance along the periphery of the vessel, removing material from the vessel wall and transporting it to the interior.
- These mixers are ideal for mixing and kneading viscous pastes or putty-like materials.

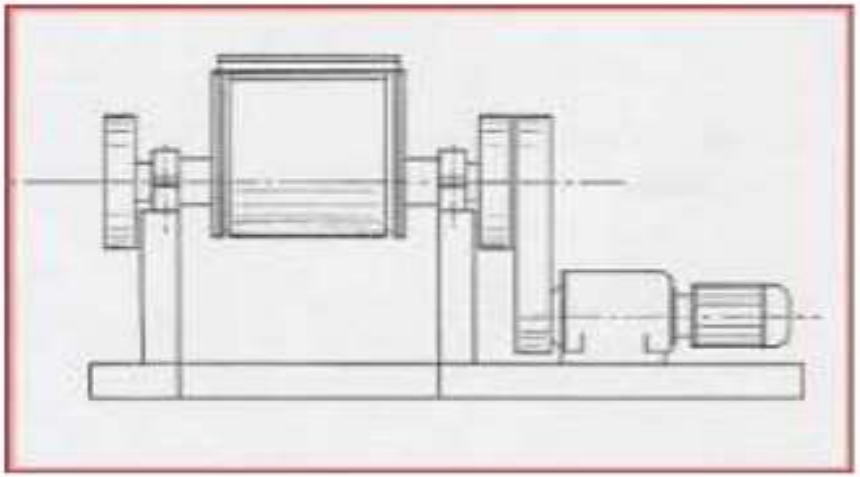
Uses of Planetary Mixer

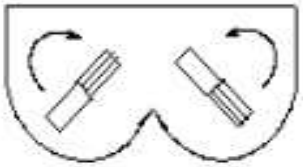
- Planetary mixers are ideal for mixing of pharmaceutical creams, ointments, ceramics, color and pigments, resins, ink, cosmetic creams, herbal creams etc.
- Planetary mixers are also ideal for mixing and kneading viscous pastes under atmospheric or vacuum conditions.
- Used in the mixing of viscous, heat sensitive and cohesive pastes, dough and moist etc.

2. Sigma blade mixer

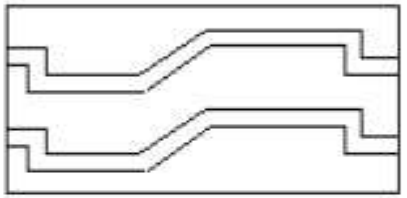
- Sigma blade mixer is a common form used to handleThe two blades rotate towards each other and operate in a mixing vessel which has a double trough shape, each blade fitting into a trough.
- The two blades rotate at different speeds, one usually about twice the speed of the other, resulting in a lateral pulling of the material and divisions into two troughs, while the blade shape and difference in speed causes end-to-end movement semi-solids of plastic consistency.

Sigma Blade mixer





CROSS-SECTION VIEW



TOP VIEW

SIGMA BLENDER

Working

- It works on the principle of shearing and convective in action.
- This mixer is designed for mixing, blending and kneading of medium and heavy on- flowing pastes.
- The impellers and bowls are accurately machined to close tolerances, eliminating build up and providing high shear and rapid distribution of materials.

Homogenization-

- It is a process in which coarse globules in emulsion are converted into smaller globules of uniform composition, so that each measured dose has the same composition. Principle: It is based on the principle that when large globules in coarse emulsion are passed under high pressure through a narrow orifice are broken into smaller globules having a greater degree of uniformity and stability.

Simple homogenizer

- It consist of a pump that rises the pressure of the dispersion to a range of 500-5000psi.
- And an orifice through which the fluid strikes upon the homogenizing valve.
- The homogenizing valve is held on valve seat by strong spring.
- As the pressure increases some of the dispersion escapes b/w valve and valve seat , and instantly pressure is released which subjects the product to intense turbulence and hydraulic shear.

Silverson homogenizer

- In silverson homogenizer the droplets are subjected to a high shear rates.
- It consists of an emulsifying head to which blades are attached , surrounded by a fine mesh sieve made up of a stainless steel .
- The emulsifying head is immersed in the liquid to be emulsified.
- The head is rotated by a small motor at very high speed.

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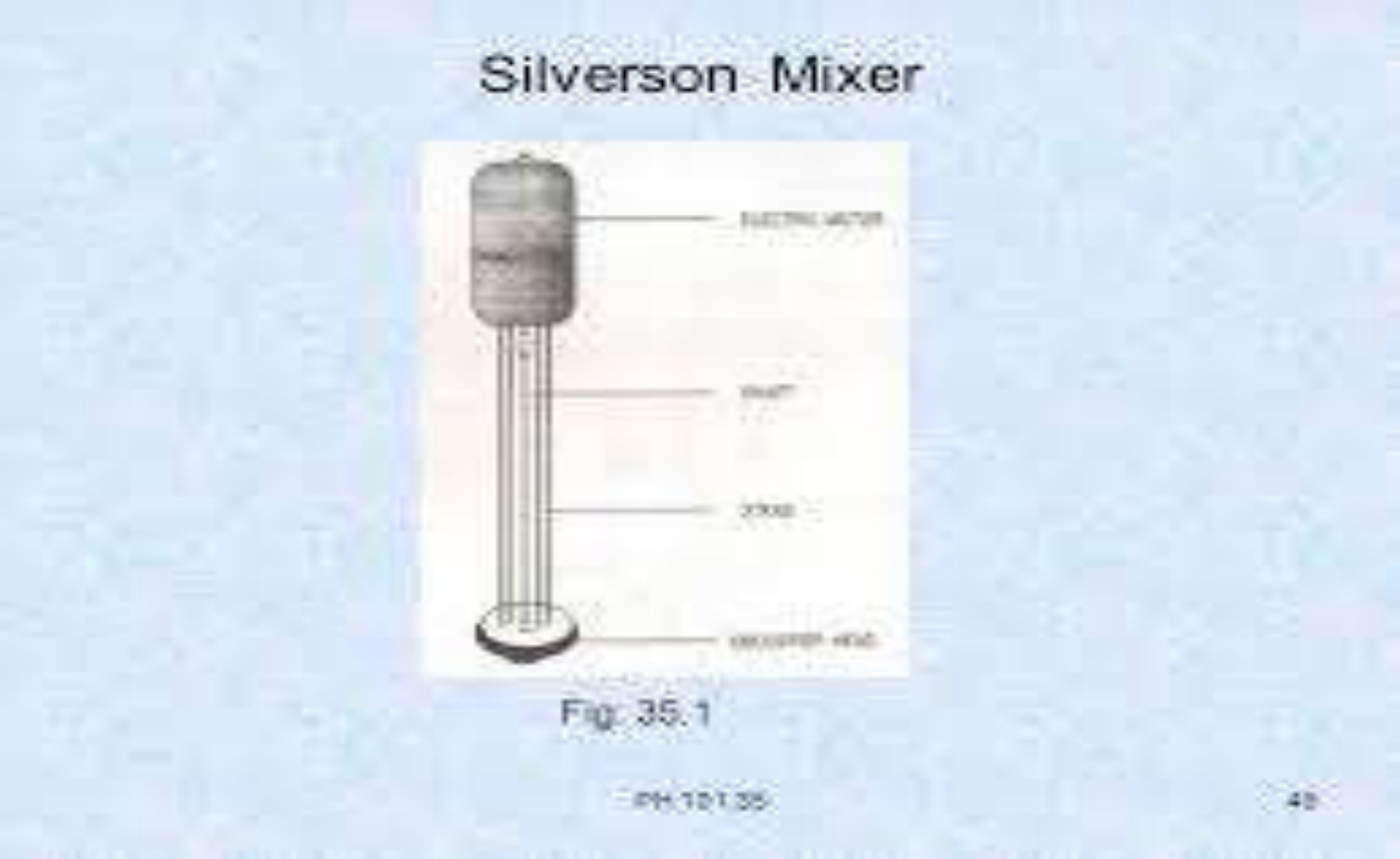
- The liquids to be mixed are sucked through fine mesh into the base of the emulsifying head where they are subjected to vigorous mixing by high speed rotation of blades.
- The mixed material is then expelled with a great force through the sieve band.
- This sucking in and forcing out sets up a pattern of circulation, and thus large size globules are reduced to small size globules.

Silverson mixer

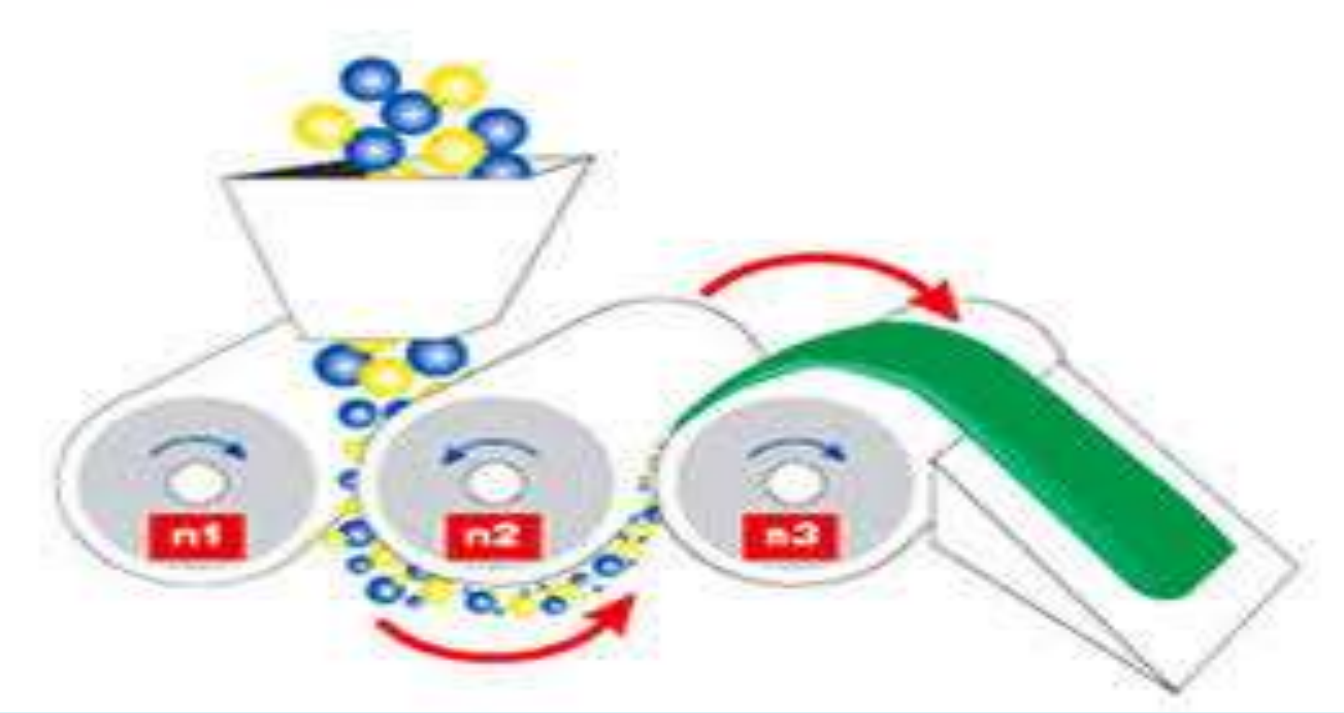


Triple roller mill

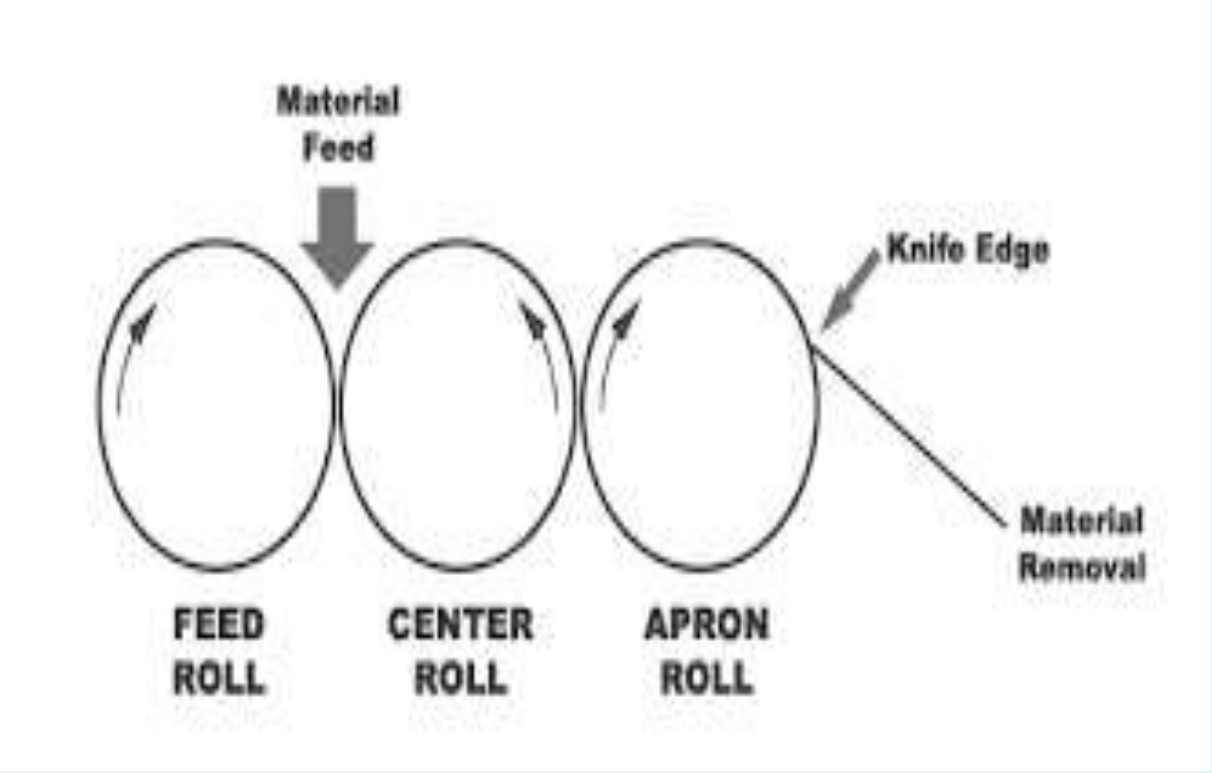
Construction and working principle:

- It is fitted with three rollers, made up of hard abrasion-resistant materials.
- Rollers are fitted in such a way that they come in close contact with each other and rotate at different speeds.
- A scraper is used to remove the final ointment of smooth and uniform texture.
- The feed enters through a hopper.

How its work-



Triple roller mill



Working-

The material passes through hopper A, in between rollers B and C where size reduction occurs.

Then the ointment is passed between the rollers C and D, where it is further reduced in size and a smooth mixture is obtained.

The gap between rollers C and D is usually less than the gap between B and C .

The smoothened material is continuously removed from roller D by means of scraper E, from where it is collected in a receiver.

Advantage

1. Produces a uniform dispersion and a continuous process
2. Material used: Stainless steel to prevent contamination
3. Applications: To mix paint, chemicals, glass coatings, pigments


thank
YOU:-)