

Mechanism of solid mixing, liquids mixing and semisolids mixing

MIXING: Theory and
Equipment

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Classification of mixing

- A. Mixing of solids
- B. Mixing of liquids
- C. Mixing of immiscible liquids
- D. Mixing of semisolids



A. Mixing of solids

- In the manufacture of tablets or granules normally a number of additives are added. Therefore mixing of powder becomes essential part of the process.
- Mixing is considered as a critical factor, especially in case of potent drugs and low dose drugs where high amounts of adjuvants are added.
- The diverse characteristics of particles such as size shape volume surface area density porosity flow charge contribute to the solid mixing.
- Depending on their flow properties solids are divided into two classes as cohesive and non cohesive.

Mechanism of mixing of solids

1. Convective mixing/Macro mixing:

Inversion of the powder bed using blades or paddles or screw element, in which large mass of material moves from one place to another.

2. Shear mixing:

In this type, forces of attraction are broken down so that each particle moves on its own between regions of different components and parallel to their surface.

3. Diffusive mixing/Micro mixing:

Involves the random motion of particle within the powder bed, thereby particles change their position relative to one another.

Classification of equipment for solid mixing

- Based on **flow properties**:

- 1. Free flowing solids:

- e.g.: V cone blend , Double cone blender

- 2. Cohesive solids:

- e.g.: Sigma blender, Planetary mixer

- Based on **scale of mixing**:

- 1. Batch type (small scale):

- e.g.: Mortar and pestle, V cone blender, Double cone blender, Ribbon blender, Sigma blender, Planetary paddle, Fluidized mixer

- 2. Continuous type (large scale):

- e.g.: barrel type, zigzag type

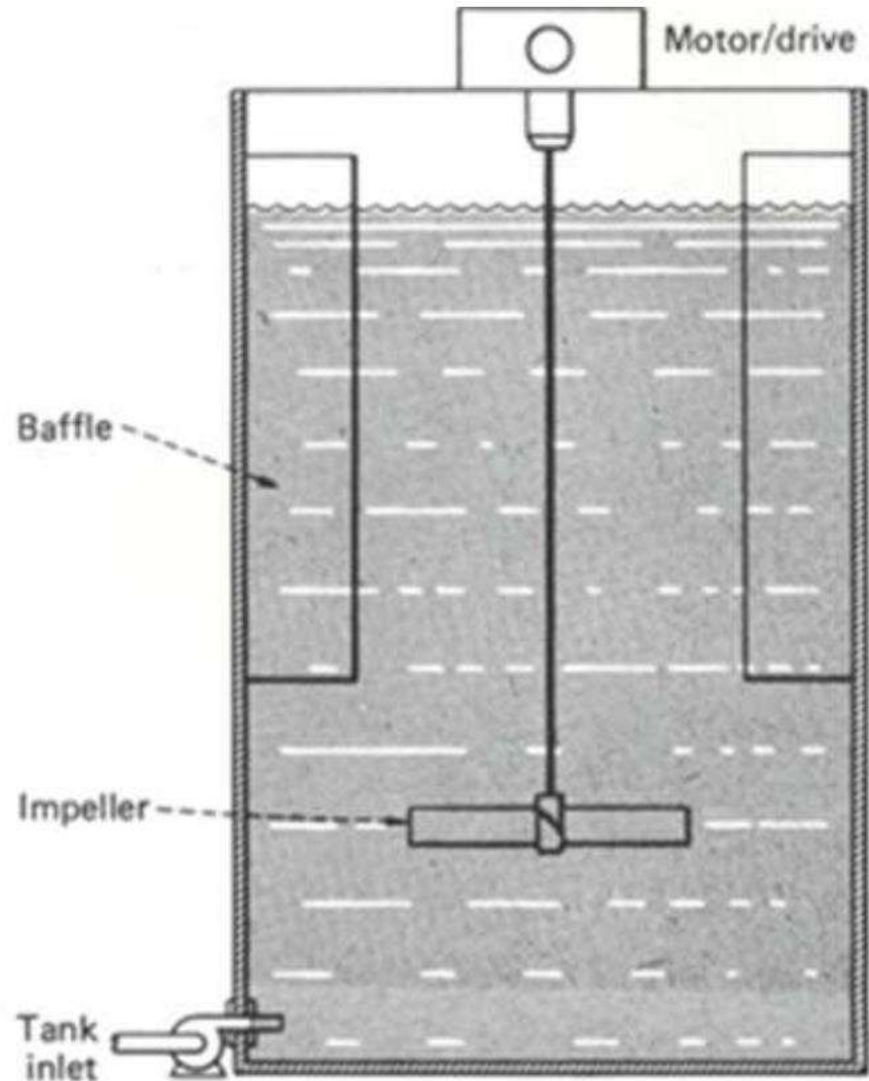
B. Mixing of Fluids

Mechanism:

- **Bulk transport:** Movement of large portion of a material from one location to another location in a given system. Rotating blades and paddles are used.
- **Turbulent mixing:** Highly effective, mixing is due to turbulent flow which results in random fluctuation of the fluid velocity at any given point within the system. Fluid velocity at a given point changes in 3 directions (X, Y and Z).
- **Laminar mixing:** Mixing of two dissimilar liquids through laminar flow, i.e., applied shear stretches the interface between them. Suitable for liquids which require moderate mixing.
- **Molecular diffusion:** Mixing at molecular level in which molecules diffuse due to thermal motion.

Mixing Apparatus for fluids

- A Container and
- A Mixing Device or Impeller



Mixing Device

- Based on **shape** and **pitch** , the are classified into 3 types,
 - » Propellers
 - » Turbines
 - » Paddles

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 pseudo plastic materials.

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.



Thank You