Sigma blade mixer,
Planetary mixers, Silverson Emulsifier

Semisolid mixing

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PLANETARY MIXER

- The name “planetary mixer” comes from the system used in the equipment that mixes the dough in the planets rotation direction.
- **Construction:**
- Consists of vertical cylinder shell for ingredients placement which can be removed.
- Mixing element (whisk, hook, flat beater, scrapper or other system)
- It consists of a rod that rotates in its own axis and also moves forward (around the bowl axis). As the movement is just like planet so it is called planetary mixer
- The blade is mounted from the top of the bowl.
- Mixing shaft is driven by planetary gear and it is normally built with variable speed drive

Planetary mixer - principle

- Mechanism of mixing is shear. Shear is applied between moving blade and stationary wall.
- Mixing arm moves around its own axis and around the central axis so that it reaches every spot of the vessel.
- The plates in the blades are sloped so that powder makes an upward movement to achieve tumbling action also.
- **Uses**
- Break down agglomerates rapidly.
- Low speeds are used for dry blending and fast for wet granulation.

Advantages and disadvantages

- Speed of rotation can be varied at will.
- Avoid dead zones and vortex formation
- More useful for wet granulation process.
- **Disadvantages:**
- Mechanical heat is buildup within the powder mix.
- It requires high power.
- It has limited size and is useful for batch work only

SIGMA-BLADE/ARM MIXER

- Used for semi-solid of plastic consistency
- **Principle:**
- Shear (Inter meshing of sigma blades creates high shear and kneading action

Construction and working

- It consists of double tough shaped stationary bowl.
- Two sigma shaped blades are fitted horizontally in each trough of the bowl.
- These blades have very low clearance and are connected to a fixed speed drive.
- Mixer is loaded from top and unloaded by tilting the entire bowl.
- The blades rotate tangentially at different speeds, one about twice than the other (2:1), which allows movement of powder from sides to centers.

- The material also moves top to downwards and gets sheared between the blades and the wall of the tough resulting cascading action.

- Perforated blades can be used to break lumps and aggregates which create high shear forces.
- The final stage of mix represents an equilibrium state

Uses:

- Used in the wet granulation process in the manufacture of tablets, pill masses and ointments,
- It is primarily used for liquid-solid mixing, although it can be used for solid-solid mixing.
- This mixer is well suited to high viscosity materials like grease, putty, toffee and bubble gum.
- With its strong construction and high power, the sigma blade mixer can handle the heaviest plastic materials and products like tablet granules, and ointments that are mixed readily
- Sigma blade mixer is used in chemical and pharmaceutical industries, to make food products, adhesives, rubber

- Advantages
- Sigma blade mixer creates a minimum dead space during mixing.
- It has close tolerances between the blades and the sidewalls as well as bottom of the mixer shell.
- **Disadvantages:**
- Sigma blade mixer works at a fixed speed.
- Problems of entrainment of the air and therefore lead to decomposition of oxidisable materials
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Silverson emulsifier

- It is used for emulsification.
- Homogenization requires the ingredients to be processed until a uniform globule or particle size. For most products, including creams, ointments, sauces, flavoring emulsions and pharmaceutical suspensions, this requires a globule or droplet size in the range of 2 – 5 microns.

Homogenization-/ emulsification

- This can be achieved using a Silverson Mixer Homogenizer. The precision-machined Silverson workhead generates exceptionally high shear rates in a three stage mixing/homogenizing process; The high speed rotor draws materials into the workhead where they are intensely mixed. Centrifugal force then drives the materials to the periphery of the workhead and subjects them to mechanical shear in the precision gap between the rotor and stator. This is followed by intense hydraulic shear, as the product is forced through the stator screen at high velocity and circulated back into the mix. Fresh material is continually drawn into the workhead, progressively reducing globule or particle size and quickly resulting in a homogeneous, uniform product.

Silverson emulsifier/ high shear mixer