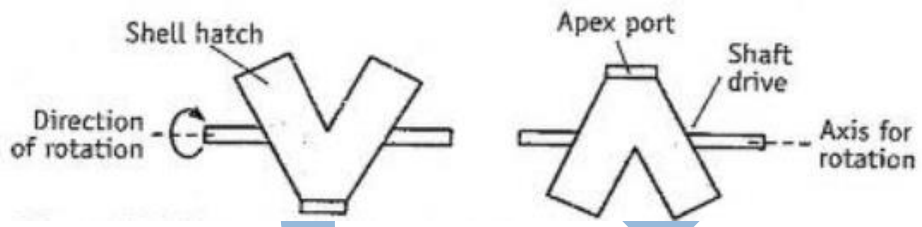
UNIT: III **(MIXING)**

CLASS:26

TOPIC: PRINCIPAL, CONSTRUCTION, WORKING, USES, MERITS AND DEMERITS OF TWIN SHELL BLENDER, DOUBLE CONE BLENDER, RIBBON BLENDER

TWIN SHELL BLENDER OR V CONE BLENDER

The construction of a twin shell blender is shown in Figure. It is made of either stainless steel or transparent plastic. Smaller models take a charge of 20 kg and rotate at 35 revolutions per minute, while larger ones take a charge of about 1 tonne and rotate at l5 revolutions per minute. The material is loaded through either of the shell hatches. Emptying of the blend is normally done through an apex port.



V cone blender. Rotating shell without baffles.

The material (to be blended), is loaded approximately 50 to 60 % of its total volume. As the blender rotates, the material undergoes tumbling motion. When the V is inverted, the material splits into two portions. This process of dividing and recombining continuously yields ordered mixing by mechanical means. The powder mass Is converted shock-wise, so that no de-mixing due to density differences will occur. It is rotated so that the material alternatively is collected in the bottom of the V

Blender speed is the key for mixing efficiency At high speeds. More dusting or segregation of fines is possible. While at low speeds. Not enough shear may be applied.

Advantages:

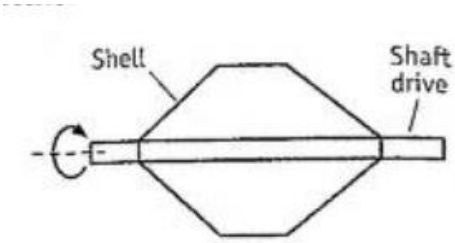
1. If fragile granules are to be blended, twin shell blender is suitable because of minimum attrition.
2. They handle large capacities
3. Easy to clean. Load and unload.
4. This equipment requires minimum maintenance.

Disadvantages

1. Twin shell blender needs high headspace for installation.
2. It is not suitable for tine particulate system or ingredients of large differences in the particle size distribution because not enough shear is applied.
3. If powders are free flowing, Serial dilution is required for the addition of low dose active ingredients.

DOUBLE CONE BLENDER

The construction of a double cone blender is shown in Figure. It is usually charged and discharged through the same port. It is an efficient design for mixing powders of different densities. These are used mostly for small amounts of powders. The rate of rotation should be optimum depending on the size and shape of the tumbler, nature of material to be mixed. Commonly the range is 30 to 100 revolutions per minute. The method remains same as that of the V-cone blender.



Double cone blender. Rotating shell without baffles.

The advantages and disadvantages for double cone blender are same as given in Twin shell blender (or V cone blender).

TUMBLING BLENDERS WITH AGITATOR MIXING BLADE

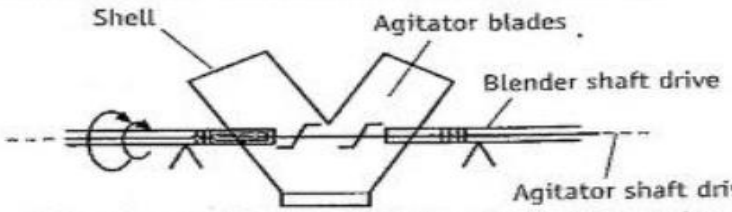
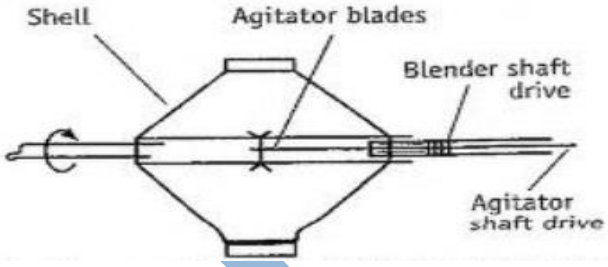


Figure 9-9. V cone blender. Rotating shell with rotating baffles.



Double cone blender. Rotating shell with rotating baffles

The V-cone blender and double cone blender with agitator blade (baffles) are shown in Figures The general construction and working is same as mentioned above. Agitator blades are added which have several advantages.

Advantages:

1. Baffles are useful for both wet and dry mixing.
2. Wide range of shearing force can be applied with agitator bars permitting the intimate mixing of very fine as well as coarse powders
3. Serial dilution is not needed when incorporating low-dose active ingredients.

Disadvantages:

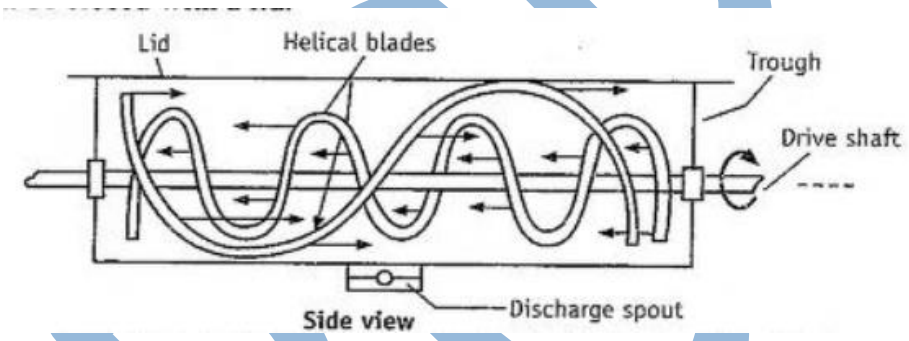
1. Attrition is large. Size reduction of friable particles results.
2. Scale-up can prove a problem, because general principles off Scale up do not work.

3. Cleaning may be a problem, because the agitator assembly must be removed and the packing should be replaced for a product changeover
4. Potential packing (sealing) problems.

RIBBON BLENDER

Principle: The mechanism of mixing is shear. Shear is transferred to the powder bed by moving blades (ribbon shaped) in a fixed (non- movable) shell. High shear rates are effective in breaking lumps and aggregates. Convective mixing also occurs as the powder bed is listed. And allowed to cascade to the bottom of the container. An equilibrium state of mixing can be achieved.

Construction: The construction of a ribbon blender is shown in Figure. It consists of a non-movable horizontal cylindrical trough (shell) usually open at the top. It is fitted with two helical blades. Which are mounted on the same shaft through the long axis of the trough. The blades have both right and left hand twists. The blades arc connected to a fixed speed drive. Ribbon blender is top loading with a bottom discharge port. The trough can be closed with a lid.



Ribbon mixer. Stationary shell and rotating blades.

Working: Through the fixed speed drive, ribbons are allowed to rotate. One blade moves the solids slowly in one direction and the other moves them quickly in opposite direction. Different powders are introduced from the top of the trough. The body is covered because considerable dust may be evolved during dry blending and granulating solution may evaporate during wet granulation.

The powders are lifted by a centrally located vertical screw. And allowed to cascade to the bottom of the container (tumbling action). The counteracting blades set up high shear and arc effective in breaking up lumps or aggregates. Helical blades move the powders. From one end to another as shown in Figure 8-9. The final stage of mix represents an equilibrium state. The: operating conditions of a given mixer can markedly affect the steady state and thus the quality of the mixing. The blend is discharged from the bottom opening.

Uses: Ribbon blender is used to mix finely divided solids, wet solid mass, sticky and plastic solids. Uniform size and density material can be easily mixed. It is used for liquid-solid and solid-solid mixing.

Advantages: High shear can be applied by using perforated baffles, high bring about a rubbing and break down aggregates. Headroom requirement is less.

Disadvantages:

1. It is a poor mixer, because movement of particles is two-dimensional.
2. Shearing action is less than in planetary mixer.

3. Dead spots (areas that remain unmixed) are observed in the miser. Though they are minimum.
4. It is having fixed speed drive.

MCQ Each carry 1 mark

1. In which type of mixer, the trough is stationary?
    a. Barrel mixer
    b. Double cone blender
    c. Ribbon mixer
    d. Zigzag mixer
2. Which mixture is used when one of the components is very less in quantity?
3. Statement 2: This mixer is used to mix items in savoury or a snack item.
    a) Ribbon mixer, planetary mixer
    b) Planetary mixer, double cone mixer
    c) Double cone mixer, double cone mixer
    d) Planetary mixer, planetary mixer
4. The mechanism of mixing in Ribbon blender
    a) Convective mixing
    b) Shear mixing
    c) Diffusive mixing
    d) All of the above
5. Tumbling action is found in
    a) Double cone blender
    b) V cone blender
    c) Cube blender
    d) All of the above
6. Which of the following is also called as V cone Blender?
    a) Twin shell blender
    b) Double cone blender
    c) Ribbon blender
    d) Colloid mill
7. Which of the following is correct about a twin shell blender?
    a) The material is loaded approximately 80%-90% by volume
    b) Twin shell blenders are U shaped
    c) Materials inside undergo tumbling motion when rotated
    d) Material is loaded via apex port and emptied through shell hatches

Each carry 2 marks

1. Mention the equipment used for solid-solid mixing.
2. List the equipment used for powder mixing in pharmaceutical industry

Each carry 5 marks

1. Explain the working of a mixer used for mixing dry powders before granulation.

2. Explain the construction and working of a Double cone blender for mixing solids
3. Explain the construction and working of a Twin shell blender for mixing solids

4. Explain the construction and working of a ribbon blender for mixing solids

Each carry 10 marks

1. Describe the equipment for solid-solid mixing of pharmaceutical materials