

DEFINITION OF SIZE REDUCTION

- Size reduction is the process of reducing drugs (vegetable & chemical substances) into smaller pieces, coarse particles or fine powder.
- It also known as comminution or pulverization.

OBJECTIVES OF SIZE REDUCTION

- To increase the rate of solution
- To allow the rapid penetration of solvent during extraction
- To get a uniform powder
- To increase the rate of absorption of a drug
- To improve the stability of certain Dosage forms
- To help in the process of separation of solids from liquids

FACTORS AFFECTING SIZE REDUCTION

- ❖ **Hardness** :- It is easier to break soft material than hard materials. Ex. For iodine hammer mill is used
- ❖ **Fibrous** :- These are tough in nature. A soft, tough material has more difficulty than a hard, brittle substance. Ex. Rauwolfia, Ginger
- ❖ **Elastic / Sticky** :- Become soft during milling. Ex. Synthetic gums, waxes, resins
- ❖ **Melting point** :- Waxy substances, fats or oils become softened during size reduction due to heat generation.

FACTORS AFFECTING SIZE REDUCTION

- ❖ **Hygroscopic** :- Certain substances absorbed moisture content rapidly. This wet mass hampers the milling process. Ex. Potassium carbonate
- ❖ **Purity required** :- Mills used for SR often cause the grinding surfaces to wear off & thus impurities come in powder. For high purity such mills are avoided.

MECHANISM OF SIZE REDUCTION

- ❑ **Cutting** -The material is cut on a small scale by means of a sharp blade, knife, root cutter or any other sharp instrument.
- ❑ **Compression** - The material is crushed by means of application of pressure.
- ❑ **Impact** - Impact occurs when material is stationary & hit by an object moving at high speed or moving particle strikes to stationary surface.
- ❑ **Attrition** - arising from particles scraping against one another or against a rigid surface
- ❑ **Shear** - Shear is produced when the particle is compressed between the edges of two hard surfaces moving tangentially.

EQUIPMENTS USED FOR SIZE REDUCTION

3. HAMMER MILL

Principle :

It works on the principle of Impact

Construction:

It consists of a stout metal casing, enclosing a central shaft, to which four or more swinging hammers are attached. The lower part consists of a screen through which material can pass and collected in receiver.

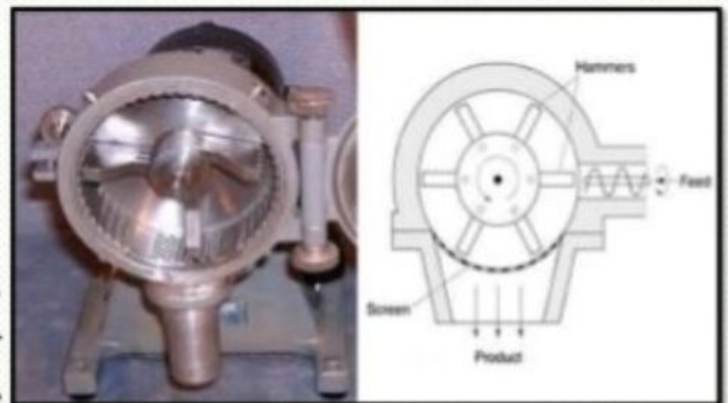


Fig . 3 Hammer Mill

Working :

- The material put into the hopper.
- Due to fast rotation of hammers material is powdered to the desired size & collected under the screen.
- The mill can produce coarse to moderately fine powder.

Uses:

The hammer mill is used for producing immediate grades of powder from almost all types of substances except sticky materials that choke the screen.

EQUIPMENTS USED FOR SIZE REDUCTION

4. BALL MILL

Principle :

It works on the principle of *impact & attrition*.

Construction:

It consists of hollow cylinder which is mounted on a metallic frame in such way that it can be rotated on its longitudinal axis.

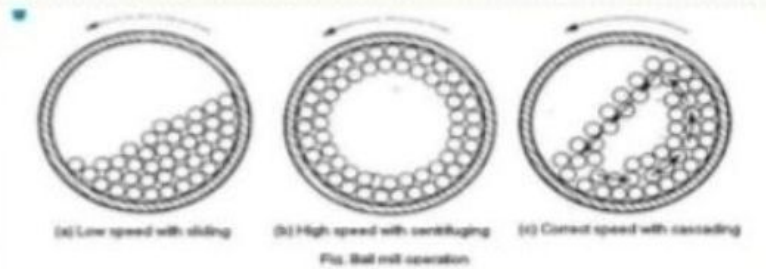
Cylinder contains metallic ball usually lined with chrome. In Pharmaceutical industry sometimes the cylinder of the ball mill is lined with rubber or porcelain. The ball used in these mills are also made of rubber or porcelain.



Fig . 4 Ball Mill

Working :

Ball Mill grinds material by rotating a cylinder with steel grinding balls, causing the balls to fall back into the cylinder and onto the material to be ground. The rotation is usually between 4 to 20 revolutions per minute, depending upon the diameter of the mill. The larger the diameter, the slower the rotation. If the peripheral speed of the mill is too great, it begins to act like a centrifuge and the balls do not fall back, but stay on the perimeter of the mill.

**Uses:**

The mill is used to grind brittle drugs to fine powder.

References:

- 1) R.M. Mehta Pharmaceuticals I , 94-101
- 2) <http://www.mine-engineer.com/mining/ballmill.htm>
- 3) Images from online sources

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