

Size Separation:
**Size separation by sifting and official
standard for powders**

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Size Separation

- It is a unit operation that involves the separation of various sizes of particles into two or more portions by means of screening surfaces.
- Size separation is also known as sieving, sifting, classification or screening.
- This technique is based on physical differences between particles such as size, shape and density.

Objectives/ Application

- To determine particle size for the production of tablets and capsules.
- To improve mixing of powders.
- To optimize feed rate, agitation, screening during production.
- To improve solubility and stability of particles during production.

OFFICIAL STANDARDS FOR POWDERS

Standards for powders for pharmaceutical purposes are laid down principally in the Indian Pharmacopoeia which states, that the degree of coarseness or fineness of a powder is differentiated and expressed by the size of the mesh of the sieve through which the powder is able to pass. The I.P. specifies five grades of powder which are as under:

1. Coarse powder :

A powder of which all the particles pass through a sieve with nominal mesh aperture of 1.70 mm (No. 10 sieve) and not more than 40.0 percent through a sieve with nominal mesh aperture of 355 μm (No. 44 sieve) is called coarse powder.

2. Moderately coarse powder:

A powder of which all the particles pass through a sieve with nominal mesh aperture of 710 μm (No. 22 sieve) and not more than 40.0 percent through a sieve with nominal mesh aperture of 250 μm (No. 60 sieve) is called moderately coarse powder.

3. Moderately fine powder :

If all the particles of a powder pass through a sieve with nominal mesh aperture of 355 μm (No. 44 sieve) and not more than 40.0 per cent through a sieve with nominal mesh aperture of 180 μm (No. 85 sieve), it falls in this group.

4. Fine powder :

In case all the particles pass through a sieve with a nominal mesh aperture of 180 μm (**No. 85 sieve**), it is called fine powder.

5. Very fine powder :

If all the particles of the powder pass through a sieve with a nominal mesh aperture of 125 μm (**No. 120 sieve**), it is said to be very fine powder.

Grade of powder	Sieve through which all particles must pass	Sieve through which not more than 40 per cent of particles pass
Coarse	10	44
Moderately coarse	22	60
Moderately fine	44	85
Fine	85	Not specified
Very fine	120	Not specified

SIEVES

Sieves for pharmacopoeial testing are constructed from wire cloth with square meshes, woven from wires of brass, bronze, stainless steel or any other suitable material. The wires should be of uniform circular cross-section and should not be coated or plated. There should not be any reaction between the material of the sieve and the substance which is being sifted from it.



Standards for sieves used for pharmacopoeial testing must specify the following:

1. Number of sieve :

Sieve number indicates the number of meshes in a length of 2.54 cm in each transverse direction parallel to the wires.

2. Nominal size of aperture :

Nominal size of aperture indicates the distance between the wires. It represents the length of the side of the square aperture. The I.P. has given the nominal mesh aperture size for majority of sieves in mm or in cm.

3. Nominal diameter of the wire :

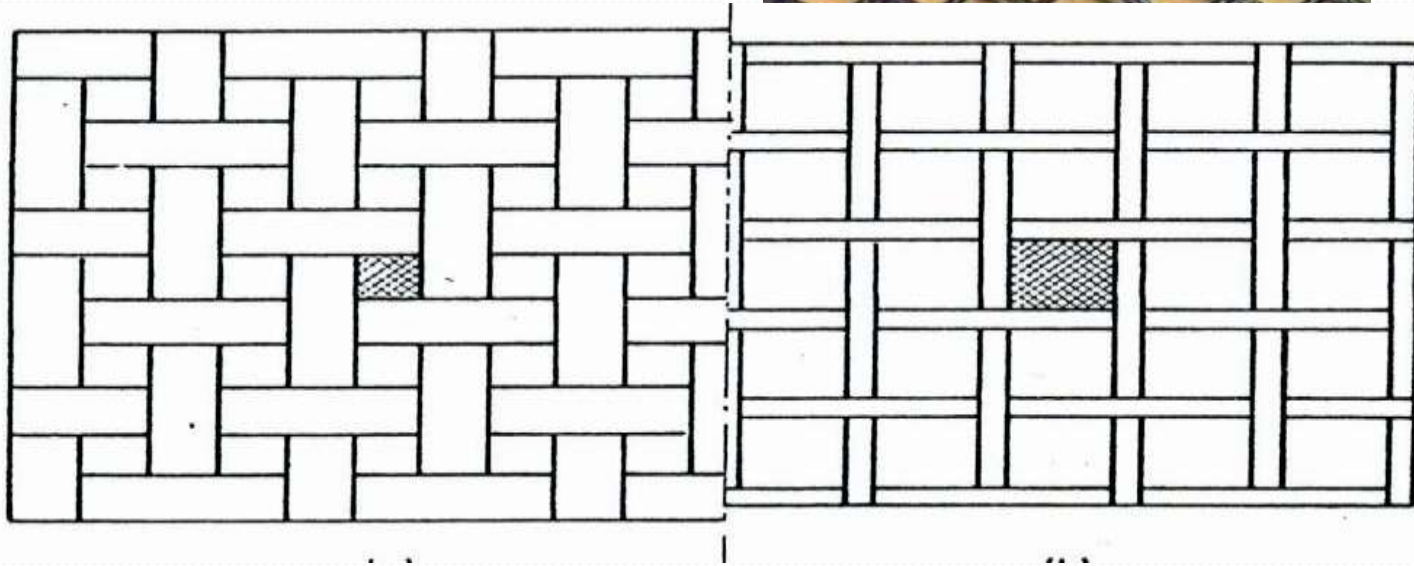
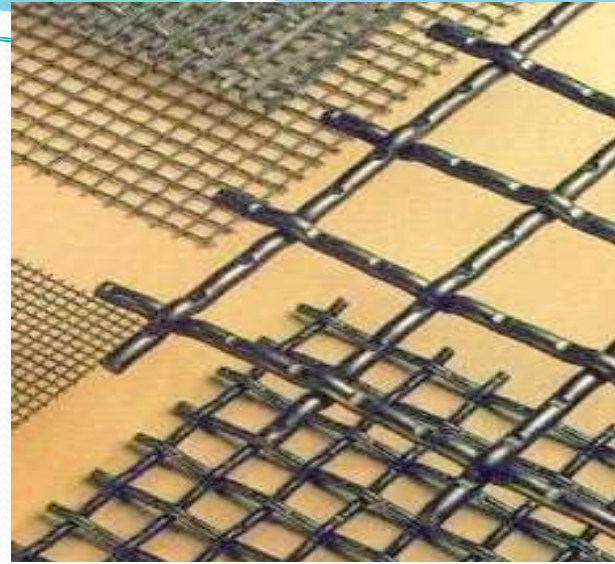
Wire mesh sieves are made from the wire having the specified diameter in order to give a suitable aperture size and sufficient strength to avoid distortion of the sieve.

4. Approximate percentage sieving area :

This standard expresses the area of the meshes a percentage of the total area of the sieve. It depends on the size of the wire used for any particular sieve number. Generally the sieving area is kept within the range of 35 to 40 per cent in order to give suitable strength to the sieve.

5. Tolerance average aperture size :

Some variation in the aperture size is unavoidable and when this variation is expressed as a percentage, it is known as the 'aperture tolerance average'.



Effect of wire diameter on sieve mesh size.

Modes of motion in size separation

1. Agitation 2. Brushing 3. Centrifugal

Agitation methods Sieves may be agitated in a number of different ways, such as:

- 1. Oscillation** : This sieve is mounted in a frame that oscillates back and forth. It is a simple method but the material may roll on the surface of the sieve.
- 2. Vibration** : The sieve is vibrated at high speed by means of an electric device. The rapid vibration is imparted to the particles on the sieve which helps to pass the powdered material through it.
- 3. Gyration** : In this method, a system is made so that sieve is on rubber mounting and connected to an eccentric fly wheel. This gives a rotary movement of small amplitude to sieve which in turn gives spinning motion to the particles that helps to pass them through a sieve. Agitation methods are not continuous methods' but can be made so by inclination of the sieve and the provision of separate outlets for undersize and oversize particles.

Advantages

- Inexpensive
- Simple and rapid

Disadvantages

- If the powder is not dried, apertures become clogged with particles leading to improper sieving.
- During agitation, attrition occurs causing size reduction.

Brushing methods

In this case, a brush is used to move the particles on the surface of the sieve and to keep the meshes clear. The brush is rotated in the middle in the case of a circular sieve but spiral brush is rotated on the longitudinal axis in case of a horizontal cylindrical sieve.

Centrifugal methods

- In this method, a high speed rotor is fixed inside the vertical cylindrical sieve, so that on rotation of rotor the particles are thrown outwards by centrifugal force.
- The current of air which is produced due to high speed of rotor helps in separating the particles. Ex- Cyclone separator and air separator.

Advantages

- Extremely useful for fine powders, because sieves have the limitation of mesh size.
- This methods are also useful in cases where conventional sieving tends to block the sieves.

SIEVING METHOD/ Sieve shaker machine

Principle

The powdered drug is separated according to its particle size by using a number of sieves in a nest. These are subjected to different types of agitation, so that size separation is rapid.

Construction

Standard sieves of different mesh numbers are available commercially as per the specifications of IP and USP. These sieves are fixed in a mechanical shaker apparatus.

Working

- Sieves are arranged in a nest with the coarsest at the top.(descending order)
- A sample (50 g) of the powder is placed on the top sieve.
- This sieve set is fixed to the mechanical shaker apparatus and shaken for a certain period of time (20 minutes). The powder retained on each sieve is weighed.

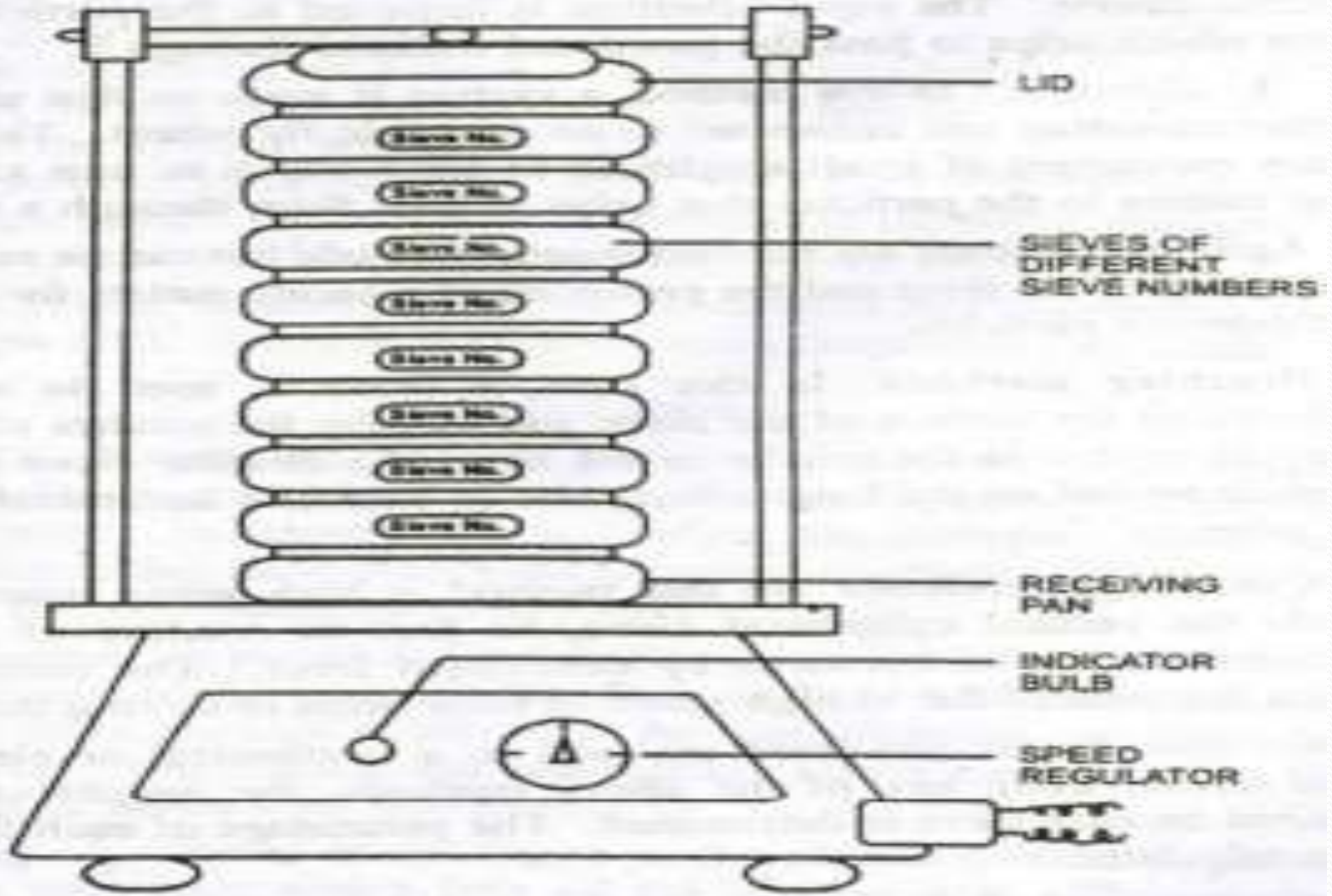


Fig. 6-1 Electromagnetic laboratory sieving machine

Advantages

- It is inexpensive, simple and rapid with reproducible results.

Disadvantages

- If powder is not dry, apertures get clogged with particles, leading to improper sieving.
- During shaking, attrition (particles colliding with each other) occurs causing size reduction of particles. This leads to error in estimation.