International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 2 Mar-Apr 2022, pp: 286-296 www.ijprajournal.com ISSN: 2456-4494

A Review on Size Separation

Jesny S*[1], Prasobh G.R[2]
[1]B Pharm student, Sree Krishna College of Pharmacy and Research Centre, Parassala, Thiruvananthapuram, Kerala, India. 695502.
[2]Principal, Sree Krishna College of Pharmacy and Research Centre, Parassala, Thiruvananthapuram, Kerala, India. 695502.

Submitted: 01-03-2022 Accepted: 13-03-2022

ABSTRACT: Size separation is a technique that involves the separation of a mixture of various size particles into two or more portions by means of screening surfaces. Size separation is also known as sieving, sifting, screening. The main advantages of these methods are simple, inexpensive, continuous in operations and it provides a clear separation of the particles in many size fractions as required
Here, we focus on the different types of size separators, its principle, construction, advantages, disadvantages and applications.
KEYWORDS: sieving, screening, strainer, sieves, elutriation, sifting

I.INTRODUCTION

[1]Size separation is unit operation that involves the separation of various size particles into two or more portions by means of screening surfaces. Size separation is also known as sieving, sifting, screening. The technique is based on physical differences between their size, shape and density.

Separation depends on the selection of a process in which the behavior of the material is influenced to a marked degree by some physical property. Thus, if a material is to be separated into various size fractions, a sieving method may be used because this process depends primarily on the size of the particles, though other physical properties such as the shape of the particles and their tendency to agglomerate, may also be involved.

Other method of separation methods of separation depends on the difference in the behavior of the particles in a moving fluid. In this case, the size and the density of particles are the most important factors.

[2]Fluid separation is commonly used for dividing a mixture of two materials through magnetic, electrostatic, and forth flotation methods are also used where appropriate. Screening is a method of separating particles according to size alone. Particles can be separated into individual sizes using sieves. The final portion consists of a more uniform size. The material that remains on the given screening surface is known as oversize or plus material. The material passing through the screening surface is known as undersize or minus material.Separation depends on the selection of a process in which the behaviour of the material is influenced to a marked degree by some physical property. Thus, if a material is to be separated into various size fractions, a sieving method may be used because this process depends primarily on the size of the particles, though other physical properties such as the shape of the particles and their tendency to agglomerate, may also be involved. Other methods of separation depend on the differences in the behaviour of the particles in a moving fluid. In this case, the size and the density of the particles are the most important factors, and the shape is of secondary importance. Other processes make use of differences in electrical or magnetic properties of the materials or in their surface properties.In general, large particles are separated into size fractions by means of screens. Small particles that would clog the fine apertures of the screen or make it impractical to collect them by narrowing the opening are separated in a fluid. Fluid separation is commonly used for dividing a mixture of two materials, though magnetic, electrostatic, and froth flotation methods are used

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 2 Mar-Apr 2022, pp: 286-296 www.ijprajournal.com ISSN: 2456-4494

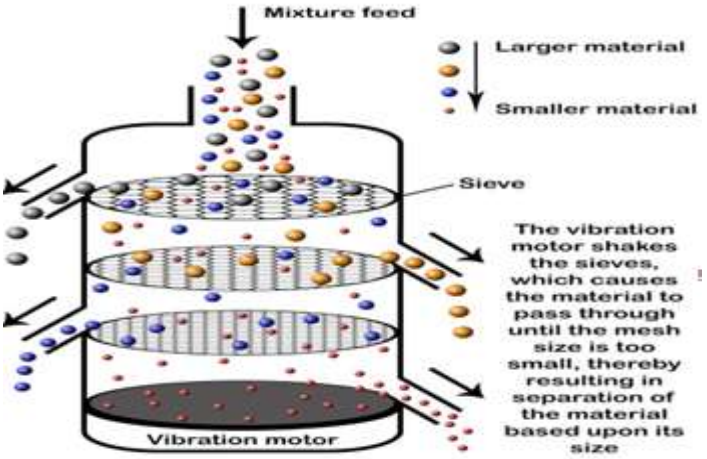

Fig no:1 Screening method of size separation

II.OFFICIAL STANDARDS OF POWDER

The Indian Pharmacopoeia (I.P) gives different grades of powders on the basis of degree of coarseness and Fineness of Powders.

S.No	Grades of Powder	Sieve No.	Nominal mesh aperture size	Sieve No. (40%)	Nominal mesh aperture size (40%)
1.	Coarse Powder	10	1.7µm	44	355µm
2.	Moderately Coarse powder	22	710µm	60	250µm
3.	Moderately Fine powder	44	355µm	85	180µm
4.	Fine powder	85	180µm	_	_
5.	Very Fine powder	120	125µm	_	_

TABLE NO. 1: Different Grades of Powders

Different Grades of Powders given by the I.P.

[3]**Coarse Powder:** This type of powders are passed through the sieve with a nominal Aperture of 1.70mm (no.10 sieve) and when we passed this powder through sieve with the nominal aperture of 355µm (no.44 Sieve) then only 40 % powder will separate from this sieve.

Moderately Coarse powder: This type of powders are passed through the sieve with a nominal aperture of 710µm (no.22 sieve) and when we passed this powder through sieve with the nominal aperture of 250µm (no.60 Sieve) then only 40 % powder will be separated.

Moderately fine powder: This type of powders is passed through the sieve with a nominal aperture of 355µm (no.44 sieve) and when we passed this powder through sieve with the nominal aperture of 180µm (no85 Sieve) then only 40 % powder will separate from this sieve.

Fine powder: This type of powders is passed through the sieve with a nominal Aperture of 180µm (№85 sieve).

Very Fine Powder: This type of powders is passed through the sieve with a nominal aperture of 125µm (№120 sieve).

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 2 Mar-Apr 2022, pp: 286-296 www.ijprajournal.com ISSN: 2456-4494

III.OBJECTIVES OF SIZE SEPARATION

[4]To determine particle size for the production of tablets and capsules.
To improve mixing of powders.
To improve the solubility and stability of particles during production.
To optimize feed rate, agitation, screening during production
Quality control of raw materials
Useful in production of tablets, capsules, suspension, emulsion, ophthalmic preparations, ointments, creams, etc

IV. ADVANTAGES

Easy handling
Low investment cost
Precise
Reproducible
Time saving
Improve powder mixing

V.DISADVANTAGES

Leads aggregation
Over loading errors
Long fibrous will not pass
Labor intensive
Agglomerated particles

VI. APPLICATIONS

To prepare granules of desired size to ensure good flow ability
To separate undesirable particles
To measure particle size and size distribution
To know the efficiency of size reduction equipment
To get uniform dosage forms
Monosize particles undergo less segregation
During filling the capsule, the particles must be uniform in weight and dose

VII.SIEVES

Sieves are the simplest and sieving is the most frequently used method for size separation. The fine mesh strainer, also known as the sift, commonly known as sieve, is a device for separating wanted elements from unwanted material or for characterizing the particle size distribution of a sample, typically using a woven screen such as a mesh or net or metal. The word "sift" derives from "sieve". In cooking, a sifter is used to separate and break up clumps in dry ingredients such as flour, as well as to aerate and combine them. A strainer is a form of sieve used to separate suspended solids from a liquid by filtration.

CONSTRUCTION: [5]Sieves for pharmaceutical testing are constructed from wire cloth with square meshes, woven from wire of brass, bronze, stainless steel or any suitable materials. Sieves should not be coated or plated. There must be no reaction between the material of the sieve and the substance to be sieved.
Brass test sieves were the old standard because they used to be cheaper than stainless steel, but that is no longer the case. Stainless steel sieves are durable and versatile. Newark Wire uses Pure Tin Soldered, UV Adhesive, and Welded Construction to make test sieves.

Fig no:2 ;sieves

TYPES OF SIEVES

The primary consideration of sieving is given to the size and SHAPE of aperture opening

Sieves commonly used in pharmaceuticals process include
1.woven wire sieves
2.bolting cloth sieves

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 2 Mar-Apr 2022, pp: 286-296 www.ijprajournal.com ISSN: 2456-4494

3.closely spaced bars
4.Punched plate

Woven wire sieves : Wire woven sieves are general purpose sieves and widely used in the pharmacy practice. The type of woven wire sieves are

Plain sieve
Twilled sieve

Bolting cloth sieve: Silk nylon and cotton are generally wove from twisted multistrand fibers. These are used for the separation of fine powders. Hum-mer screens uses this type of screen

Bar screens: Bar screens are generally used in handling large and heavy pieces of materials. The bars are fixed in parallel position and held by cross bars and spacers

Punched plates: This are used for coarse sizing. The screens are prepared by using a metal sheet of varying thickness with perforated holes

[6]Standards of sieves: Standards for sieves used to testing must specify the following:

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

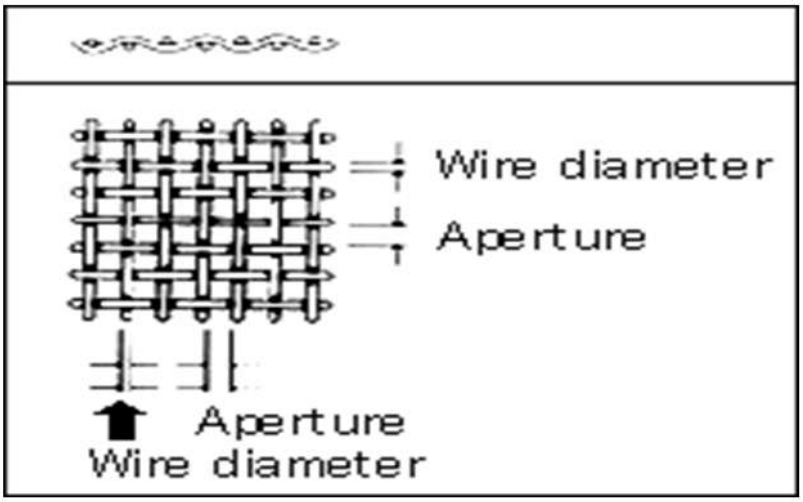

Fig no:3 Sieve number and size

Nominal mesh size of aperture: nominal size of aperture indicates the distance between the wire.it represents the length of the side of the square aperture. The IP has given the nominal mesh aperture size for majority of sieves in mm or in cm

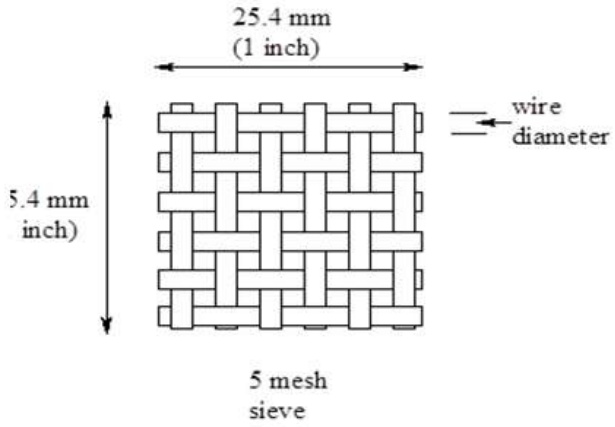

Fig no:4nominal mesh aperture

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 2 Mar-Apr 2022, pp: 286-296 www.ijprajournal.com ISSN: 2456-4494

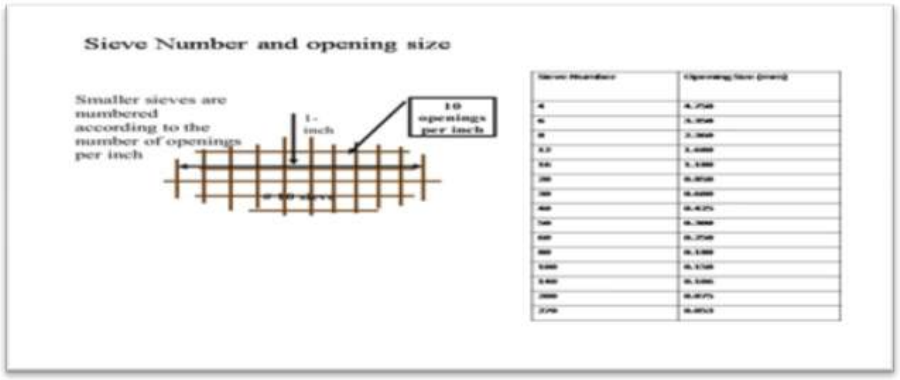

Fig no5: sieve dimensions

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.

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 percent in order to give suitable

Aperture Tolerance Average Some variation in the aperture size is unavoidable and this variation, expressed as a percentage, is known as the aperture tolerance average. The term tolerance is used in engineering practice to mean the limits within which a particular quantity or dimension can be allowed to vary and still be acceptable for the purpose for which it is required. Finer wires are likely to be subject to a greater proportional variation in diameter than coarse.

PERFORATED PLATE SIEVES

Sieves may also be made by drilling holes in metal plate, so that this type will have circular apertures as against the square apertures of the wire mesh sieve. ν In general, these sieves are used in the larger sizes and can be made with greater accuracy than wire-mesh sieves, as well as beingless susceptible to distortion in use. This type is commonly used also as screens in impact mills. Usually, the holes are spaced with their centers arranged at the apices of equilateral triangles, so that all the apertures are equidistantSimilar standards are laid down with the appropriate equivalent specifications for plate thickness and nominal width of the bridge (dimension A in the Figure) which control the strength of the sieve in the same way as wire diameter in wire mesh sieves.

Materials Used for Sieves

1) The wire should be of uniform, circular cross-section.

2) The material should have suitable strength to avoid distortion

3) Be resistant to corrosion by any substances that may be sifted.

VIII.SIEVING METHODS

[7]Sieves should be used and stored with care, since a sieve is of little value if the meshes become damaged or distorted.

With the exception of the use of sieves for granulation, material should never be forced through a sieve. ϖ Particles, if small enough, will pass through a sieve easily if it is shaken, tapped, or brushed.

MECHANICAL SIEVING METHODS

Principle: Based on methods as Agitation, Brush the sieve, Use centrifugal force

1. Agitation Methods

Sieves may be agitated in a number of different ways: Oscillation (move back and forth) The sieve is mounted in a frame that oscillating.

Advantages

Simple method , Vibration The mesh is vibrated at high speed, often by an electrical device. The rapid vibration is imparted to the particles on the sieve and the particles are less likely to “blind” the mesh

Disadvantages

The material may roll on the surface of the sieve, and fibrous materials tend to “ball”.

2. Brushing Methods

A brush can be used to move the particles on the surface of the sieve and to keep the meshes

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 2 Mar-Apr 2022, pp: 286-296 www.ijprajournal.com ISSN: 2456-4494

clear. A single brush across the diameter of an ordinary circular sieve, rotating about the mid-point, is effective; In large-scale production a horizontal cylindrical sieve is employed, with a spiral brush rotating on the longitudinal axis of the sieve.

3. Centrifugal Methods

Use a vertical cylindrical sieve with a high speed rotor inside the cylinder, so that particles are thrown outwards by centrifugal force. The current of air created by the movement helps sieving. Especially is useful with very fine powders. Industrial methods of particle size separation based on sedimentation or on elutriation. Wet sieving is more efficient than the dry process, because particles are suspended readily and passing easily through the sieve with less blinding of the meshes

WET SIEVING METHODS (FLUID CLASSIFICATION): Industrial methods of particle size separation based on sedimentation or on elutriation. Wet sieving is more efficient than the dry process, because particles are suspended readily and passing easily through the sieve with less blinding of the meshes

IX.EQUIPMENT FOR SIZE SEPARATION

A wide variety of equipment have been developed differing in the scale of operations ruggedness, method of movement of materials and material of construction.

Factors to be considered are

a. wear of the sieves

b. blinding

machine noise

GENERAL CLASSIFICATION OF SCREENING EQUIPMENT

The screening or screening machines may be divided into different classes

Grizzles; for coarse particles above 50mm large lumbs

Revolving screens; separation about 13mm particles

Shaking screens; separation from 13mm downwards to fines

Vibrating screens; coarse size to fineness

Oscillating screens; fine mesh size

Fluidised systems; for very fine powders

SIEVE SHAKER MACHINE

[8]In this method, the fine powder is separated from the coarse powder by using sieves of desired number. The degree of fineness of a powder is known with the help of sieve through which the powdered material is passed. Sieves are numbered in order to distinguish from each other.

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

WORKING & CONSTRUCTION Size separation of powder is done by passing the powdered material through a set of sieves. Sieves are arranged in descending order i.e., sieve of larger size is at the top and the smallest one at the bottom. The bottom sieve is attached to the receiving panThe material is placed in the uppermost sieve. The sieves are shaken with the help of mechanical sieve shaker or electromagnetic devices. It helps the particles to pass through the sieves

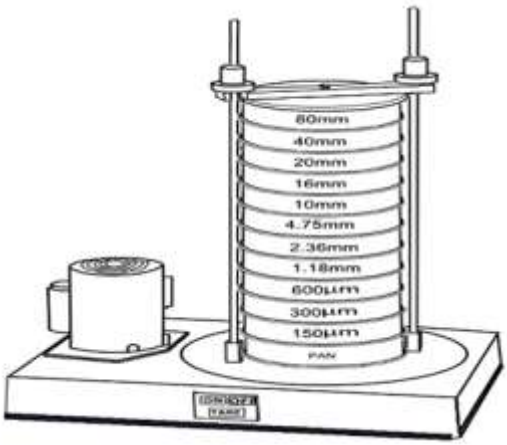

Fig no 6; Sieve shaker machines

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 2 Mar-Apr 2022, pp: 286-296 www.ijprajournal.com ISSN: 2456-4494

Advantages: Inexpensive and easy to use
Disadvantages: Chance of clogging of sieve if powder is not properly dry.
During shaking, attrition may occur.

CYCLONE SEPARATOR

[9]Cyclonic separation is a method of removing particulates from an air, gas or liquid stream, without the use of filters, through vortex separation. When removing particulate matter from liquid, a hydro cyclone is used; while from gas, a gas cyclone is used. Rotational effects and gravity are used to separate mixtures of solids and fluids. The method can also be used to separate fine droplets of liquid from a gaseous stream

PRINCIPLE In cyclone separator, the centrifugal force is used to separate solids from fluids. The separation depends not only on the particle size but also on density of particles. Hence depending on the fluid velocity, the cyclone separator can be used to separate all types of particles or to remove only coarse particles and allow fine particles to be carried through with the fluid.

Component of cyclone separator	Dimension (mm)
Cyclone diameter (D_c)	50
Barrel length (L_c)	100
Cone length (Z_c)	100
Cyclone Outlet diameter (D_e)	25
Inlet height (H_c)	25
Inlet width (B_c)	12.5
Outlet pipe length (H_c+S_c)	31.25

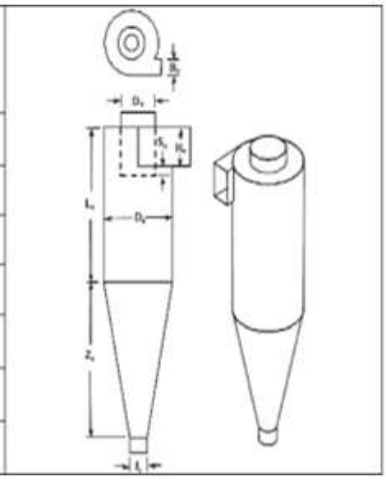

Table no.2 dimensions of cyclone separator.

CONSTRUCTION- It consists of a cylindrical vessel with a conical base. In the upper part of the vessel is fitted with a tangential inlet and a fluid outlet and at the base it is fitted with solid outlet.
WORKING : The suspension of a solid in gas (usually air) is introduced tangentially at a very high velocity, so that rotary movement takes place within the vessel. The fluid is removed from a central outlet at the top. The rotatory flow within the cyclone separator causes the particles to be acted on by centrifugal force. The solids are thrown out to the walls, thereafter it falls to the conical base and discharged out through solids outlet.
USES

- [10]Cyclone separators are used to separate the suspension of a solid in a gas (air).
- It can be used with liquid suspensions of solids

Large scale cyclones are used in sawmills to remove sawdust from extracted air. Cyclones are also used in oil refineries to separate oils and gases, and in the cement industry as components of kiln preheaters. Cyclones are increasingly used in the household, as the core technology in bagless types of portable vacuum cleaners and central vacuum cleaners. Cyclones are also used in industrial and professional kitchen ventilation for separating the grease from the exhaust air in extraction hoods. Smaller cyclones are used to separate airborne particles for analysis. Some are small enough to be worn clipped to clothing, and are used to separate respirable particles for later analysis.

AIR SEPARATOR

PRINCIPLE; [11]It works on the same principle as that of cyclone separator. But in this case the air movement is obtained by means of rotating disc and blades. To improve the separation, the stationary blades are used. By controlling these blades and the speed of rotation, it is possible to vary the size at which separation occurs.

CONSTRUCTION It consists of a cylindrical vessel with a conical base. In the upper part of the separator the vessel is fitted with feed inlet, and at

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 2 Mar-Apr 2022, pp: 286-296 www.ijprajournal.com ISSN: 2456-4494

the base there are two outlets, one for light particles and other for heavy particles. The rotating disc and rotating blades are attached to the central shaft, to produce air movement.

WORKING The sample powder is passed through the feed inlet, which falls on the rotating disc. The rotating blades are attached to the same shaft. These produce a current of air as shown by the arrows. The fine particles are picked up and are carried into space, where air velocity is sufficiently reduced. The fine particles are dropped and ultimately collected at an outlet meant for fine particles. The heavy particles which fall downward are removed at an outlet meant for heavy particles.

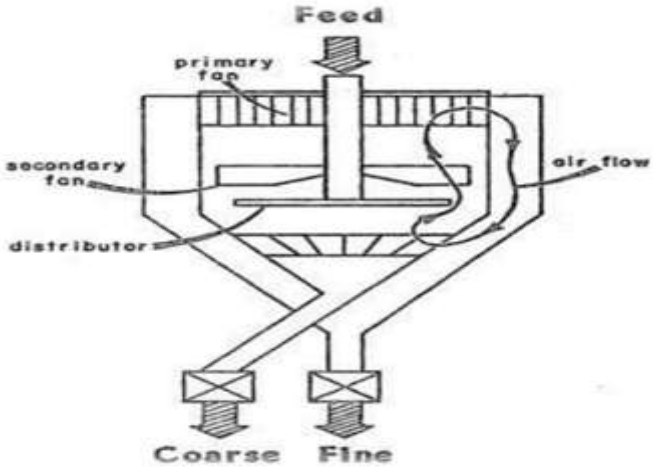

Fig no. 7:air separator

USES -

Air separator is often attached to the ball mill or hammer mill to separate and return and return oversized particles for further size reduction

ELUTRIATION METHOD

[12]The size separation of powder is based on the low density of fine particles and high density of the coarse particles. Elutriating tank is used to separate the coarse and fine particles of powder after levigating

WORKINGThe dry powder or paste made by levigating process is kept in an elutriating tank and mixed with a large quantity of water.

The solid particles are uniformly distributed in the liquid by stirring and then it is allowed to settle down. Depending on the density of solid particles, it will either settle down or remain suspended in water. The sample is withdrawn at different heights through the outlets. These are dried and thus the powder with various size fractions are collected. Nowadays in elutriation process, the particles are suspended in a moving fluid, generally water or air. The apparatus consists of a vertical column with an inlet near the bottom for suspension, an outlet at the base for coarse particles and an overflow near the top for fluid and fine articles. One column will give single separation into two fractions. If more than one fraction is required a number of tubes of increasing area of cross section can be connected in series. The velocity of the fluid decreases in succeeding tubes as the area of cross section increases, thus giving a number of fractions. These fractions are separated and dried.

Advantages

- [13]The process is continuous.
- Depending on the number of fractions required, the same number of tubes of different area of cross section can be connected.
- The separation is quick as compare to other methods of separation.
- The apparatus is more compact than as that used in sedimentation methods.

Disadvantage

The suspension of solid particles has to be diluted which may not be desired in certain cases

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 2 Mar-Apr 2022, pp: 286-296 www.ijprajournal.com ISSN: 2456-4494

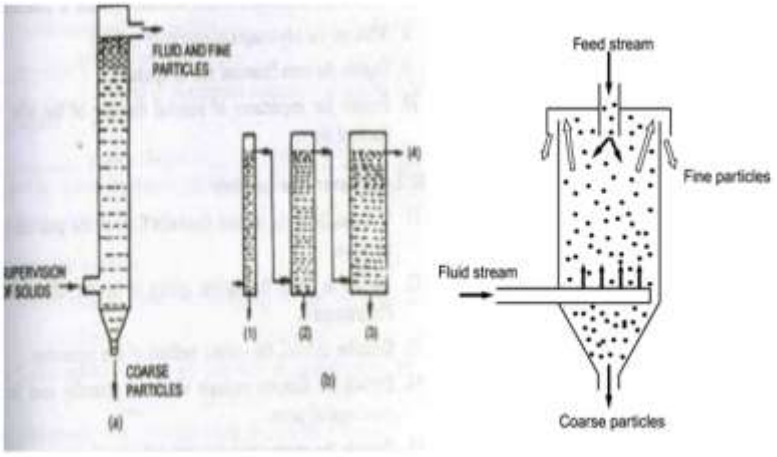

Fig no 8:elutrition apparatus

ALPHINE AIR JET SIEVE

.[14] ALPINE air jet sieves have always been characterised by simple operation and reliable results Because extremely fine particles have a tendency to agglomerate and therefore often clog up the sieve, the air jet sieve is the device of choice for sieving fine powders. As a result of the air jet principle, the e200 LS offers maximum effectiveness with such materials. The reason for this effectiveness bases on two components: a slotted nozzle which rotates in the sieving chamber and an industrial vacuum cleaner connected up to the sieving chamber. As soon as the vacuum cleaner is switched on, it generates a vacuum inside the sieving chamber.

PRINCIPLE It depends on the use of a jet of air blown from below the sieve mesh in order to fluidize the powder this prevent mesh block with forming a cushion of air that minimise friction of particles and thus reduce fines

CONSTRUCTION: It consist of metal housing into which the sieve mesh is fitted. Sieve cover is placed in such a way that an air tight seal is obtained A slit is provided such that its upper edge is in level with the upper edge of the housing. Provision is made to pass air jet below the slit. Suction line is provided below the sieve, which maybe controlled by the help of a mano meter

WORKING: A small amount of powder is spread on the sieve. the cover is placed in position. The slit is sit into rotation by sending a jet of air from below. The powder is fluidised in the upward jet of air. The suction is adjusted until the manometer reads about 27kpa. The vacuum sucks the undersized particles through the sieve. The material is recovered.

Sieving is continued for two minutes and residual powder is weighed. The powder is transferred to the next sized mesh with a fine brush. The process is continuing until all fractions are collected from the sample, by changing the sieve meshes as well as magnitude of the suction

USE

Used for analysing powder for its size distribution

ADVANTAGE

- In alphine air jet sieve, fluidisation of powder prevents blocking of the mesh
- It is rapid method once the mesh is placed and gives reproducible results
- It is very useful for fine powders

DISADVANTAGES

- Capacity is limited so not useful in large scale production
- This method is tedious, because each time only one particle size is obtained

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 2 Mar-Apr 2022, pp: 286-296 www.ijprajournal.com ISSN: 2456-4494

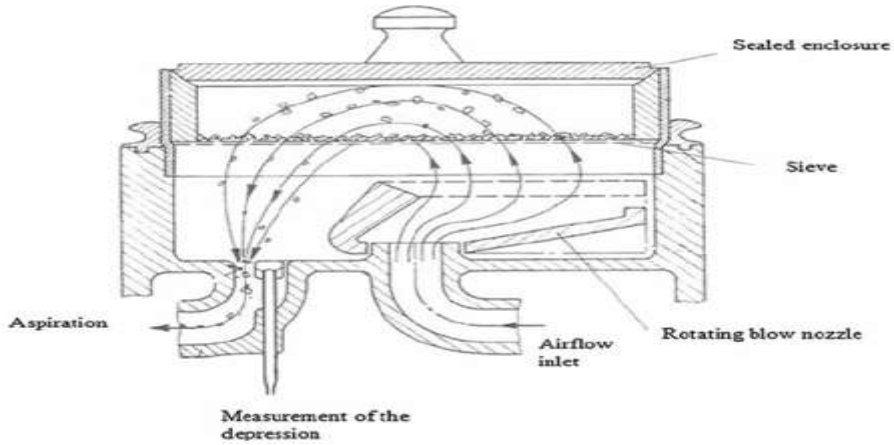

Fig no 9: diagrammatic representation of alpine air jet sieves

BAG FILTER

Size separation of fine dust from the milled powder is achieved in 2 steps

[15] In 1st step, the milled powder is passed through a bag filter (cloth) by applying the uction on the opposite side of feed entry

In the 2nd step pressure is applied in order to shake the bags so that powder adhering to bags alls off, which is collected from the conical base

CONSTRUCTION: : It consist of number of bags made of cotton or wool fabric. These are suspended in a sheet metal container. A bell crank lever arrangement is made to bring the filter to normal atmospheric condition.

WORKING**:**

Step I-Feed is separated from air by passing it through the cloth bags u

Step II-Bags are shaken to collect the fines that are adhered to the bags These 2 steps are subsequent and are controlled at different interval with the help of bell crank lever arrangement.

Filtering period-: The exhaust fan positioned at the top keeps the bags under less pressure than atmospheric pressure. The gas containing fine particles or dust enters the hopper and passes up. The gas feed passes through the fabric of bag. During this process, the fines are retained in the bags, while gas reaches the top of the casing. Because of air the bag remains taut during filtration operation. u

Shaking period-: Since vacuum is cut off in the chamber, air from ooutside enters the casing and passes through the bags. This result in violent shaking of the bags, so that the dust and fine particles are displaced from the bags and falls into the conical base.

USES

Bag filters are used along with other size separation equipment e.g.: cyclone separator It is connected to the fluidized energy mill to discharge underside enters the casing and passes through the bags. This result in violent shaking of the bags, so that the dust and fine particles are displaced from the bags and falls into the conical base.

X.SELECTION OF SIZE SEPARATION EQUIPMENT

The most efficient method should be selected based on the particle properties. If particles are already present in suspension as obtained from colloidal mill(water) or fluid energy mill (air) then separation can be achieved by elutriation and cyclone separator. As many pharmaceutical solids are water soluble, separation must be restricted to use of air (cyclone separator or air separator) or sieve method.

Final choice of equipment depends upon feed material, nature of finished product facilities available and costs in terms of procurement and maintenance.

Selection of a specific size separation method may be limited by pharmacopeial requirements, but for general cases the most efficient method should be selected based on particularly important, as each separation method is most efficient over a particular size range.

Particles that have just undergone size reduction will already be in suspension in a fluid whether air or water, and can be separated quickly by elutriation or cyclone separation methods, so that oversize materials can be returned to the mill

Alternatively, many powders used pharmaceutically are soluble in water, and size

International Journal of Pharmaceutical Research and Applications
Volume 7, Issue 2 Mar-Apr 2022, pp: 286-296 www.ijprajournal.com ISSN: 2456-4494

separation may have to be restricted to air classification method
e suspended readily and passing easily through the sieve with less blinding of the meshes

XI.CONCLUSION

Size matters and this holds particularly true in the world of macromolecules. Their size influence materials properties significantly and additionally. Size separation is a unit operation that involves the separation of a mixture of various size particles into two or more portions by means of screening surfaces. Size separation is also known as sieving, sifting, screening.

Size separation, the parceling of particulate materials on the basis of size, is an important industrial unit operation that produces on a continuous bases, coarser and finer stream from a feed stream in a single stage or multiple of size separation. Multiple stages of size separation devises can be arranged to produce multiple streams of differing degree of fineness such as various stages of aggregates or coals

Multiple staging that is multiple stages combine with blending, is also practiced to produce two streams, in the same manner as a single stage separation ,except more efficiently example are the drilling of starch or paper pulp . Size separation devises are also used in conjunction with other unit operations such as closed circuits crushing and grinding

Separation depends on the selection of a process in which the behaviour of the material is influenced to a marked degree by some physical property. Thus if a material is to be separated into various size fractions, a sieving method may be used because this process depends primarily on the size of the particles, though other physical properties such as the shape of the particles and their tendency to agglomerate, may also be involved. Other methods of separation depend on the differences in the behaviour of the particles in a moving fluid. In this case, the size and the density of the particles are the most important factors, and the shape is of secondary importance. Other processes make use of differences in electrical or magnetic properties of the materials or in their surface properties.

In general, large particles are separated into size fractions by means of screens. Small particles that would clog the fine apertures of the screen or make it impractical to collect them by narrowing the opening are separated in a fluid. Fluid separation is commonly used for dividing a mixture of two materials, though magnetic, electrostatic, and froth flotation methods are also used where appropriate.

REFERENCES

[1]. petri luckie, separation, size separation, research gate December 2000
[2]. J N staniforth, M E aulton particle size separation January 2007
[3]. Anthony, chiYing wong, fundamental parameters of powder charecteristics,powder technologies in plastic processing(PP 23-46) august 2021
[4]. Yasuo Arai, Determination of powder characteristics, January1996 ,
[5]. Konrad Menzel,structural sieves ,research gate ,December 2021
[6]. Krishnan pal Chaudhary, Chandra shaker, measurement of the size and spacing of standard wire sieves using an image processing system and wavelet transfer
[7]. Poulet P, Munoz-PerezJJ , Poortvliet G,mere J, Contreras A, López. Influence of different sieving methods on estimation of sand size parameters. 2019 may (5)
[8]. Helmut Herrmann, Herbert bucksch ,sieve shaker January 2014, DOI 10.1007/978-3-642-417114-6
[9]. Niko vujosevic ,cyclone separator, April 1984,research gate
[10]. Vinay sati,shivasheesh Kaushik, comparison of a classical cyclone separator and protruding surface cyclone separator using CFD software.DOI:10.1088/1757-899X/802/1/012008
[11]. Peyman khademi,air separator, October 2019
[12]. R. whimper, analyticalelutriation methods of separating cacao husk from cocoa powder, January1922
[13]. Helmut Herrmann, Herbert bucksch, Elutriation, January 2014
[14]. S,V. Masih , J.H.Shukla, A comparative evaluation of air jet sieve for particle size analysis of pharmaceutical powders, October 2008
[15]. Hiroyasu Hattori, energy saving Bag filter ,January 2018,DOI:10’2525/jtappij.72.611