FILTRATION

Syllabus

Theory of filtration, Kozeney's equation, filter media, filter aids. Selection of filters.
Study of filter press, rotary drums filter, leaf filter, metafilters, membrane filters.

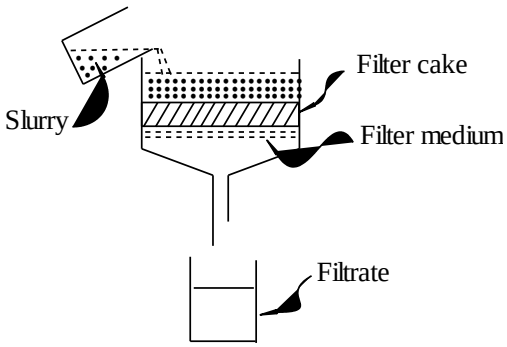
Questions:

- Discuss the factors affecting rate of filtration. (2000) [8]
- Describe the construction and working of a rotary drum filter. (2000) [8]
- Describe a method of determining cake resistance and filter medium resistance in a filter press. (1999) [5]
- Describe working of different types of membrane filters. (1999) [4]
- State Kozeney's equation. Derive expression for filter medium and cake resistance in cake filtration. (1998) [6]
- Bag filter(1998) [4]
- Write a brief note on membrane filtration. [1997] [4]
- Air filters and their uses in drying industry. [1997] [4]
- Explain the working and use of filter press. What are leaf filters? [1996] [16]
- Write note on bag filters. [1996] [8]
- With a neat sketch write the principle of a operation of working type plate and frame filter press.[1995] [10]
- Factors affecting rate of filtration. [1994] [4]

Definition

Filtration may be defined as the separation of a solid from a fluid by means of a porous medium that retains the solid but allows the fluid to pass.

Mechanism of filtration



Slurry: The suspension of solid and liquid to be filtered.
Filter medium: The porous medium used to retain the solids.
Filter cake: The accumulation of solids on the filter medium.
Filtrate: The clear liquid passing through the filter and collected in the receptor.

In the early stages of liquid filtration particles are retained on the fibers of filter medium by the following mechanisms:
(i) Straining, (ii) Impingement, (iii) Entanglement and
(iv) Attractive forces

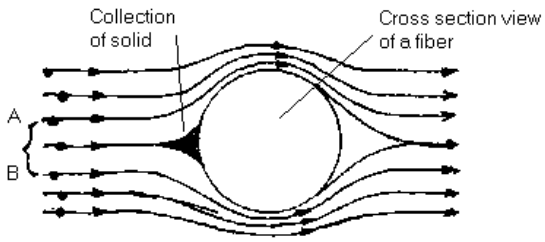
After a preliminary layer of particles are deposited on the filter-medium, the filtration occurs through the filter cake. This time filtration obeys Kozeney's equation.

Straining

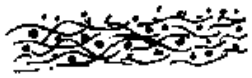
The particles larger than the pore size of filter medium will be retained on the latter.

Impingemnt

When a dilute suspension approaches a fiber the fluid passes along the side of the fiber will pass with the fluid but the particles in between A – B region will hit directly on the fiber. Due to their higher moment of inertia they strike (impinge) on the fiber and accumulate to form a ridge, roughly triangular in section.



Entanglement



If the filter medium consists of a cloth or is a porous felt, then particles become entangled in the mass of fibers. Usually the particles are smaller than the pores.

Attractive forces

In some cases, particles may collect on a filter medium as a result of attractive forces. Gas flowing through a filter medium causes generation of charges on the filter surface. The particles containing charge gets attracted to the surface.

Kozeny's Equation

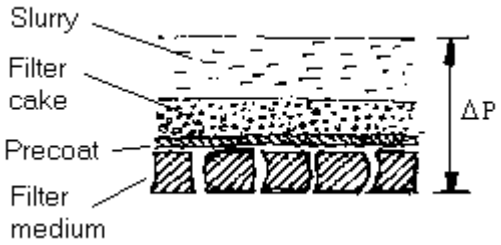
In the process of filtration the fluid passes through the filter medium, which offers resistance to its passage. Pressure difference across the filter is the driving force for the operation.

$$\text{Rate of filtration} = \frac{\text{Driving force}}{\text{Resistance}}$$

$$\frac{dV}{d\theta} = \frac{A\,\Delta P}{R} \quad \text{where} \quad \frac{dV}{d\theta} = \text{volume flow rate}$$

A = Area of filtration

R = Resistance to flow through the filter



Resistance to filtration is offered by the filter medium, precoat and filter cake.

Resistance, $R = \eta r (L + L_C)$ where, R = resistance to filtration

η = viscosity of fluid

r = Specific resistance of cake

L_C = Thickness of cake (increases with time)

L = Equivalent length of filter medium and pre-coat (fictitious thickness)

If 'V' volume of liquid is filtered containing 'w' fraction of solid content per unit volume of liquid, then the thickness of the cake formed is :

$$L_C = \frac{w\,V}{A}$$

Therefore,

$$\frac{dV}{d\theta} = \frac{A\,\Delta P}{R} = \frac{A\,\Delta P}{\eta r (L + L_C)} = \frac{A\,\Delta P}{\eta r \left(L + \frac{wV}{A}\right)}$$

$$\boxed{\frac{dV}{d\theta} = \frac{A\,\Delta P}{\eta r \left(L + \frac{wV}{A}\right)}}$$ – Kozeny's equation

FACTORS AFFECTING THE RATE OF FILTRATION

1. Properties of the filter medium and filter cake

The resistance of the filter medium and filter cake is denoted by R. The resistance of filter medium is of less significance in industrial scale than the resistance of filter cake. The latter increases with time. The rate of filtration decreases as the thickness of the cake increases. When the rate is uneconomically low the filtration is stopped and the cake is removed mechanically; and the filtration is resumed.

The resistance also depends on the properties of the solids, e.g. particle size, particle size distribution, particle shape, and compressibility of the solid. In case of compressible cake the porosity decreases with increasing pressure drop, so filter aids are incorporated to increase the filtration rate.

2. Area of filter

The rate of filtration can be increased by increasing the area of filtration. This area can be increased by using larger filters or by using a number of small units in combination. In rotary filters the filter cake is continuously removed providing an infinite area of filtration.

3. Pressure drop

Rate of filtration can be increased by increasing the pressure drop across the filter medium. Pressure drop can be achieved by (i) gravity, (ii) negative pressure (reduced pressure or under vacuum), (iii) positive pressure and (iv) centrifugal force.

Gravity: The height of the slurry over the filter medium gives pressure under gravity. By increasing the height of the slurry the pressure drop can be increased.

Negative pressure: The pressure below the filter medium can be reduced below atmospheric pressure by connecting the filtrate receiver to a vacuum pump.

The disadvantage of this method is that the pressure drop can never be increased above one atmospheric pressure.

The second disadvantage is that under reduced pressure the boiling point of liquid is lowered and the liquid may boil in the filtrate receiver that may cause loss of liquid or may damage the vacuum pump.

Positive pressure: The simplest method of raising the pressure difference across the filter membrane is to increase the pressure to the surface of the slurry.

The advantage is that greater pressure difference can be achieved.

Centrifugal force: The gravitational force can be increased by centrifugal force.

4. Viscosity of liquid

An increase in the viscosity of the liquid will decrease the flow rate. The viscosity of the liquid can be decreased by raising the temperature of the slurry or by dilution with a miscible liquid.

5. Thickness of the filter cake

Thickness of the filter cake increases as the filtration progresses. Highly concentrated slurry is first decanted or strained to reduce the solid content and then it is filtered (this reduces the cake thickness). In a rotary drum filter cake is removed continuously so that the cake thickness is minimized.

FILTER MEDIA

The filter medium may be responsible for the collection of solids, while in other cases it is no more than a support for the filter cake.

There are two types of filter media:

1. Surface filtration media
   - A. Screen type
   - B. Edge type
   - C. Stacked disc
2. Depth filtration media
   - A. Fibrous media
   - B. Porous media
   - C. Cake type media

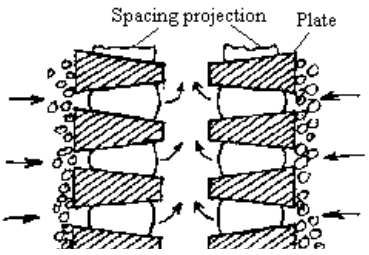
SURFACE FILTRATION MEDIA

A. Screen type

Examples: Cloths made from wool, cotton, silk, glass, metal or synthetic fibers (rayon, nylon etc.)

Cloths of different weights and weave are used according to the concentration of slurry. The final choice of fiber will depend on the chemical nature of the cloth.

(a) M*uslin cloth* (cotton with duck weave) has high porosity, hard surface, can withstand pressure, allows easy discharge of cake. It is easily damaged by acids and alkalis
(b) *Nitrated cotton cloth* provides much harder surface.
(c) *Glass cloth* offers high thermal and corrosion resistance, high tensile strength but it lacks flexibility.
(d) *Synthetic cloths* (nylons) do not swell and have high acid and alkali resistance. They are resistant to fungal or bacterial growth. It resists relatively high temperature and hence smooth surface for esy clening.
(e) *Metallic screens* or *cloth* made up of steel, copper, bronze, nickel are suitable for handling corrosive liquids and high temperature filtration.
(f) *Perforated and screen* are used for coarse solids.



B. Edge type

They involves the use of cartridge type element with flow directed from out side to inside. The element is composed of a stack of discs or washer paper, plastic or metal clamped together by compression. Channels are formed in between the discs by "spacing projection" on the disc surface. Solid particles are retained on the outer surface that may be scraped off regularly.

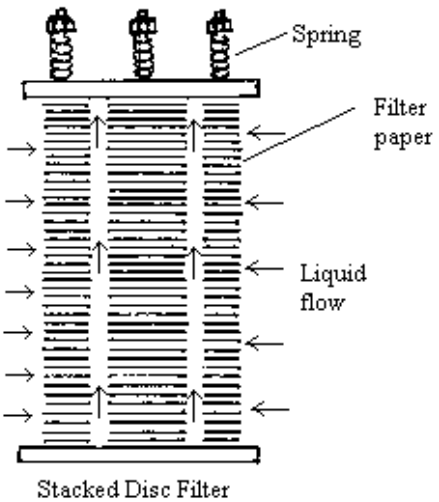
Advantages:

It is not affected by sudden pressure changes.

No clogging takes place.

C. Stacked disc filters

Individual discs are stacked around a perforated inner tube with intermediate spacing washer.



Stacked Disc Filter

DEPTH FILTRATION MEDIA

An ideal depth filter medium has increasingly dense layers from outside to inside.

A. Fibrous medium

It is a layer or mat containing numerous fine fibers randomly oriented and form numerous tortuous passages in which Particles are trapped.

Materials: Fibers of cotton, cellulose, rayon, polypropylene, micro-glass fibers.

The layers of fibers are bound together using resins, so that its structure is retained through out the process.

N.B. Filter media made up of a permanently charged dielectric polymer called "electret" has an open structure and has high collection efficiency and low pressure drop. For these reason they are suitable for clean air systems to reduce microbial burden of air in hospital and pharmaceutical units.

Borosilicate microfibers are made by fusing the fibers by heat and pressure. They are chemically resistant.

B. Porous medium

It is made up of sintered glass, metal or porous plastic or porous ceramic. These materials form a capillary type passage. Pore size can vary with the particle size of the material.

FILTER AIDS

If the slurry contains highly compressible materials the cake produced will provide very high resistance to the flow of fluid (i.e. very high specific cake resistance) – so filtration rate will be reduced. Filter –aids are the substances incorporated in the concentration up to 5% to the high resistance cakes to decrease their resistance and increase filtration rate.

Mechanism of action

Filter aids impart rigidity and porosity to the cake due to their peculiar irregular shape, low surface area and narrow particle size distribution. The rigid structure provides support for the compressible particles in the slurry.

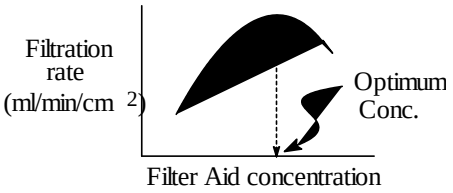
Agents used as filter aids

Purified talc, keiselghur or diatomaceous earth (pure SiO_2), charcoal, kaolin, asbestos, cellulose and volcano glass (called "Pearlite").

Effects of filter-aid concentration on filtration rate

Observation:

As the filter-aid concentration increases, rate of filtration increases. At optimum concentration the rate of filtration is highest. When concentration crosses this point the rate falls.



Explanation:

As the filter-aid concentration increases the porosity and thickness of the cake increases simultaneously.

If porosity is increased rate of filtration will increase.

If thickness is increased rate of filtration will decrease.

Initially, increase in porosity is much higher compared to the cake thickness – so rate increases. At optimum concentration to the cake thickness porosity is maximum. After that point increase in concentration will increase the thickness of the cake only, reducing the rate of filtration.

N.B. Let us take $CaCO_3$ slurry for filtration and talc as filter media. Let us filter V volume of slurry.

Amt. of $CaCO_3$. (g)	5	5	5	5	5	5	5
Amt. of Talc (g)	1	2	3	4	5	10	20
Porosity	+	++	+++	++++	++++	++++	++++
Thickness	6	7	8	9	10	15	20
Rate of filtration	+	++	+++	++++	+++	++	+

APPLICATION METHODS OF FILTER AIDS

The filter aid is used by three methods:

1. *Body mix method*: The filter-aid in the concentration of 0.01 – 4% w/v is mixed with the main slurry to be filtered. The slurry containing the filter aid is then filtered.
2. *Pre-coat method*: If the pressure drop is very high then this method is preferred. A layer of filter-aid up to a suitable thickness is first formed by filtration of filter aid and then slurry is filtered.
3. *Special pre-coat method*: It is used in rotary drum filter. The filter aid slurry is first filtered, while the scrapper-knife is removed. Once the filter-aid cake (pre-coat) of desired thickness is formed the main slurry is filtered. This time scrapper-knife is fitted, it scrapes the cake along with a small thickness of the pre-coat.

INDUSTRIAL FILTERS

1. Leaf filters
2. Filter press
3. Rotary filters e.g. Rotary drum filter
4. Edge filters e.g. Meta filter

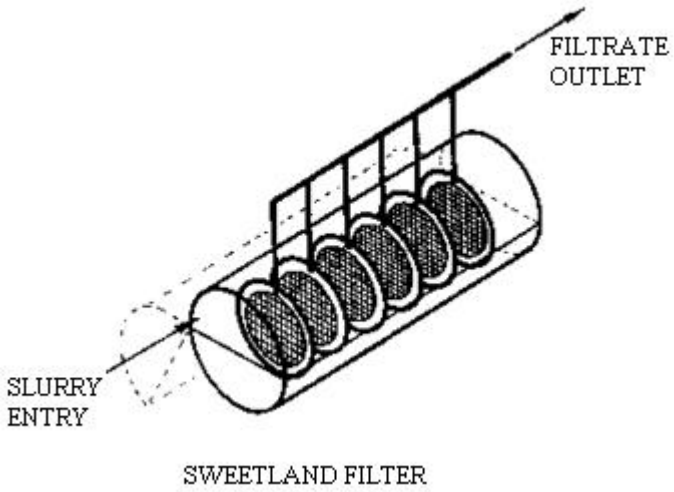
LEAF FILTER (FILTER LEAF)

Construction

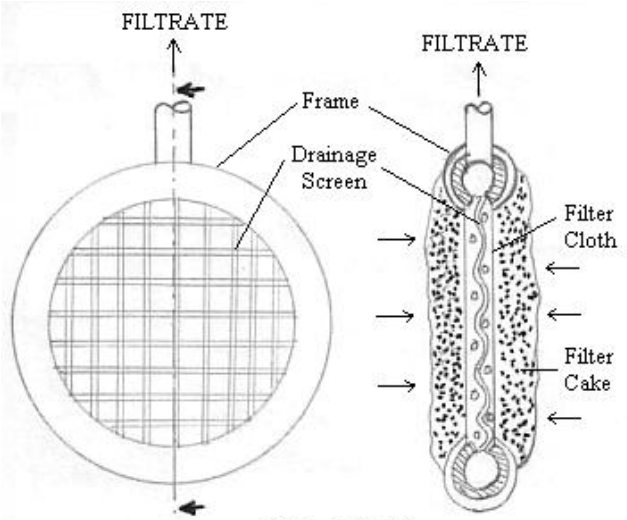
It consists of a frame enclosing a drainage screen or grooved plate. The whole unit is covered with filter cloth. The outlet for the filtrate is connected to the frame. The frame may be of any shape – circular, square, and rectangular.

Method

The whole assembly is placed inside a container of slurry and vacuum is applied. Solids accumulate on the cloth. Filtrate passes through the outlet. The cake is washed by immersing the filter in a vessel of water and passing air in the reverse direction.



SWEETLAND FILTER



LEAF FILTER

Sweetland filter

Several leaf filters are enclosed within a special cylindrical vessel from which slurry is pumped under vacuum. All the filter leaves are connected to a common outlet. The upper part of the cylinder is fixed. Lower part can be swung away. The cake is removed by compressed air.

Advantage:

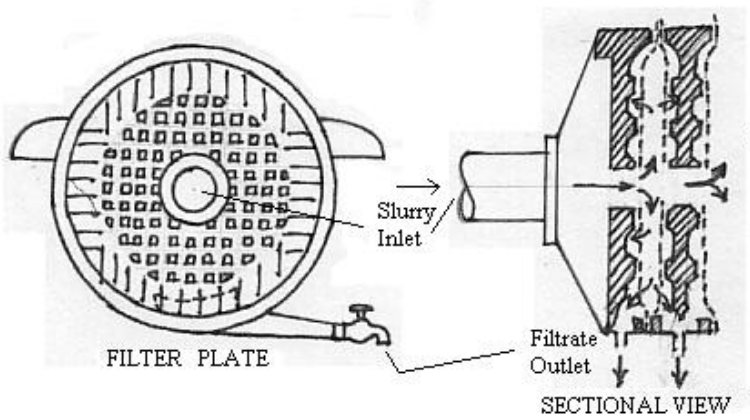
1. Pressure difference may be obtained by vacuum or by using pressure up to 8 bars.
2. Area of filtration can be increased by increasing the number of leaves.
3. High efficiency of washing.

Disadvantages:

Maximum concentration of slurry that can be filtered is 5%w/v.

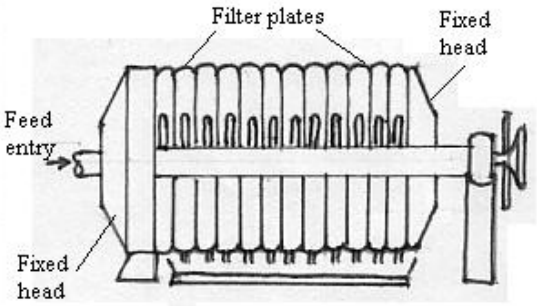
FILTER PRESS

Chamber press



FILTER PLATE

SECTIONAL VIEW



CHAMBER PRESS

Construction

It consists of a set of corrugated filter plates placed in between two heavy fixed head of cast iron. Two rods are extended from one fixed head to the other, on which the plates are supposed by 'lug'. The circular or square plates are made of cast-iron. Both surfaces are corrugated. There is a hole at the center of each plate trough which feed string is introduced. Over each plate a sheet of filter cloth, with a hole cut in the center, is fastened with 'rings', called grommets.

Several such plates are assembled on the two rods and pressed in between the fixed head either by heavy screw or a hydraulic-pressure device. The cloths serve as gaskets between the edges of adjacent plates.

Workings

The slurry is pumped though the connections of the center of the head of the press, it will fill all the openings between the cloths. As slurry continues to be pumped in, the filtrate passes through the cloths, runs down corrugations on the face of the plate, and escapes through the holes in the bottom of the plate, connected to an external outlet.

When sufficient amount of cake is deposited, the closing screws are released, plates are drawn back and cakes are discharged.

Plate-Frame Filter Press

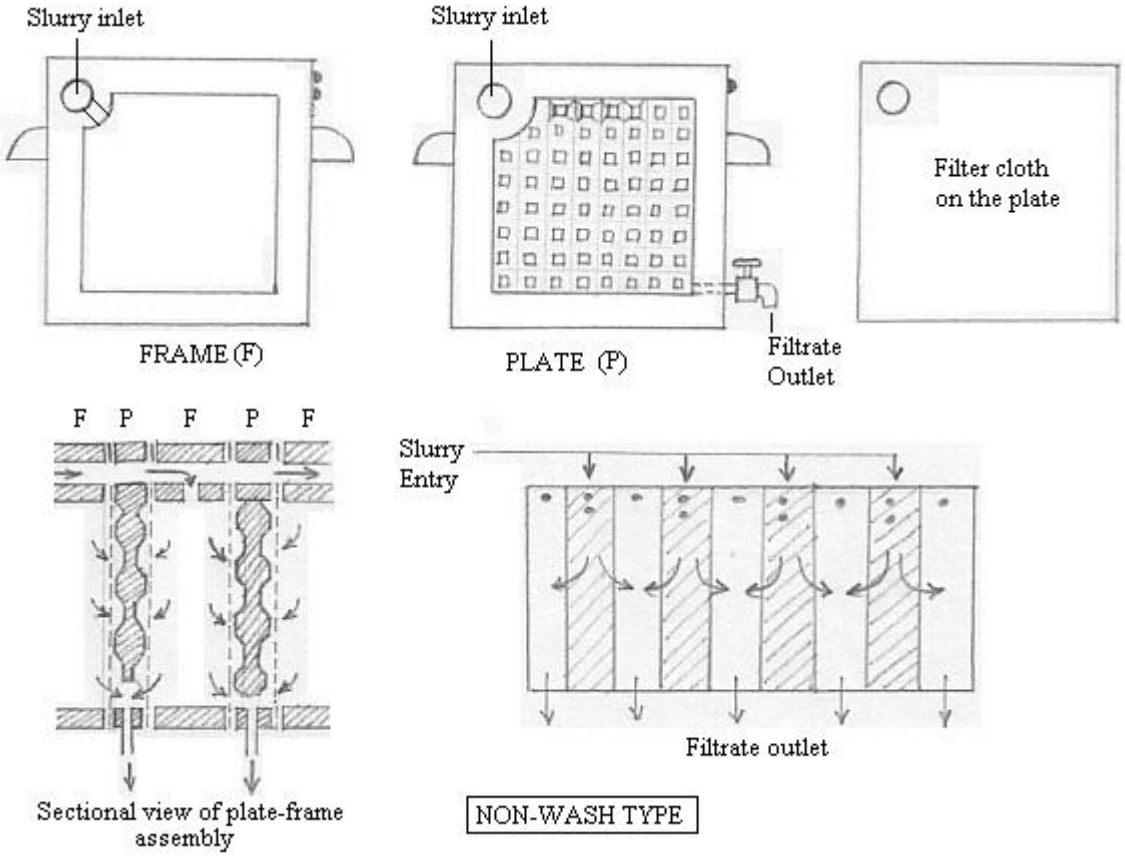
Construction

It consists of a plates and frames arranged alternately. A *plate* is a square shaped structure with raised edges and corrugated surface. *Frame* is a hollow structure with thickness in between 2 to 15 cm. The size of the plate is in between 4inches x 4 inches to 4ft x 4ft.. A *filter cloth* is placed on the surface of the plates. Plates and frames are hung alternately on the tension rods, and compressed by a hydraulic device.

The plate and frame assemblies are designed in two types, namely, (i) *non - washing type* and (ii) *washing type*.

Non-washing type

In this type the plates and frames have one hole at one of the top corners. The holes on the plates and frames align to form a continuous channel through which slurry is fed. The holes on the frame open inside the frame, but the holes on the plate are not connected to inside.



Operation

The slurry is pumped through the channel and it can enter inside the frame only. As slurry is pumped pressure is developed inside the frame (100 psi) and slurry gets filtered through the filter cloth on the plate surface. The filtrate passes over the plate and collected at the bottom.

There are two types of filtrate collection systems:

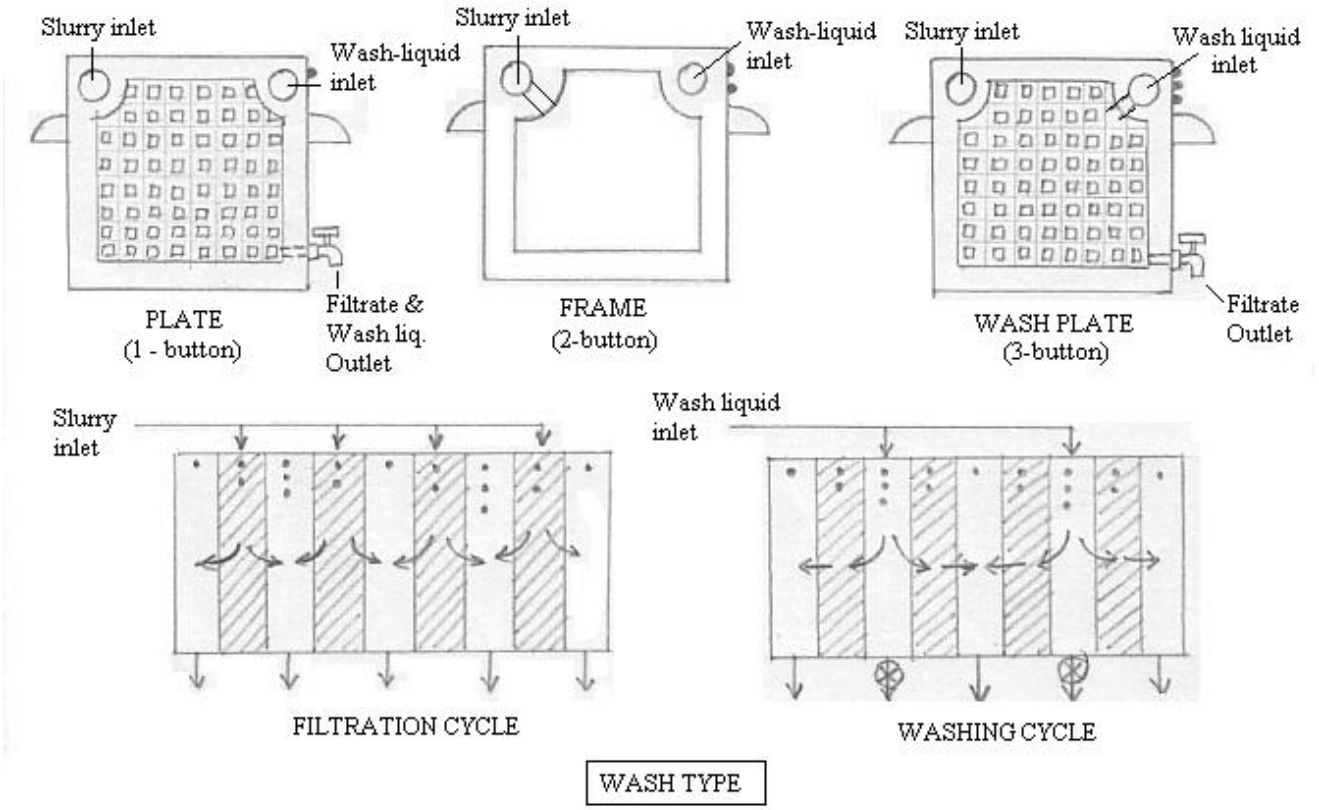
(i) *Open collection system*

The filtrate collection hole of each plate opens separately to the outside by stopcocks. The filtrate is collected in a trough.

(ii) *Closed collection system*

The collection points from all plates are connected together to form a single channel. The filtrate is collected through this closed channel and is taken out from one end.

Washing type



WASH TYPE

Washing type of plate-frame filter press is required when the cake is to be washed thoroughly with washing liquid (when contaminations are there). Two different types of plates are used. For identification of the plates and frames from outside button systems are there.

For example One button: Plate (1)
Two button: Frame (2)
Three button: Wash plate (3)

The arrangement of the Plate frame and wash-plate is always in the order of 1-2-3-2-1 button.

Operation

Wash type filter press has two cycles – (i) Filtration cycle and (ii) Washing cycle.

Filtration cycle: In the filtration cycle slurry is passed through the *slurry inlet channel* into the frame (i.e. 2–button). Filtrate will pass to both 1 and 3–button plates, filtrate collected from all the 1 and 3-button plate *outlets*. Cake is formed within the frame (2-button).

Washing cycle: When cake is formed within the frame *slurry inlet channel* is closed. Wash liquid is passed through the *wash-liquid channel inlet*. Wash liquid is passed through the cake and the wash liquid is collected from the outlet of 1-button plates while all the 3-button plates remains closed.

Advantages of plate-frame filter press

(a) Construction is very simple and a wide variety of materials can be used.
Cast iron – for handling common substances
Bronze – for smaller units
Stainless steel– to avoid contamination
Hard rubber or plastics – where metals must be avoided
Wood – for lightness
(b) It provides a large filtering area in a relatively small floor space.
(c) Capacity can be increased by increasing the thickness of the frames and the number of plate / frames used.
(d) The strong construction can withstand very high pressure difference (up to 20 bars).
(e) Efficient washing of cake is possible.
(f) Filter cloths are renewable.

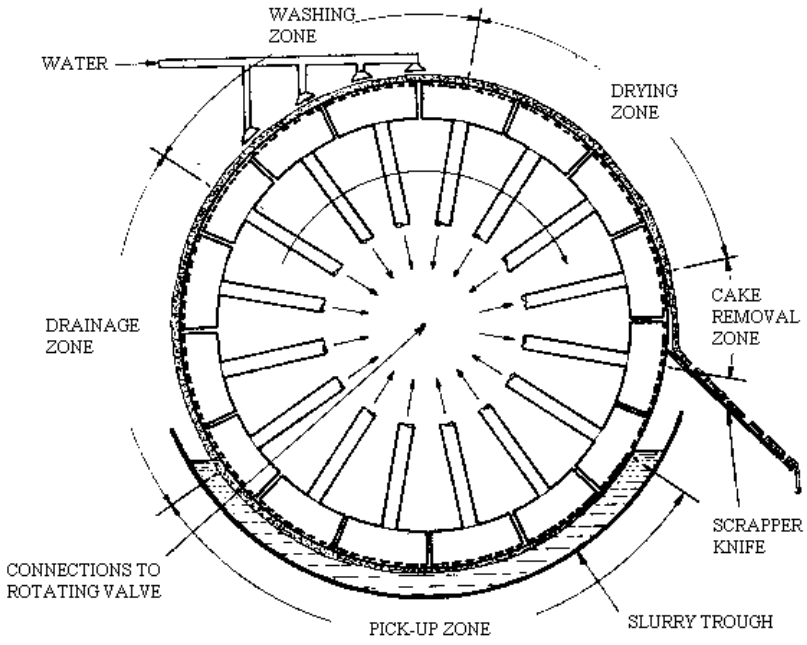
Disadvantages of plate frame filter

(a) It is a batch filter so in between batches time wastage is considerable.
(b) The filter press is used for slurries containing less than 5% solids.
(c) Running cost including labor cost is high. So only expensive materials are filtered.

Examples of materials those can be filtered:
(i) bismuth salts, (ii) precipitated antitoxins, (iii) removal of precipitated proteins from insulin liquor.

ROTARY FILTERS

Construction

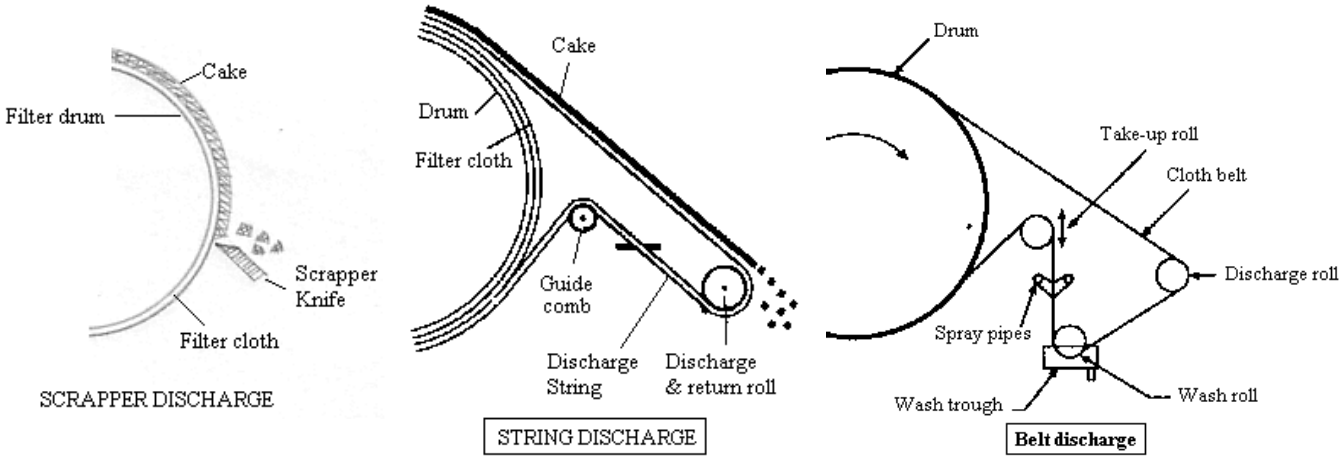


ROTARY DRUM FILTER

It consists of a hollow metal cylinder on which a mesh is mounted as support for filter cloth.
Some times the filter units have the shape of longitudinal segments of the periphery of a cylinder. Each unit has a perforated metal surface to the outer part of the drum and is covered with filter cloth.
Connections are made from each unit through a rotating valve at the center of the drum where vacuum is applied.
Dimensions:
Rotary filters may be up to 2m in diameter and 3.5 m in length.
Operation:
The cylinder rotates at a low speed of 0.1 to 3 rpm. The total operation may be divided into following zones:

Zone	*Position*	*To receiver*	*Operation*
Pick-up	Slurry trough	Filtrate receiver	The drum picks up the slurry as soon as it comes in contact with the slurry trough. Cake builds up on the filter cloth.
Drainage	Filtrate receiver	Filtrate receiver	Under vacuum the filtrate is received in filtrate is received in filtrate receiver
Washing	Wash sprays	Wash water receiver	Water is sprayed on the cake and simultaneously drainage is taking place.
Drying		Wash water receiver	Under vacuum the filter cake is dried.
Cake removal	Scrapper knife	Filter cake conveyor	Compressed air is passed to this zone so that the cake may be loosen

The cake discharge may be carried out by:
(i) Scrapper discharge
(ii) String discharge or by
(iii) Belt discharge



(i) Scrapper discharge

In this method a knife is fitted to scrap a small thickness of the pre-coat along with the cake. But wear and tear on the filter cloth is considerable with scrapper knife so the cloth is frequently changed.

(ii)String discharge

Numbers of endless strings are placed at about ½ inch pitch over the width of the drum. The run or this string is extended from an open conveyor system passing over a discharge and return roller. As compared to scrapper, the wear of filter cloth is minimized.

(iii)Belt discharge

It makes the filter cloth to pass on the roller and material is discharged on the first roll and before its passage to the fed trough it is subjected to washing. Therefore, higher filtration rates may be achieved using belt discharge.

Advantages

(i) It is automatic and continuous; labor cost is low.
(ii) Very high capacity.
(iii) Thick slurries containing 15–30% of solids can be filtered.
(iv) Variation of speed of rotation enables the cake thickness to be controlled. E.g. For solids forming impenetrable cakes thickness is kept constant within 5 mm. For porous cakes thickness is kept within 100mm.

Disadvantages

(i) Complex design with many moving parts.
(ii) Very expensive.
(iii) The cake tends to crack under vacuum, so washing and drying are not efficient.
(iv) As vacuum is applied, it is unsuitable for liquids near boiling point.
(v) Gelatinous or slimy precipitates forming impenetrable cake will not separate cleanly from cloth.

Application

(i) Collection of calcium carbonate, magnesium carbonate, starch.
(ii) Separation of the mycelium from the fermentation liquor in the manufacture of antibiotics.

EDGE FILTERS

Edge filters use a pack of filter medium, so that filtration occurs on the edges.

Metafilters

It consists of a large number of metal rings packed on a fluted rod. The grooves on the surface of rod provides a channel for discharge of the filtrate.

The rings are made of stainless steel.
Inside diameter 15mm
Outside diameter 22mm
Thickness 0.8mm

The plate contains a number of semicircular projections. When the rings are packed on the rod channels are formed in between the plates that are tapered from about 250μm down to 25μm.

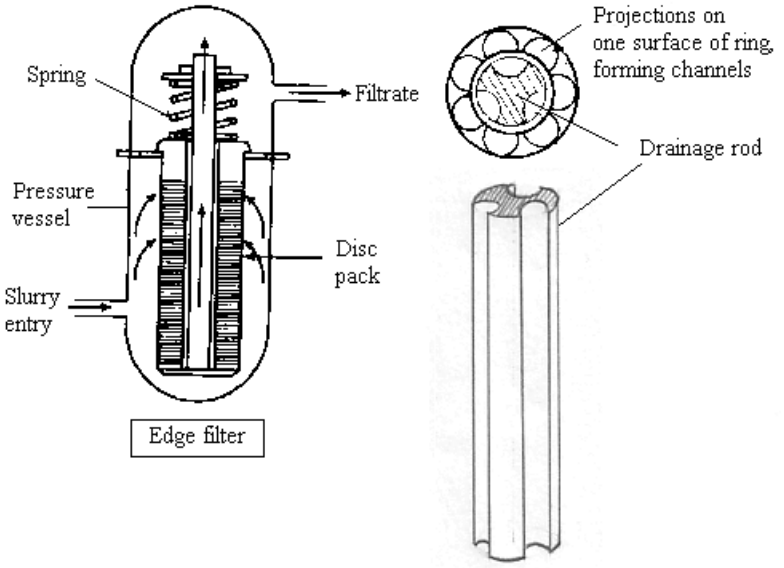
One or more of these packs is mounted in a vessel. The slurry to be filtered is pumped under pressure or vacuum may also be used. The cake formed can be removed from outside edge by back flushing of water or by a scrapping-blade.

Advantages:

(a) Very strong, so high pressure can be used, with no danger of bursting the filter medium.
(b) No filter medium is required, so running cost is low.
(c) Meta filter can be made of corrosion resistant material.
(d) It is useful for filtering coarse particles. If a filter bed is prepared and then filtration carried out then finer particles can also be filtered.
(e) Removal of the cake is effectively carried out by back-flushing with water. In automatic cleaning devices a scrapping baled cleans the outer edge.

Disadvantages: It is used for low solid content.

Application: Meta filter filters are used for clarification of viscous liquids like syrups.



MEMBRANE FILTRATION

Membrane filters are microporous surfaces filters with pore size ranging from 0.005μm to 12 μm.

- *Material of construction of membrane filters*: Cellulose acetate, cellulose nitrates, polytetrafluoroethylene (PTFE), polyvinylchloride, nylon etc.
- *Shape*: The membrane filters are available as discs or cartridges.
- *Membrane filter holders* accept membranes from 13 to 293 mm in diameter.
- *Procedure*: The membrane filter is soaked in water and then fitted in the filter holder. Slurry can be drawn through the membrane under vacuum from filtrate side or may be pressed through under positive pressure from the slurry side.
- *Filter life*: Filter life is limited due to clogging. This problem is significant in case of thick solutions of large or fibrous particles like blood, gelatin, colloid, slimy plant extracts etc. Filter life can be increased by passing the slurry through a pre-filter. Finally it is passed through membrane filter.

- *Integrity test of membrane filters:*
  Since the membranes are brittle hence the integrity test are carried out to predict the performance of a filter. Various integrity tests are:
  (a) *Bubble-point test*
  The pores in the membrane are similar to capillary holding liquid. A minimum pressure is required to force the liquid out off the capillary is called the "bubble point pressure". Pressure is applied on the slurry side or the membrane, first bubble will appear in the pore having the largest diameter. When the pressure is increased numerous bubbles will appear in the filtrate side of the membrane. This pressure is taken as the "bubble point pressure".
  Use: It is required for determination of the pore size of the membrane, pore size distribution and the integrity of the membrane (i.e. if any micro-crack is developed in the membrane then the bubble point pressure will drop).
  (b) *Bacterial challenge test*
  Suspension of specific bacterial culture is filtered through the membrane. The filtrate is incubated. After a specified time if bacterial growth has taken place in the medium then it is concluded that the bacteria had passed the membrane.

Use: It gives an idea about the nominal pore size of the membrane and about the integrity of the membrane.

The bacteria used to test membrane filters of various sizes are as follows:

Pore size (μm)	Test Organism
0.2	*Pseudomonas diminuta*
0.3	*Pseudomonas aeruginosa*
0.45	*Serratia marcescens*
0.65	*Saccharomyces cerevisiae*

SELECTION OF FILTERS

1. Purpose of filtration

The purpose may be as follows:

(i) *Collection of the solids after washing* : Washing of precipitates (like magnesium hydroxide, aluminium hydroxide) require *washing type plate frame filter press* or /*rotary drum filter* may be suitable.

(ii) *Collection of the filtrate*: Elixirs contain very small amount of solid and it requires polishing; in this case *metafilter* is suitable.

(iii) *Removal of dust particles from air*: In this case *bag filter* is suitable.

(iv) *Removal of microorganisms from liquid / air* (i.e. sterilization) : In this case *membrane filters* having pore size 0.2μm is suitable.

2. Conditions of filtration

(i) *Pore size*: For sterilization filtration a 0.2 μm pore size filter is used; for clarification a plate and frame filter or woven-fiber may be used.

(ii) *Chemical compatibility*: The filter medium and filtering liquid should be chemically compatible. It is advisable to check the chemical compatibility chart provided by the vendors for selection of filter type. Filter media may be selected from cellulose, polytetrafluoroethylene (PTFE), metal, polyvinylidene difluoride, nylon, or polysulfones may be selected. For gaseous filtration, a hydrophobic filter medium should be chosen.

(iii) *Maximum operating temperature*: In case of low boiling liquid *vacuum filter* should not be used.

(iv) *Characteristics of filters*: Energy consumption is less if the pressure loss across the filter bed is less. It is economical if the flow rate at a certain pressure loss is less. So such a filter is chosen that provides high filtration rate wih low pressure drop.

(v) *Concentration of particles*: If the concentration of solids in the slurry is less than 5%w/v then leaf filter and plate frame filter may be suitable If the solid content is within 15–30% then rotary drum filter is preferable.

3. Filtration cycle

If the filtration is a batch process then leaf filter, plate frame filter may be used. When filter cake is built up on the filter media it must be cleaned. If the filtration is required to be a continuous process then rotary drum filtration with suitable discharge type is preferred.