FILTRATION
Main Processes for Separation of Food

- Filtration
- Settling and sedimentation
- Centrifugation
- Expression

Principles of separation

- Filter medium
- Gravity
- Centrifugal force
- Pressure
Filtration is the removal of solid particles from a fluid by passing the fluid through a filtering medium (or septum) on which the solids are deposited.

The fluid may be a liquid or a gas.

Modification of feed to increase the filtration rate (by heating, recrystallising, or adding a filter aid)
Filters

- Cake Filters
- Clarifying Filters
- Cross flow Filters
Pressure filters are usually discontinuous; vacuum filters are usually continuous.
Commercial filters
Plate and frame filter press

![Diagram of a plate and frame filter press]
Plate and frame filter press

- Plates and frames arranged alternatively and supported on a pair of rails
  (Filter clothes separate the hollow frames from the plates)

Plates
- Set of plates make a series of chambers to collect solids
- Ribbed surfaces
- may be square or circular, vertical or horizontal
  (Usually square: 0.15 m x 0.15 m to 2 m x 2 m)
- Thickness: 6 to 50 mm
- Hand screw or hydraulic press to close the plates
Plate and frame filter press

- Slurry channel
- Openings from this channel in each frame
- Outlet at the bottom of each plate
- Liquor passes through the cloth, down grooves or corrugations in each faces
- A thick cake is formed
- Low pressure (1.5-3.2 kg/cm² gauge pressure)
- Slurry is admitted to each compartment under pressure; liquor passes through the canvas and out a discharge pipe, leaving the wet cake of solids behind.
- Filtration continues till the frames are completely filled (no filtrate at the bottom) ➔ known as solid filling or jamming.
Plate and frame filter press

Removal of solid filling

First blow of air

Wash solution/water under pressure

2nd blow of air behind filter cloth

Opening of Press to remove cake

Usually no displacement of cake as the cell is completely filled with solids.

Air blow removes the wash and obtain as dry cake as possible.

Cake dropped onto a conveyor or storage bin.

*The dryness of the cake is one major advantage with the plate and frame press.*
Plate and frame filter press

- Low capital cost
- Highly flexible for different types of products
- Easy maintenance
- Intermittent operation
- Used for production of apple juice and cider, other juices, and filtration of oil.
Shell and leaf filters
Shell and leaf filters
Shell and leaf filters

- A set of mesh leaves held on a retractable tract inside a pressure vessel.
- Vertical or horizontal
- Leaves coated with filter medium and supported on a hollow frame, which forms the outlet channel for the filtrate.
- During operation, the leaves are inside the closed tank; feed enters through the side of the tank; feed liquor is pumped into the shell at a pressure of approx. 400 x 10³ Pa.
- Filtrate passes through the leaves into a discharge manifold.
- The cake is blown or washed from the leaves after completion of the filtration operation.
- In some designs the set of leaves rotate at 1-2 rev/min to improve the uniformity of cake build up.
Shell and leaf filters

- Involves higher cost than the plate filters and less labour.
- Widely used for filtration involving the filter aids.
- Used for filtration under higher pressures than are possible in a plate and frame filter.
- Used when more effective washing of the cake is necessary.
Filters for gas

- *Pad filters* for atmospheric dust
- Granular beds and *bag filters* for process dust

In all of these filters most of the separation is by impingement.
Filters for gas - Pad filter

- Air is cleaned by passing it through pads of cellulose pulp, cotton, felt, glass fibre, or metal screening.
- The pad material may be dry or coated with a viscous oil to act as a dust holder.
- For light duty the pads are disposable, but in large-scale gas cleaning they are frequently rinsed and recoated with oil.
Granular bed filters

Contain stationary or moving beds of granules ranging from 30 mesh to 8-mesh in size in some designs, to 12 to 40 mm in others.
Bag filter

- A bag filter contains one or more large bags of felt or thin woven fabric, mounted inside a metal housing.
- Dust-laden gas usually enters the bag at the bottom and passes outward, leaving the dust behind, although sometimes the flow is inward.
- Efficiencies are typically 99% even with extremely fine particles- far finer than openings in the bag material.
- Periodically the flow is automatically cut off and clean gas is blown back or the bag is mechanically shaken to dislodge the dust for recovery or disposal.
- In most cases, bag filters act as clarifiers with particles trapped within the fabric of the bag, but with heavy dust loadings a thin but definite cake of dust is allowed to build up before it is discharged.
Thank You