CREAM SEPARATION
Centrifugation

Principle of separation

Centrifuge increases the forces on particles many fold

The particles that do not settle readily or at all in gravity settlers can be separated from fluids.
If gravity separation is too slow because of:

- closeness of the densities of the particle and the fluid, or
- association forces holding components together (as in emulsions)

Centrifuges are also used in *centrifugal filtration*, where the centrifugal force is used (not the pressure difference) to separate the solids through a filter medium.
Centrifugation

Major applications of Centrifuges

- Separation of immiscible liquids
  - Tubular bowl centrifuge
  - Disc bowl centrifuge

- Clarification of liquids by removal of small amounts of solids
  - Solid bowl clarifier
  - Nozzle centrifuges/
    valve discharge centrifuges

- Removal of solids from liquids
  - Conveyor bowl
  - Screen conveyor
  - Basket
  - Reciprocating conveyor
  - Centrifuges
Cream separation

Tubular bowl centrifuge

Disc bowl centrifuge
Tubular bowl centrifuge

Dia: 0.1-0.15 m,
Ht: 0.75 m
Rev/min: 15000-50000
Tubular bowl centrifuge

• Vertical cylinder (or bowl), typically 0.1-0.15 m in diameter and 0.75 m long.
• Rotates inside a stationary casing (15000-50000 rev/min depending on the diameter).
• Tubular bowl centrifuges, which develop about 13000xg force, are also known as super centrifuges.
• Feed liquor is introduced continuously at the base of the bowl and the two liquids are separated and discharged through a circular weir system into stationary outlets.
• Some narrow centrifuges known as ultra centrifuges have a diameter of 75 mm and very high speeds of about 60000 rev/min.
Tubular bowl centrifuge

Dia: 0.1-0.15 m, Ht: 0.75 m, Rev/min: 15000-50000
Tubular bowl centrifuge
Tubular bowl centrifuge
Disc bowl centrifuge

Dia: 0.2-1.2 m
Rev/min: 2000-7000
Cone gap: 0.5-1.27 mm
Disc bowl centrifuge

- Cylindrical bowl (0.2-1.2 m dia), which contains a stack of inverted metal cones.
- Cones rotate at 2000-7000 rev/min.
- Fixed clearance between cones: 0.5-1.27 mm; have matching holes which form flow channels for liquid movement.
- Due to the centrifugal force,
  - Denser fraction moves towards the wall of the bowl, along the underside of the discs.
  - Lighter fraction moves towards the centre along the upper surfaces.
- Both liquid streams are removed continuously by a weir system at the top in a similar way to the tubular bowl system.
Disc bowl centrifuge

- Milk
- Cream
- Skim Milk
- Solid impurities
Disc bowl centrifuge
Disc bowl centrifuge

- Disc bowl and tubular centrifuges can have capacities of up to 150,000 l/h.
- Better separation is obtained by the disc bowl centrifuge due to the formation of thinner layers of liquid.
- Periodic cleaning of deposited solids is required.

Applications:
- Separation of cream from milk
- Clarification of oils, coffee extracts and juices
- Separation of starch-gluten.
Domestic cream separator

- On/Off switch
- Supply can
- Regulating cover, float inside
- Cream Spout
- Skim milk spout
- Disc washer
- Bowl
- Bowl chamber
Domestic cream separator
Thank You