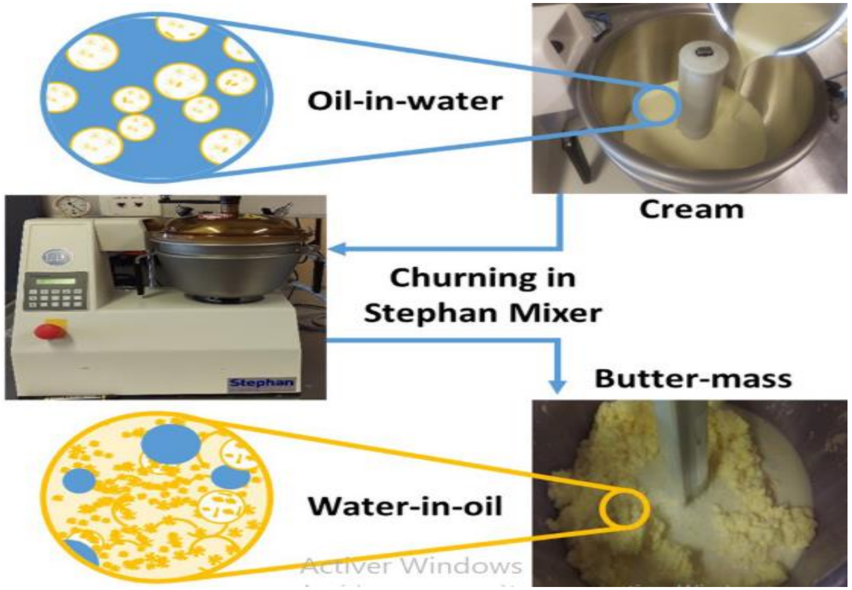


The top part shows cream as an oil-in-water emulsion, where fat globules (oil) are dispersed in the aqueous phase.

During churning in a Stephan mixer, intense mechanical agitation breaks the fat globule membranes, allowing fat droplets to coalesce.

As churning continues, the emulsion inverts — changing from oil-in-water to water-in-oil.

The final product is a butter mass, where water droplets are dispersed in a continuous fat phase.
→ This inversion marks the transformation of cream into butter.

Milk contains large fat globules (1–10 µm) dispersed in the aqueous phase. Casein micelles float freely in the continuous phase.

The system is an unstable emulsion of fat in water (oil-in-water).

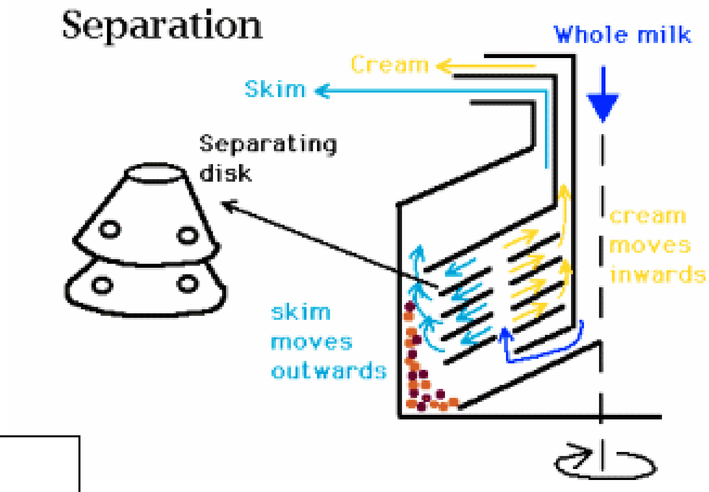
Homogenization forces milk through a narrow valve at high pressure (10–25 MPa).

The shear and turbulence break large fat globules into many smaller ones (<1 µm).

The original MFGM is disrupted, exposing fat to the aqueous phase. Casein micelles and whey proteins rapidly adsorb onto the new fat surface, forming a new interfacial membrane (protein–lipid–protein complex).

The result is a stable emulsion where fat globules are coated with proteins. Smaller globule size prevents creaming (no phase separation).

The emulsion becomes more stable against aggregation and oxidation.



To separate cream (fat phase) from skim milk (aqueous phase) :

1. Whole milk enters from the top (blue arrow).
2. Inside the stack of separating disks, centrifugal force acts differently on each phase:
   - Fat globules (lighter) move inward toward the center (yellow arrows).
   - Skim milk (heavier) moves outward (blue arrows).
3. Two separate outlets remove each product:
   - **Cream outlet** → central or inner tube.
   - **Skim milk outlet** → peripheral tube.

- The goal is **phase separation** based on **density difference** ($\rho_{fat} < \rho_{serum}$).
- Flow directions are **opposite**:
  - Cream moves inward,
  - Skim milk moves outward.