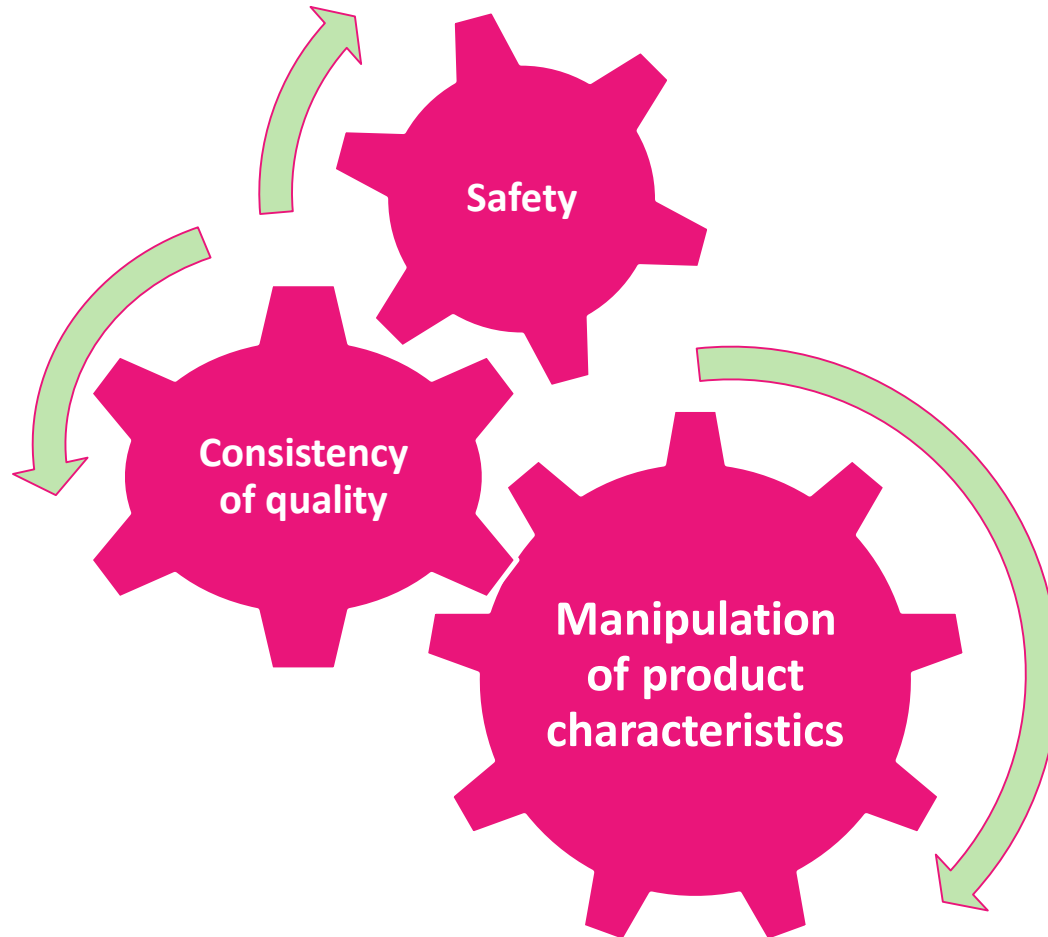
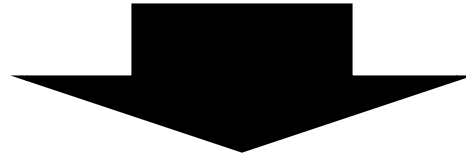


Pre-treatments of milk for cheese making

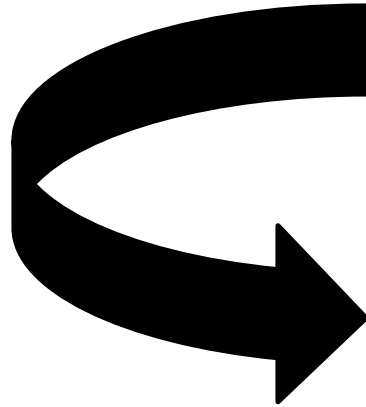


Pre-treatment of milk



Chilling and cold storage.....

1. Raw milk is sometimes cooled to about 4 C and stored in refrigerated or storage tanks prior to its conversion into cheese.
2. Storing milk at refrigerated temperature not only increases the possibility of **growth of psychrotrophs** but also **alters the physico-chemical properties of milk components like casein and minerals**. Due to these alterations, **rennet coagulation time increases, firmness decreases and moisture retention increases** due to cold storage of milk.



Impaired technological properties as a result of chilling and cold storage of the raw milk can be improved by:

**Acidification of
cheese milk with
lactic acid to pH
6.5**

**Addition of
calcium chloride
@ 0.02%**

**Addition of more
rennet within
permissible limits**

**Use of higher
renneting
temperature**

**Use of higher
cooking
temperatures**

Clarification

- ✓ One of the centrifugal processes used in dairy industries.
- ✓ Used to remove leukocytes, cellular debris and particles from earth or fodder gaining entry into milk.
- ✓ Centrifugation of milk by clarifier removes small sized particles in milk, having specific gravity >1.032 , particularly dirt, cells and larger microorganisms if they are present in clumps.
- ✓ Clarification decreases **tendency of fat to form aggregates on standing, increases the rate of multiplication of starter organisms, may increase the fat losses in whey, decrease moisture and yield of cheese.**

Bactofugation

- 1. Physical process where bacteria are removed from milk, the size and density of bacteria is the criteria for their removal.**
- 2. Efficiency of bactofuge to remove bacteria depends on: initial bacterial load, pre-treatment of milk, frequency of partial desludging and duration of the run.**
- 3. Bactofuge is a clarifier with one inlet for raw milk and one outlet for treated milk. There are 2-4 nozzles fitted into the bowl wall for the discharge of skim milk. Bacteria are subjected to a centrifugal force of the order of 7000- 9000 G.**
- 4. Bactofuge used in cheese industry remove spores from cheese milk that could cause late fermentation in semi-hard cheeses.**

Effect of bactofugation on cheese making

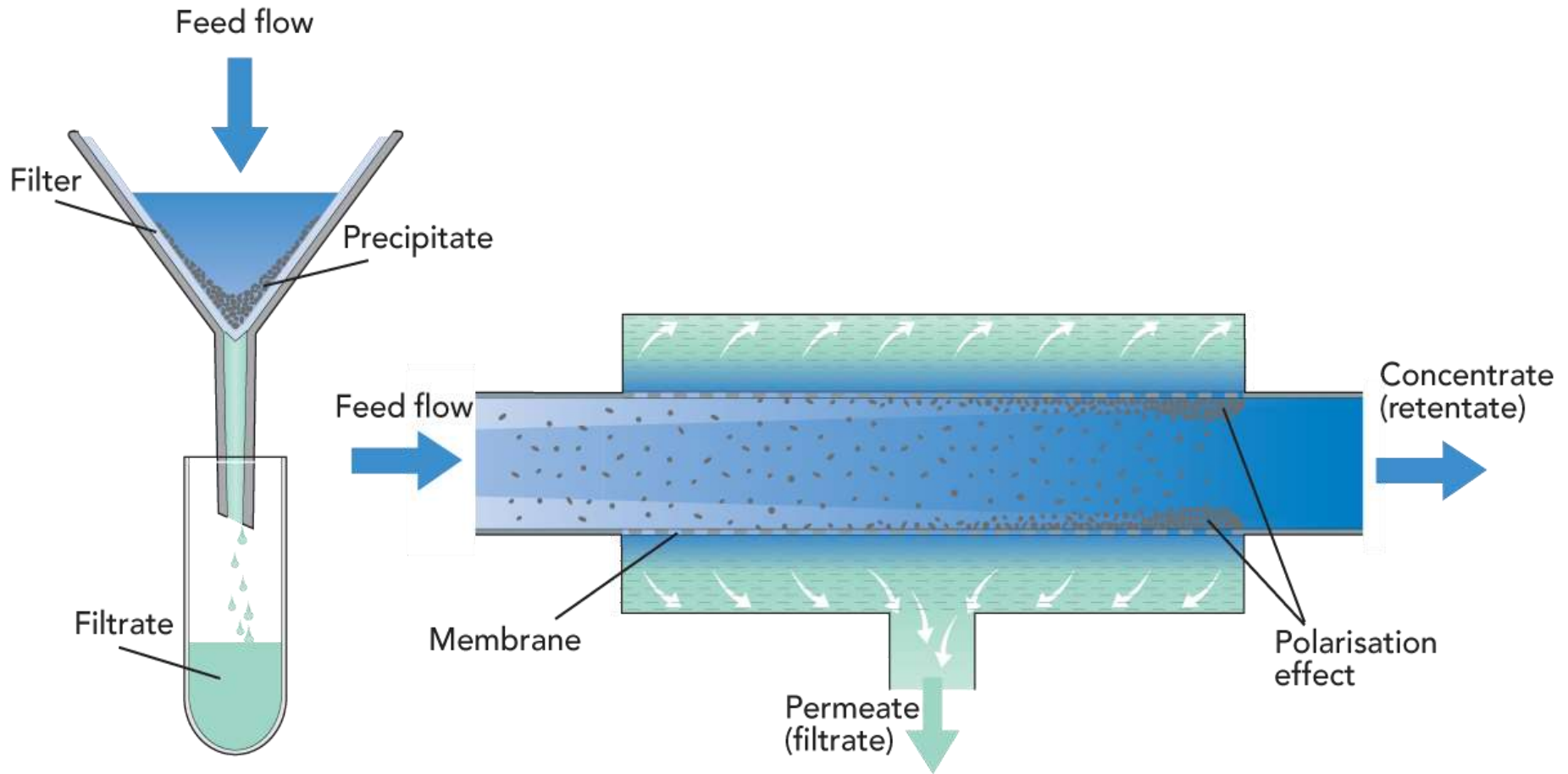


Effective method for preventing late blowing defect in semi-hard or hard varieties of cheeses

Facilitates reduction or elimination in the use of nitrates

Weakens the coagulum during cheese making which can be overcome by addition of calcium chloride

Membrane Processing



Ultrafiltration.....

- 1. UF enables concentration of casein content and recovery of whey proteins for cheese manufacture.**
- 2. UF of milk at pH 6.6–6.8 concentrates mineral salts bound to casein micelles in the same proportion as proteins and increases buffering capacity, which affects acidification, pH, rennet coagulation and rheological characteristics of curd.**
- 3. Acidification before or during UF and/or salt addition to retentate leads to solubilisation of colloidal calcium in permeate. As a result of UF of milk, globular fat, caseins, whey proteins and micellar salts are selectively concentrated in the UF retentate whereas; lactose, serum salts and peptides are found largely in the UF permeate at their original concentration.**

- 4. Cheese making properties of UF retentate differ from unconcentrated milk in several aspects.**
- 5. Cheese made from UF retentate is often characterized by a long time required to reach the desired pH and an acidic taste which is related to the higher buffering capacity of a UF retentate.**
- 6. Flavour development in hard and semi-hard cheese made from UF retentate is generally slow, which has been related to a reduced rate of proteolysis of caseins during ripening of such cheese.**

Microfiltration.....

1. Used for partial microbial decontamination of cheese-milk and standardization of the casein content of milk.
2. Cheese prepared from microfiltered milk may lack flavour development due to absence of flavour producing organisms during ripening as they are filtered out in permeate during MF.
3. MF uses larger pore sizes and lower pressures than UF. Whey proteins are smaller molecules (3-5 μm) compared to casein micelles (15-600 nm) and separated by use of 0.1-0.2 μm pore size membranes. This separation produce casein-enriched retentate and permeate containing significant amounts of native state α -lactalbumin and β -lactoglobulin.

- 4. Casein-enriched milk prepared by MF has been reported to have improved rennet coagulation properties and reduced loss of fat in whey.**
- 5. Increasing MF concentration factor result in increased moisture, protein and calcium content, proteolysis and flavour and decreased hardness.**

Heat treatments

Pasteurisation inactivates some enzymes, influences microflora of nonstarter lactic acid bacteria (NSLAB) in the final cheese, so impairs the cheese flavor as a result of its influence on NSLAB. Severe heat treatments than pasteurization result in significant denaturation of whey proteins and their resulting incorporation into cheese curd, with significant effects on cheese yield and composition.

Milk is heat treated....

1.

- To eliminate pathogenic bacteria

2.

- To minimise damage to caseins by proteolytic bacteria on storage or to incorporate heat-denatured whey proteins in curd, thereby improving cheese yield.

3.

- To inactivate spores of *Clostridium tyrobutyricum*

- 1. Heat treatment of milk severe than conventional pasteurisation results in denaturation of whey proteins, interactions between whey proteins and casein micelles and transfer of soluble calcium, magnesium and phosphate to insoluble colloidal state.**
- 2. Denaturation of whey proteins exposes side chain groups originally buried in native structure, particularly reactive thiol groups, and unfolded proteins may self-aggregate or interact with casein micelles, through interactions with κ -casein.**
- 3. Extent of association of denatured whey protein with casein micelles is dependent on pH of milk prior to heating, levels of soluble calcium and phosphate, milk solids concentration and mode of heating.**

4. In the cheese vat, high heat treatment of milk prolongs rennet coagulation times and reduces strength of rennet gels leading to impaired syneresis.
5. Adverse effects on coagulation are attributed to the inhibition of hydrolysis of κ -casein by chymosin due to the β -lactoglobulin/ κ -casein complex at the micelle surface impairing the accessibility of κ -casein to the coagulant, to reduced reactivity of renneted micelles with attached denatured whey proteins to aggregation, or to a reduction in the concentration of micellar calcium.