Membrane Processing In Dairy Industry

MEMBRANE....?

"Barrier which separates 2 phases & restricts transport of various molecules in a selective manner".

Driven by

- Pressure
- Concentration
- Temperature

 Electrical potential Thick/Thin

Can b

Liquid/Solid

Symmetric/Asymmetric

Natural/Synthetic

Neutral/Charged

• MEMBRANE FILTRATION

Uses a physical barrier

Porous membrane or filter,

To separate particles in a fluid.

WORKING MECHANISM:

• **MEMBRANE PROCESS**: The feed stream is divided into two streams:

- Retentate (concentrate) stream
- Permeate stream



• Either the concentrate or permeate stream is the product of our interest.

REPRESENTATION OF MEMBRANE SEPARATION







Feed

CLASSIFICATION OF

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MEMBRANES







Membrane distillation

Thermally driven

Thermal diffusion



Pressure driven



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Low pressure driven (2 bar)

Membrane with an open structure

Allows-Dissolved particles Rejects-Undissolved particles





APPLICATIONS

Bacterial reduction

• Fat removal in milk

Whey as well as protein and casein standardisation

Removal of casein from whey protein

ULTRA FILTRATION

Medium pressure driven (1-10 bar)

Membrane with a medium open structure

ULTRAFHERATION

Allows-Most dissolved, some undissolved particles Rejects-Large particles



APPLICATIONS

Protein standardization of cheese, milk powders,

Fresh cheese production

Protein concentration

Lactose reduction of milk.

NANO FILTRATION

Medium to high pressure driven

(5-40 bar)

Membrane with slightly more open structure

Allows-Monovalent ions Rejects-Divalent ions



APPLICATIONS

Partial demineralisation of whey {NaCl & KCl}

Volume reduction of whey

Lactose free milk

Efficient crystallization process

Detergent recovery from CIP solution

Reduction of viruses, bacteria & pesticides



High pressure driven (10-100 bar)

Dense membrane

Allows only water



APPLICATIONS

Concentration of milk & whey

Total solid recovery

Water reclamation

MEMBRANE CHARACTERISTICS

• Pore size:

- Microfiltration $-0.1 5\mu m$
- Ultrafiltration 0.01-0.1 µm
- Nano filtration 0.001-0.01 µm
- Reverse osmosis- 0.0001 0.001 μm

• Temperature resistant <40°C & 70-80°C

• Pressure resistant

MEMBRANE FOULING

• Process where solute or particles deposit

• Onto a membrane surface or into membrane pores

• Degrades the membrane's performance.

METHODS TO REDUCE FOULING Pre-treatment of the feed solution

Cleanin

Membrane properties

a. Heat treatmentb. pH adjustmentc. Chlorination

a. Narrow pore size distribution b. Hydrophilic membranes

a. Hydraulic cleaning
b. Mechanical cleaning
c. Chemical cleaning
c. Chemical cleaning

APPLICATIONS IN

DAIRY INDUSTRY

Extending shelf life

Desalting or demineralization

Fat processing

Protein processing

Cheese industry







Lactose free ice-cream





