

MEMBRANE FILTRATION OF MILK

Presentation to Southern Dairy Conference

February 9, 2004

By

Calvin Covington



Not New Technology

- **Used by cheese plants for over 20 years**
- **Topic of discussion Southwest Milk Marketing Conference in 1989**

TYPES OF MEMBRANE FILTRATION

- **Reverse osmosis – smallest pore size**
- **Nanofiltration**
- **Ultrafiltration**
- **Microfiltration – largest pore size**

DEFINITIONS

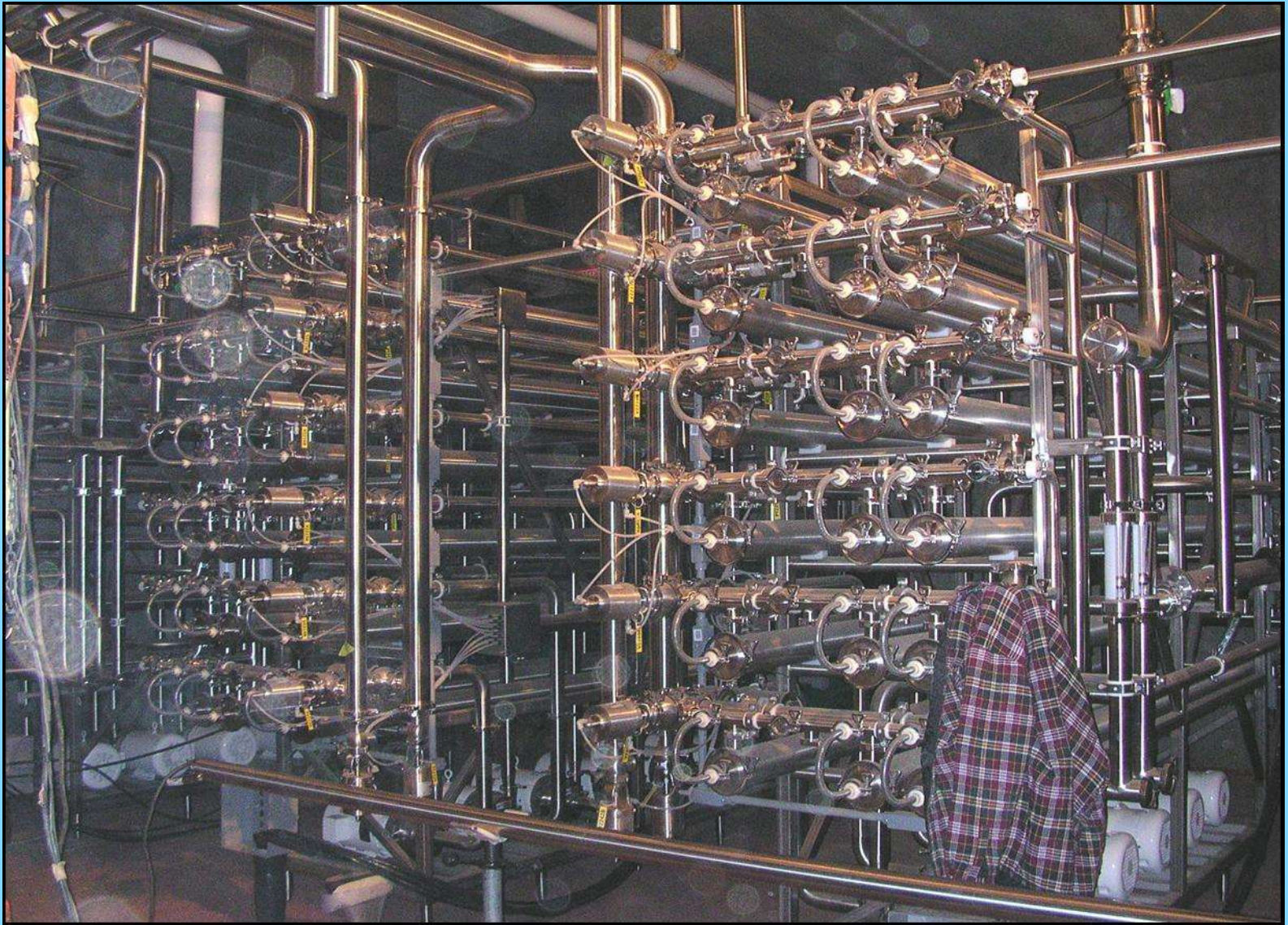
Permeate- the milk components that pass through the filter.

Retentate – the milk components that do not pass through the filter.

SIZE OF MILK COMPONENTS

| <u>Component in Milk</u> | <u>Average Dimension (nm)</u> |
|--------------------------|-------------------------------|
| Water | 0.2 |
| Lactose | 0.5 |
| Casein Proteins | 2.0-4.0 |
| Fat | 1,000-10,000 |

Source: David Barbano, Cornell University



Membrane Filtration System

REVERSE OSMOSIS

- **Basically, a concentration process.**
- **A portion of the water passes through the filter (permeate).**
- **Other components – fat, lactose, protein are the retentate.**

REVERSE OSMOSIS COMPONENT LEVELS

Milk Concentrated Three Times

| | <u>Butterfat</u> | <u>Protein</u> | <u>Lactose</u> |
|--------------|------------------|----------------|----------------|
| Raw milk % | 3.5 | 3.2 | 4.7 |
| RO product % | 10.5 | 9.6 | 14.1 |

REVERSE OSMOSIS MILK APPLICATIONS

- **Ice cream**
- **Yogurt**
- **Fluid milk reconstitution**
- **Specialty milks**

ULTRAFILTRATION

- **Basically, a separation process.**
- **Water and lactose passes through the filter (permeate).**
- **Other components – fat and protein are the retentate.**

ULTRAFILTRATION COMPONENT LEVELS

Milk Concentrated Three Times

| | <u>Butterfat</u> | <u>Protein</u> | <u>Lactose</u> |
|--------------|------------------|----------------|----------------|
| Raw milk % | 3.5 | 3.2 | 4.7 |
| UF product % | 10.5 | 9.2 | 4.7 |

ULTRAFILTRATION

150,000 lbs. raw milk
3.5% fat
3.2% protein
4.7% lactose

50,000 lbs. retentate
10.5% fat
9.2% protein
4.7% lactose

100,000 lbs. permeate
0.0% fat
0.2% protein
4.7% lactose

ULTRAFILTRATION USES

- **Cheese**
- **Cottage Cheese**
- **Dairy ingredient**
- **Low-carb dairy products**

BENEFITS TO PRODUCERS AND END-USERS

Producers

- **Reduced hauling costs**
- **Value added milk product**

End-Users

- **More consistent product**
- **Improved plant efficiency – increased yields**
- **Less whey to dispose**

SOUTHEAST MILK, INC. ULTRAFILTRATION PLANT

- **On-farm operation in Baconton, Georgia**
- **Use cold process – Sixth in the U.S.**
- **Projected operation - February 17, 2004**



Ultra Filtration Plant – Baconton, Georgia

FUTURE – MILK FILTRATION

- **Here to stay**
- **Find more uses for filtrated products**
- **Long-term: Milk will have more value separated and sold into components than milk as a whole.**