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Aspects of Whey Utilization

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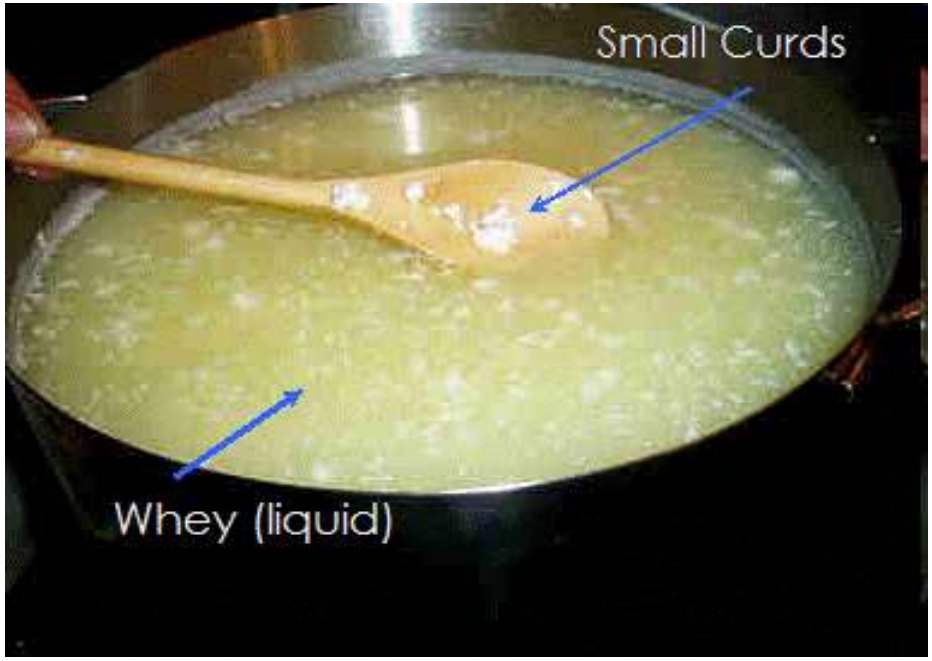
What Is Whey and How It Is Made?

A Little Bit of Know-How…

The Final Product (by-product) and Its Properties

- Greenish-yellowish colour
- Unattractive flavour
- Persihable and putruscent



Whey – „Necessary Evil” ☺

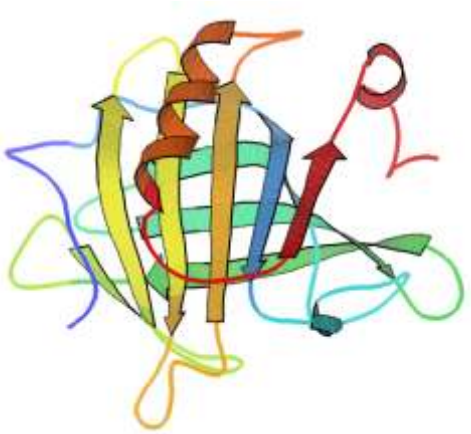
- **Considered a waste, that was thoughtlessly disposed to the rivers**
- **High fines for enviromental pollution made dairy processors take action to deal with the whey**
- **After a thorough analysis it turned out, that the whey is no longer a waste, but very valuable product-the source of excellent whey proteins**

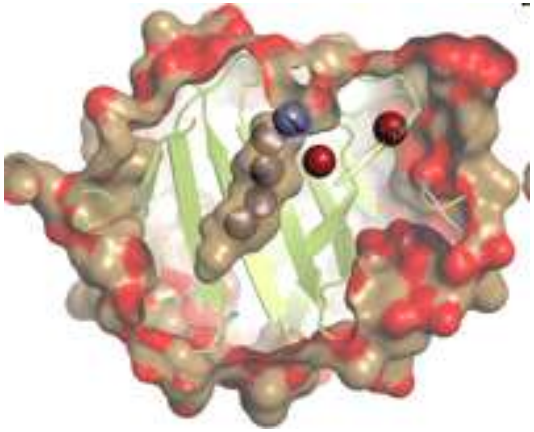
The composition of Liquid Whey

Compound	Sweet Whey	Acid Whey
Dry matter	6,5%	6,4%
Protein	0,6%	0,5%
Fat	0,25%	0,05%
Lactose	5,0%	4,5%
Minerals	0,52%	0,6%
Lactic Acid	0,15%	0,5%

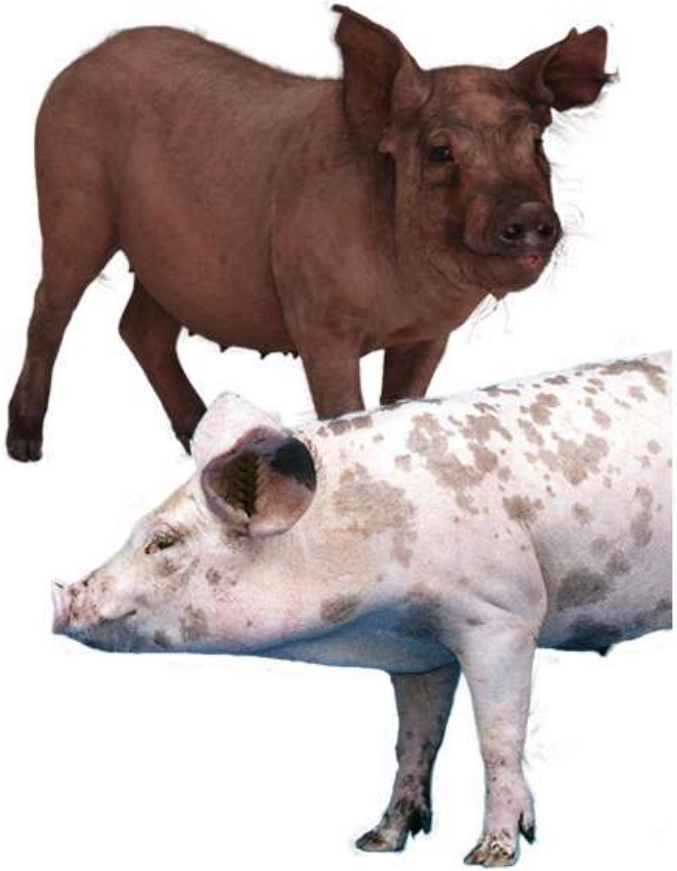
A Few Words about Whey Composition

- **Whey Proteins that turned out to be the best proteins of all available. These are:**
- **α–lactoalbumin,**
- **β – lactoglobulin**
- **BSA**
- **immunoglobulins**
- **lactoferrin**
- **Lactose**
- **Fat**
- **Vitamins and Minerals**

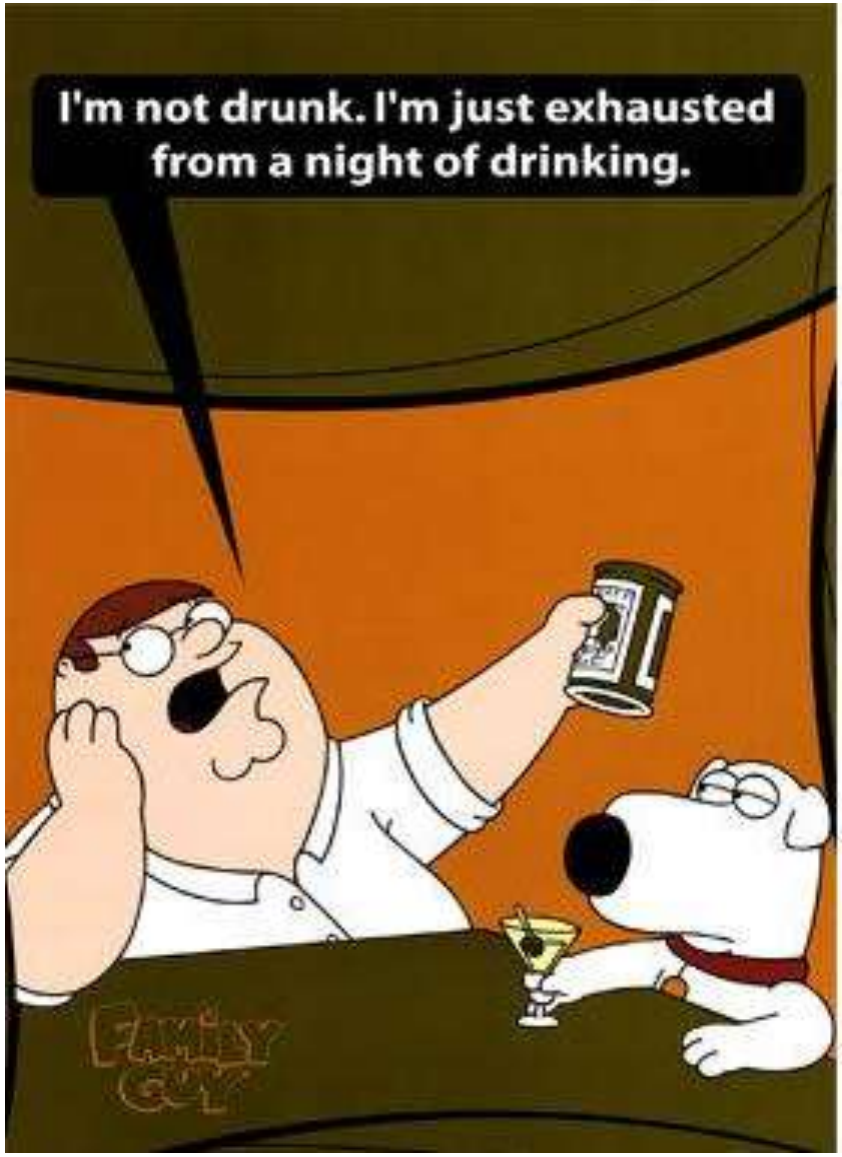




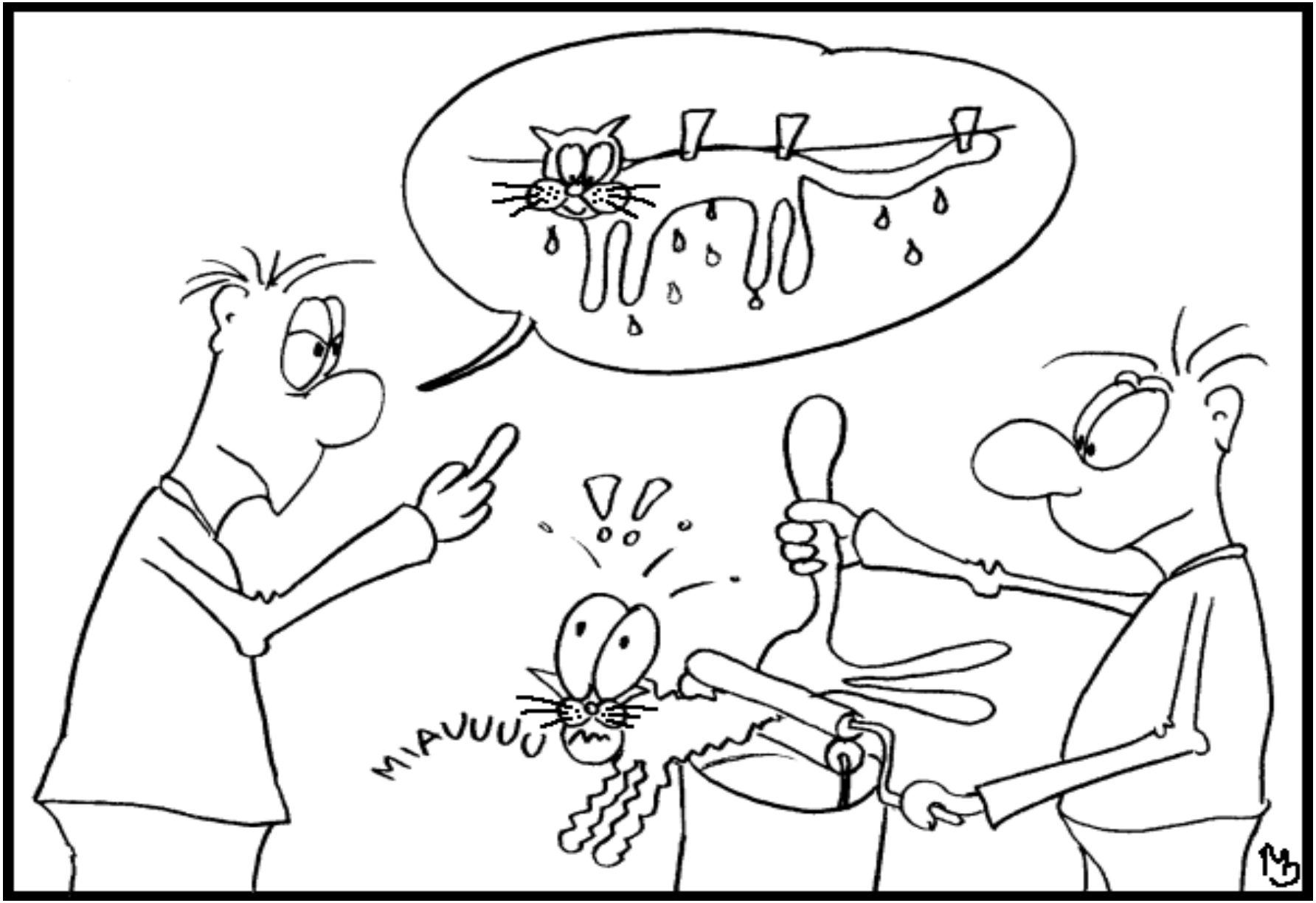
Animal Feeding



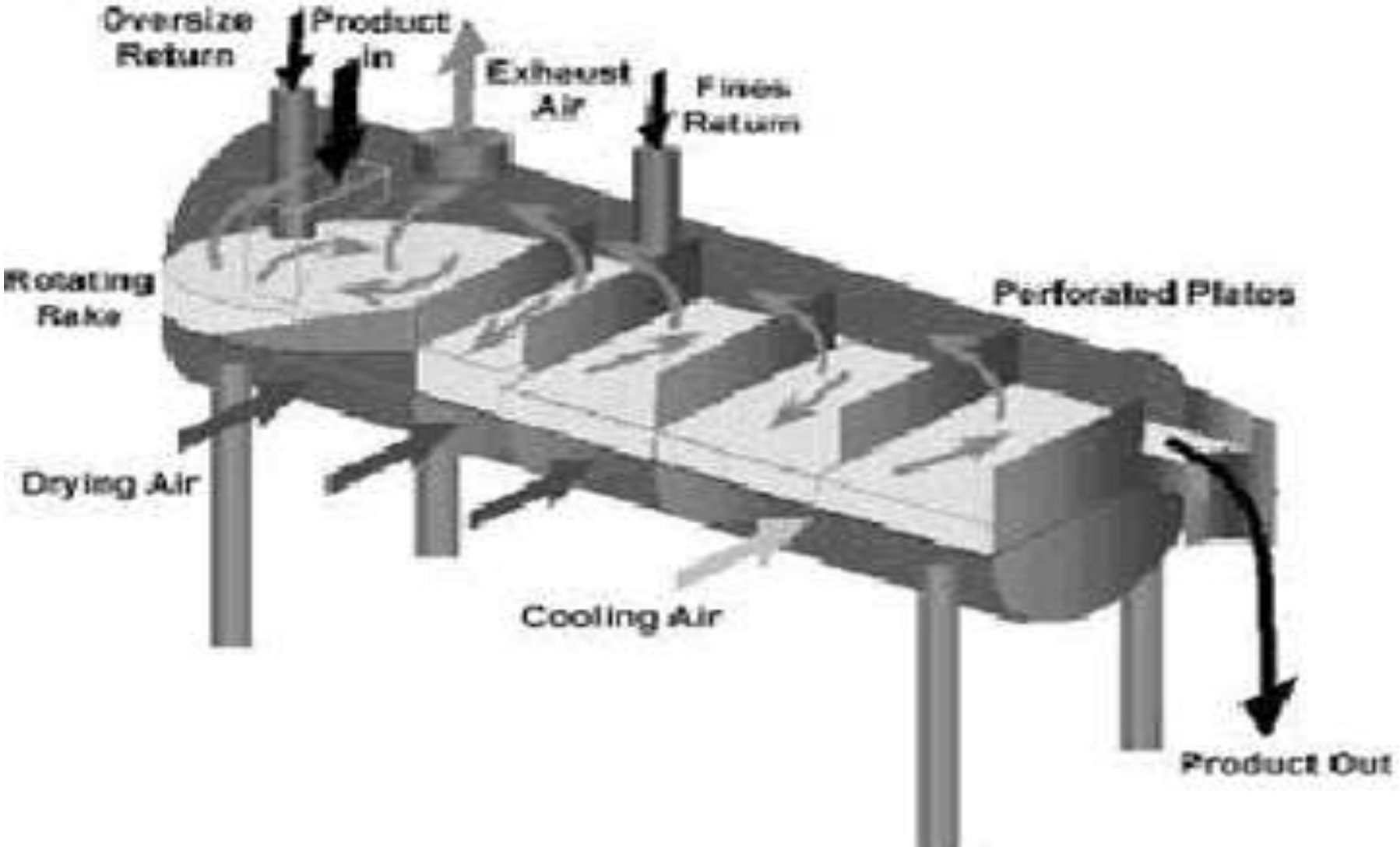
Hangover Killer



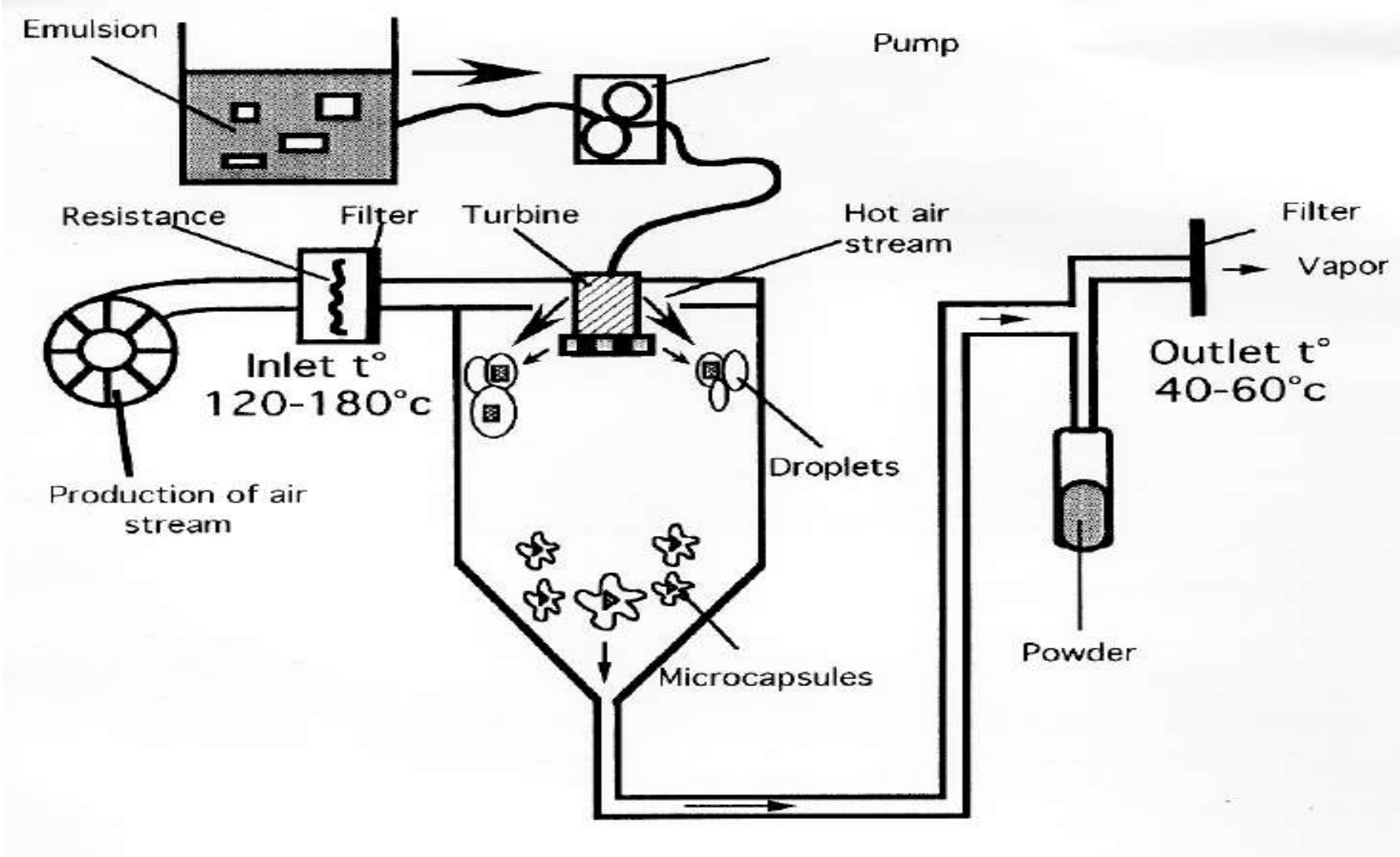
Methods of Whey Drying



Rotating razor method



Spray-drying method



The composition of powdered whey

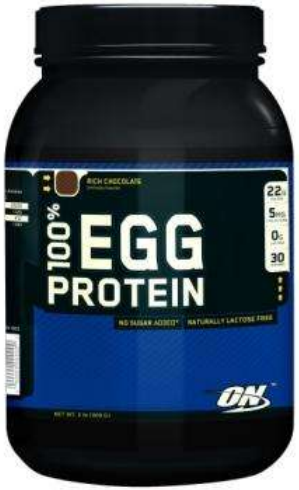
Compound	Sweet whey	Acid whey
Water	≤ 3,5 %	≤ 3,5
Protein	≥ 12 %	9 ± 1 %
Fat	≤ 1,5 %	≤ 1,5 %
Lactose	≥ 70 %	≥ 65 %
Minerals	≤ 8,5 %	11 ± 1

Whey proteins and their biological value (BV)

- Biological value (BV) of proteins is a measure determining the amount of protein, that may be absorbed by the organism's body
- It summarises how readily the digested protein can be used in protein synthesis in the cells of the organism. In the case of animal-derived proteins such as: whey proteins, their utilization in the system is high and they are called high BV proteins

Whey Proteins Amongst Others

BV=159



BV=100

BV=77

BV=74

Biological Value of Proteins in Chosen Foods

Eggs (whole)	**100**
Eggs (whites)	**88**
Chicken / Turkey	**79**
Fish	**70**
Lean Beef	**69**
Cow's Milk	**60**
Unpolished Rice	**59**
Brown Rice	**57**
White Rice	**56**






Lactose – Milk Sugar

- Relieves during digestive disorders
- Promotes growth of protective bacterial flora, very important for good intestinal condition
- Enhances calcium absorbtion from food, that is crucial for good bone and teeth condition
- Supports peristalsis and accelerates digestion process (laxative in the way)
- May lead to obesity if consumed in excess
- Not tolerable by everyone (lactose intolerance)

Vitamins and minerals

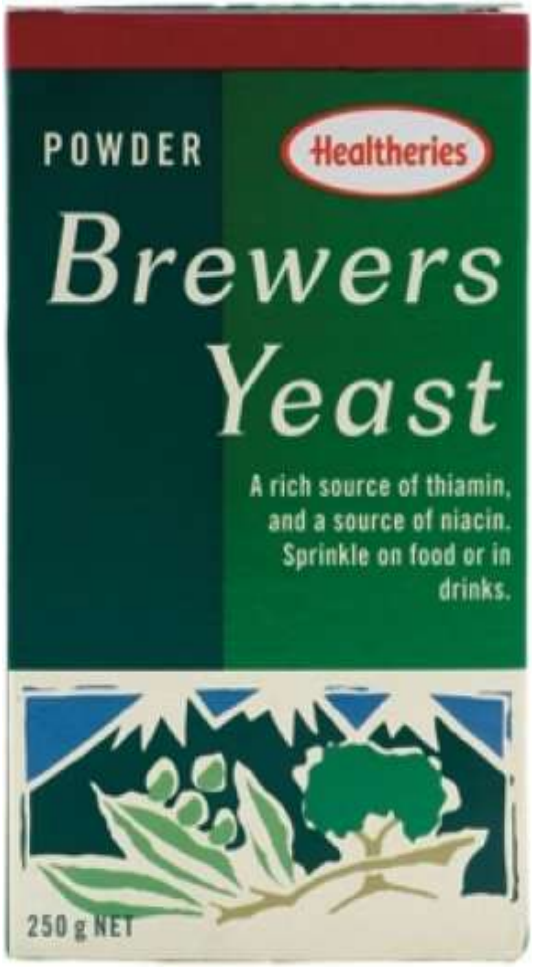
- **Water soluble vitamins: B_2, B_{12}, B_1 i B_6, panthotenic acid, biotin (vitamin H)**
- **Fat soluble vitamins: A, D**
- **Phosphorus, calcium, iodine, sodium, iron, magnesium, potassium**

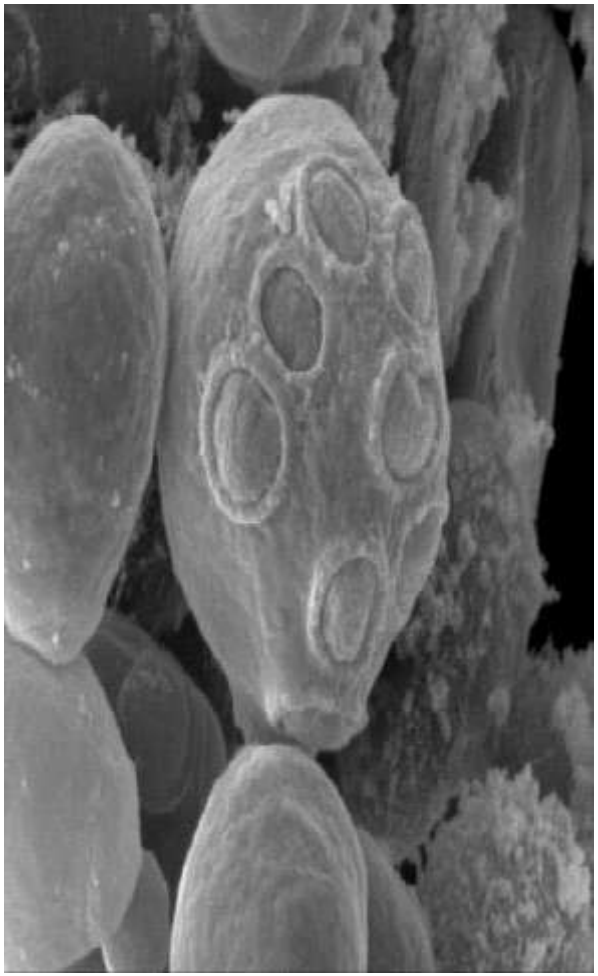
Alcohol industry

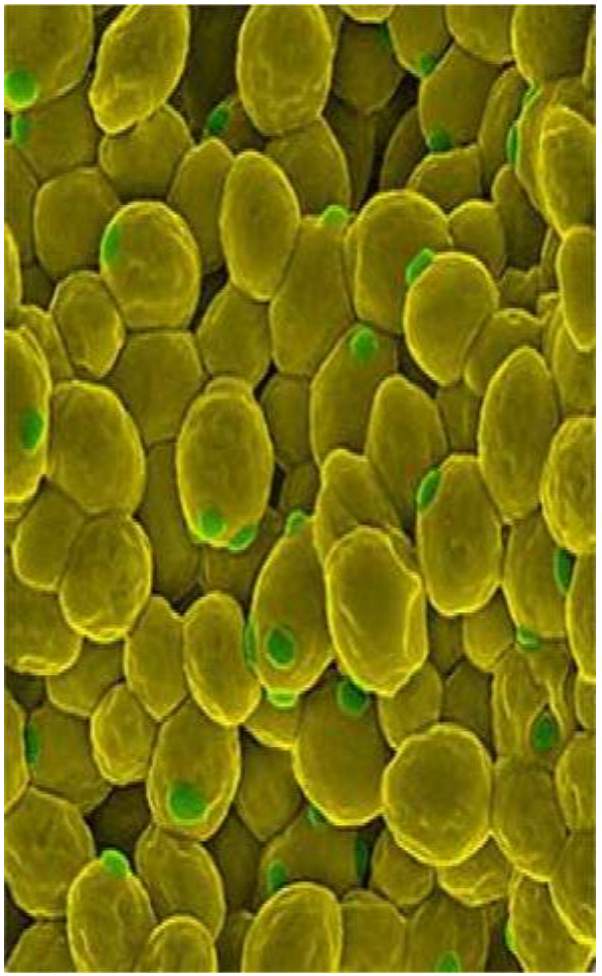
Bakery Industry

Pharmaceutical industry

Yeast


POWDER
Healtheries
Brewers
Yeast
A rich source of thiamin,
and a source of niacin.
Sprinkle on food or in
drinks.
250 g NET



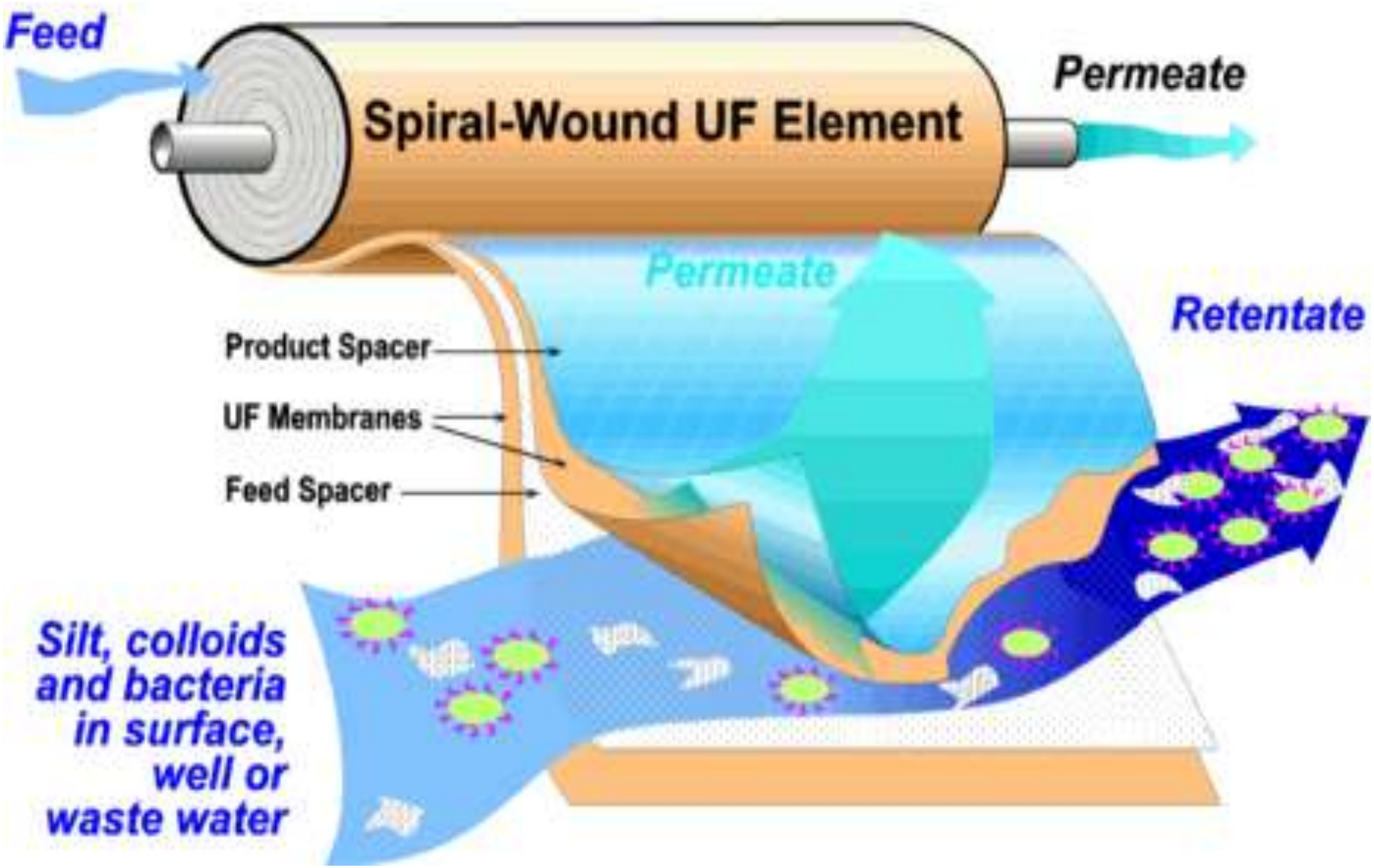


Cosmetology

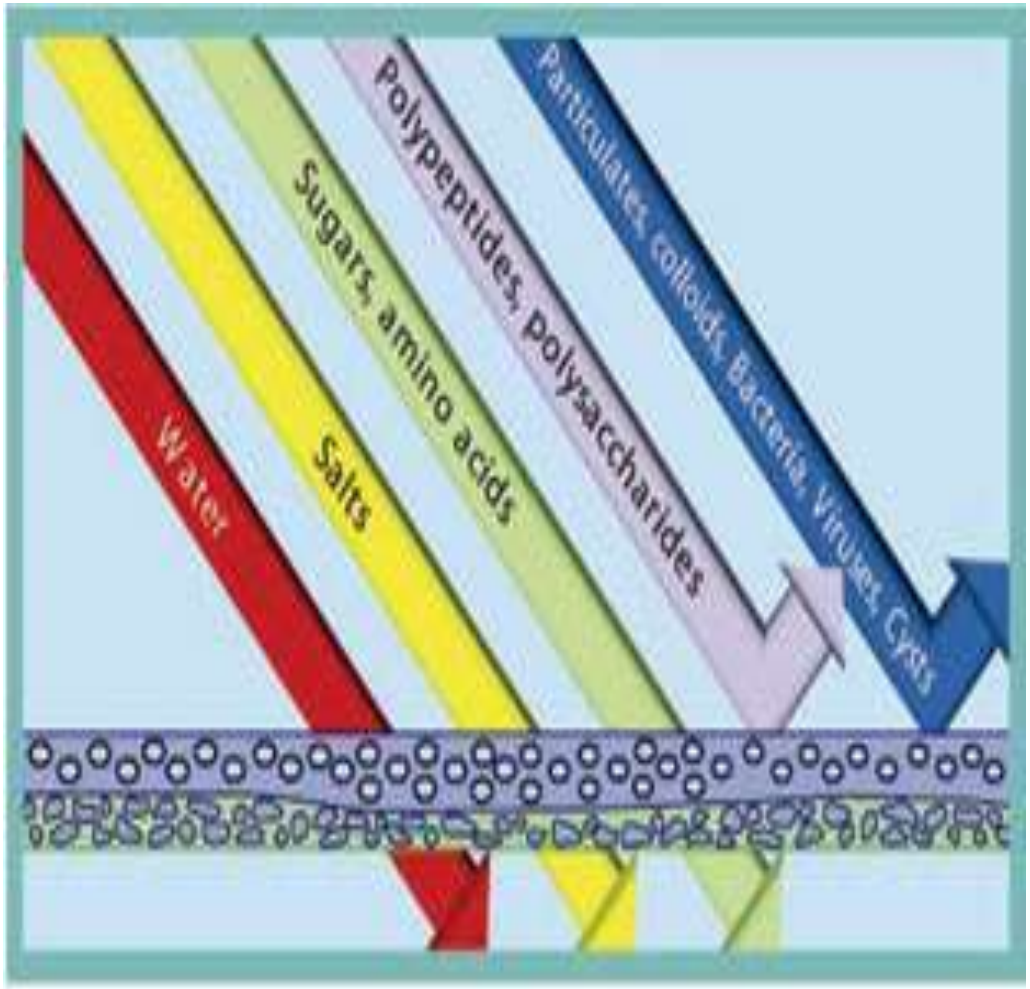
Advanced Separation Processes

- Solution clarification, preliminary purification, waste disposal
- Disinfection by macromolecules, bacteria and viruses removal
- Disposal of the monovalent ions and small organic particles
- Desalting of sea water

Ultrafiltration



UF Mechanism and UF Modules

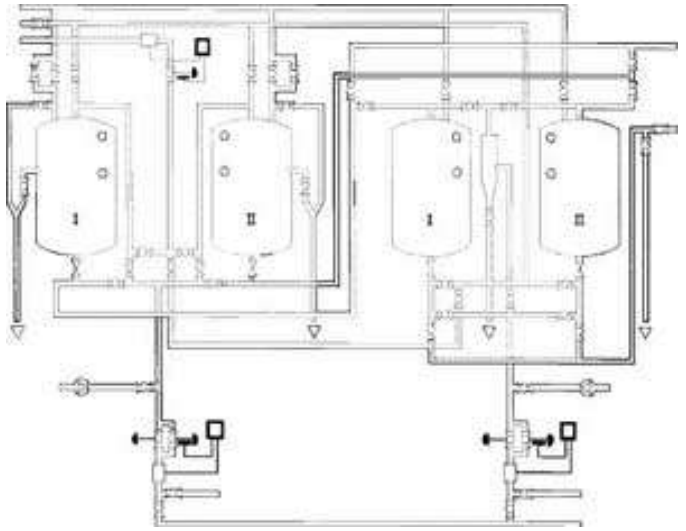


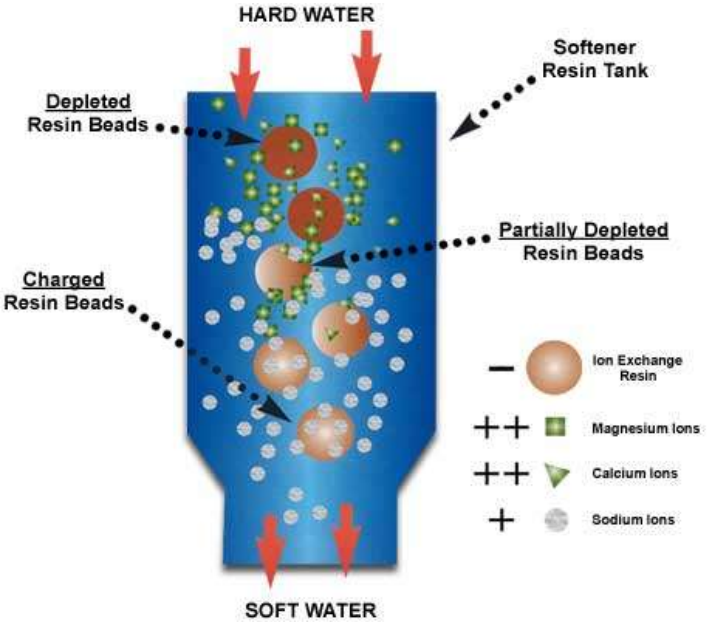
Ultrafiltration (UF)

Ion exchange

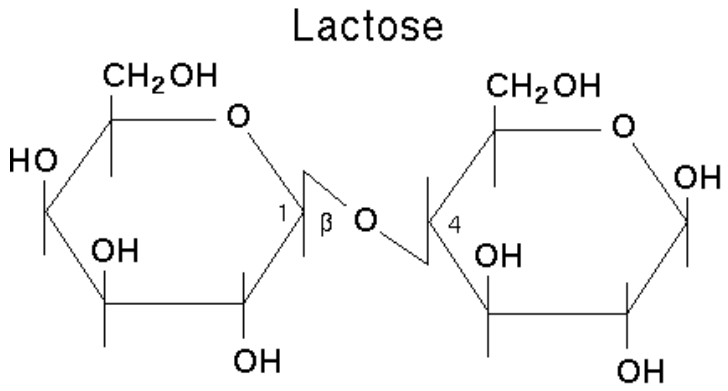
Cation exchange:

- Whey stream is taken to acid pH, which causes the whey proteins positively charged
- Subsequently whey protein stream is pumped to the tank containing negatively charged ions. The whey proteins attach to the resin
- Fat, lactose, minerals don't. They just flow through and are removed.
- Once the resin is loaded with protein, pH of the tank is made alkaline. It makes proteins detach from the resin





Lactose Production



Liquid Whey Tanks

UF Installation

Condensed Whey Protein Solution - Retenate

Spray-drying Station

The Composition of Whey Protein Preparates

	WPI	WPC 80	WPC 65	WPC 30
Protein	93	80	65	30
Lactose	< 1	5	20	59
Fat	< 1	5	5	2
Minerals	2	3	4	5
Moisture	< 5	< 5	< 5	5

Functional Properties of Whey Proteins

- **Excellent water solubility over wide pH range**
- **Viscosity and water holding**
- **Gelation**
- **Adhesion**
- **Emulsification**
- **Foaming**

Functional Requirements of Food Protein Ingredients

- **Sensory - flavour, odor, texture, color**
- **Visual - opacity, turbidity, color**
- **Comparability with other ingredients and with processing conditions**