

Whey and Whey Components as Ingredients with outstanding nutritional and functional Properties

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Session III A

Processing technologies for waste reduction and by-product utilisation



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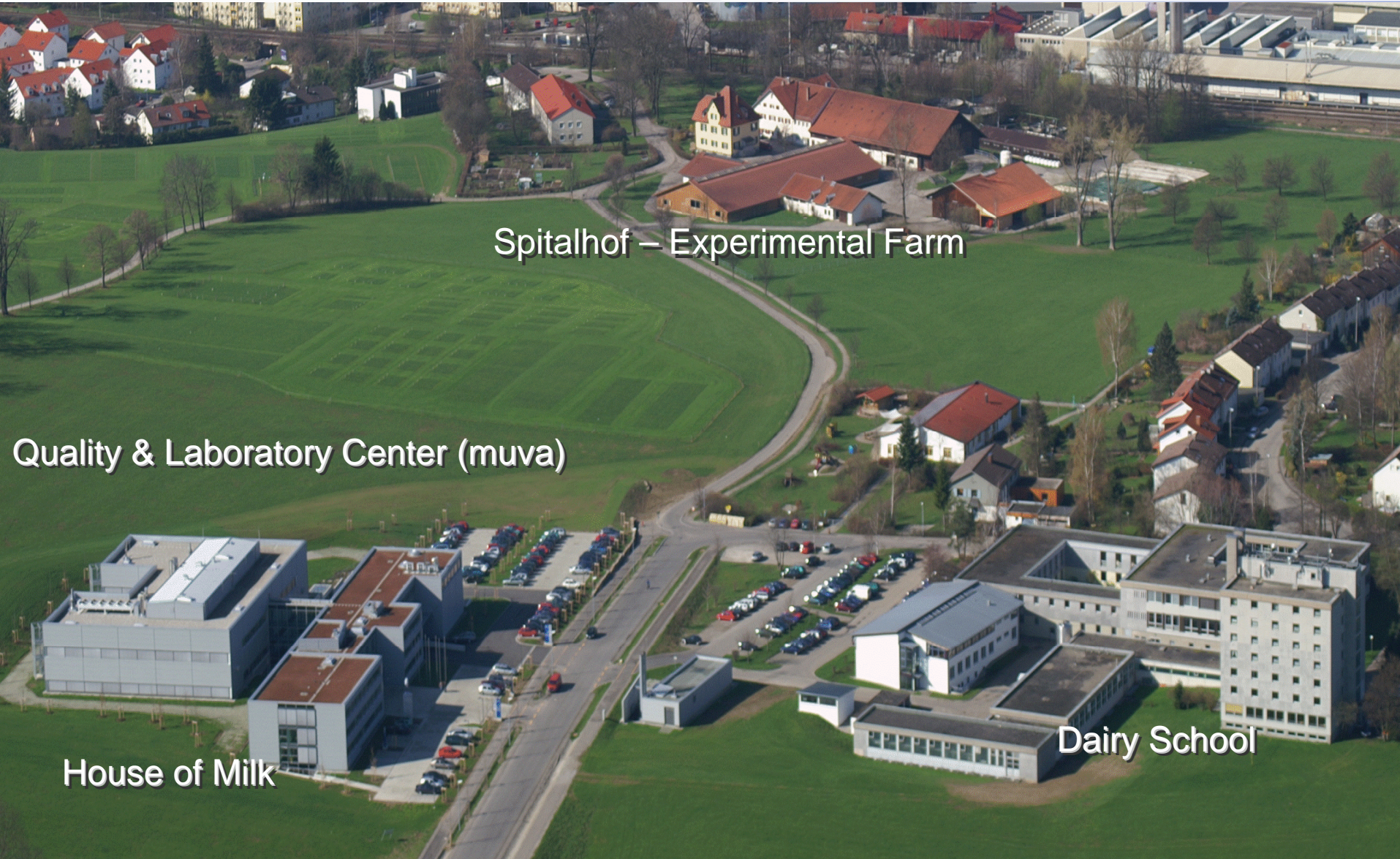
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Bavarian Milk and Dairy Center



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Spitalhof – Experimental Farm

Quality & Laboratory Center (muva)

House of Milk

Dairy School

Should we consider Whey as a Waste Product?

- Today most of whey in Oceania, USA and Europe - derived from cheese and casein production - is utilized to whey powder or other derivatives
- As an valuable raw material in FEED and FOOD it is not accepted to waste whey
- Since modern processing equipment and technologies are available and introduced to the Dairy industry, especially whey derivatives are becoming more and more a regular ingredient status in many food stuffs
- With its protein resp. amino acid profile, energy-rich milk sugar and calcium-phosphate complex with high bioavailability – whey offers a wide range of options to be used in many foods

Is the Raw Material Basis still growing?

EU Cheese Balance Sheet for 2011

'000 t	2007	2007	2008	2009*	2010*	2011**
	EU 25	EU 27	EU 27	EU 27	EU 27	EU 27
Production	8.811	8.983	9.084	9.086	9.220	9.300
- from cows' milk in dairies	8.082	8.222	8.334	8.336	8.480	8.560
- on farms	85	100	100	100	100	100
- from other milk	644	661	650	650	640	640
Imports	105	94	89	84	82	75
Processing addition ¹⁾	260	265	255	250	260	245
Available	9.176	9.341	9.428	9.420	9.562	9.620
Exports	610	594	555	576	676	670
Stock Change	20	20	10	-30	-5	5
Consumption	8.546	8.728	8.864	8.874	8.891	8.945
- per capita (kg)	18,3	17,6	17,8	17,8	17,8	17,9

1) From processed cheese.

*)Provisional **) Forecast.

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Growing Cheese Export in 2011

Exports of Cheese				
tonns		2010	2011	± %
EU-27	Jan. - July	377.200	375.300	- 0,5
Switzerland	Jan. - July	33.849	30.775	- 2,3
New Zealand	Jan. - July	165.151	148.063	- 10,3
Australia	Jan. - July	94.857	96.880	+ 2,1
USA	Jan. - July	96.452	135.856	+ 40,9
Brasilia	Jan. - July	2.580	1.794	- 30,5
Argentina	Jan. - July	21.231	27.600	+ 30,0
Uruguay	Jan. - July	18.833	20.529	+ 9,0
Total amount		805.520	834.552	+ 3,6
Sources: ZMB, EU-Comm., GTA, national statistics				© ZMB

EU Balance Sheet for Whey Powder

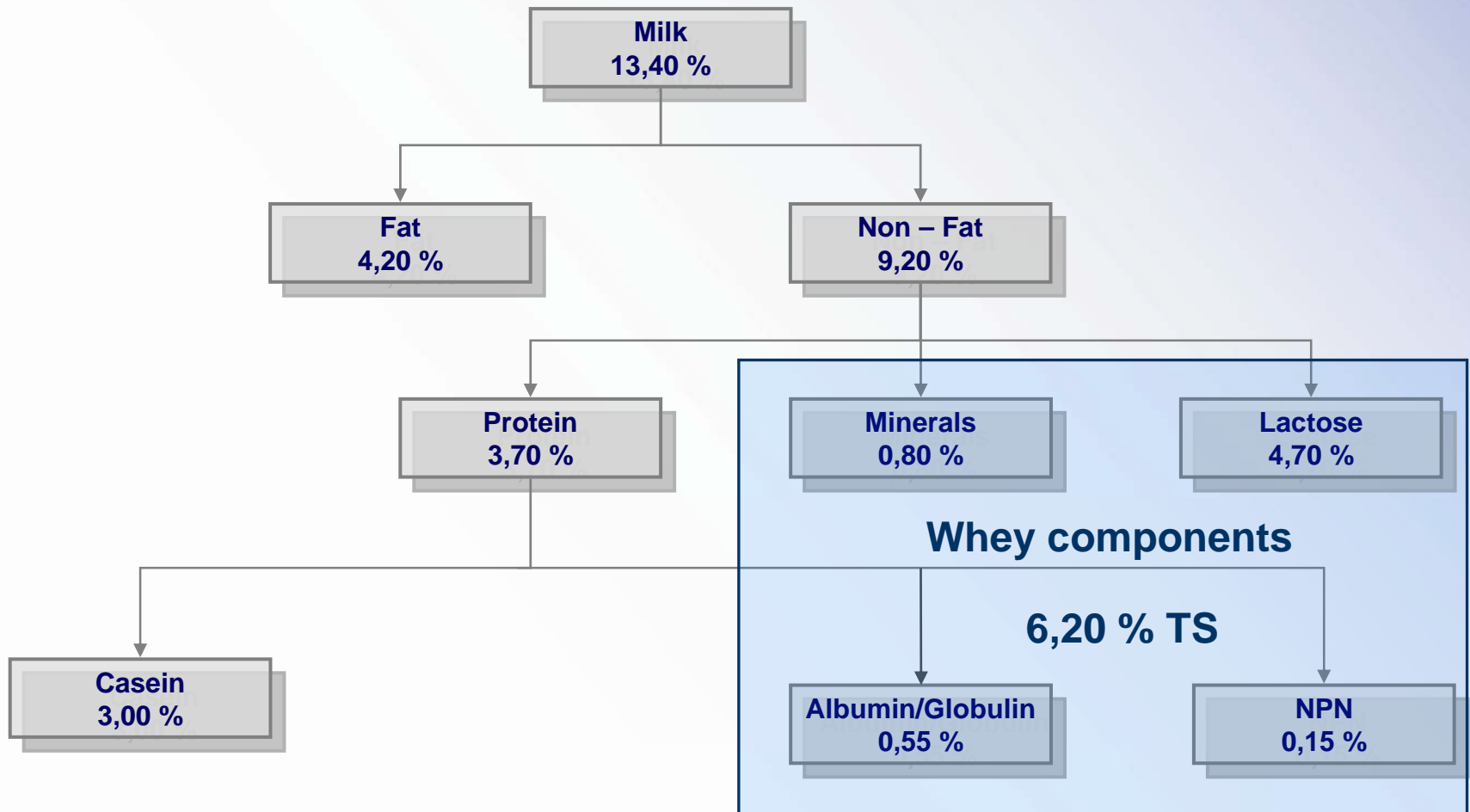
'000 t	2008 EU 27	2009* EU 27	2010** EU 27	2011** EU 27
Production	1.670	1.580	1.620	1.640
Imports	6	3	5	6
Exports	326	387	387	440
Stock change	-20	-70	0	0
Consumption	1370	1266	1238	1206
- of which in milk replacers	980	940	920	900
- other use	390	326	318	306

Partly desugared and demineralised whey powder included.

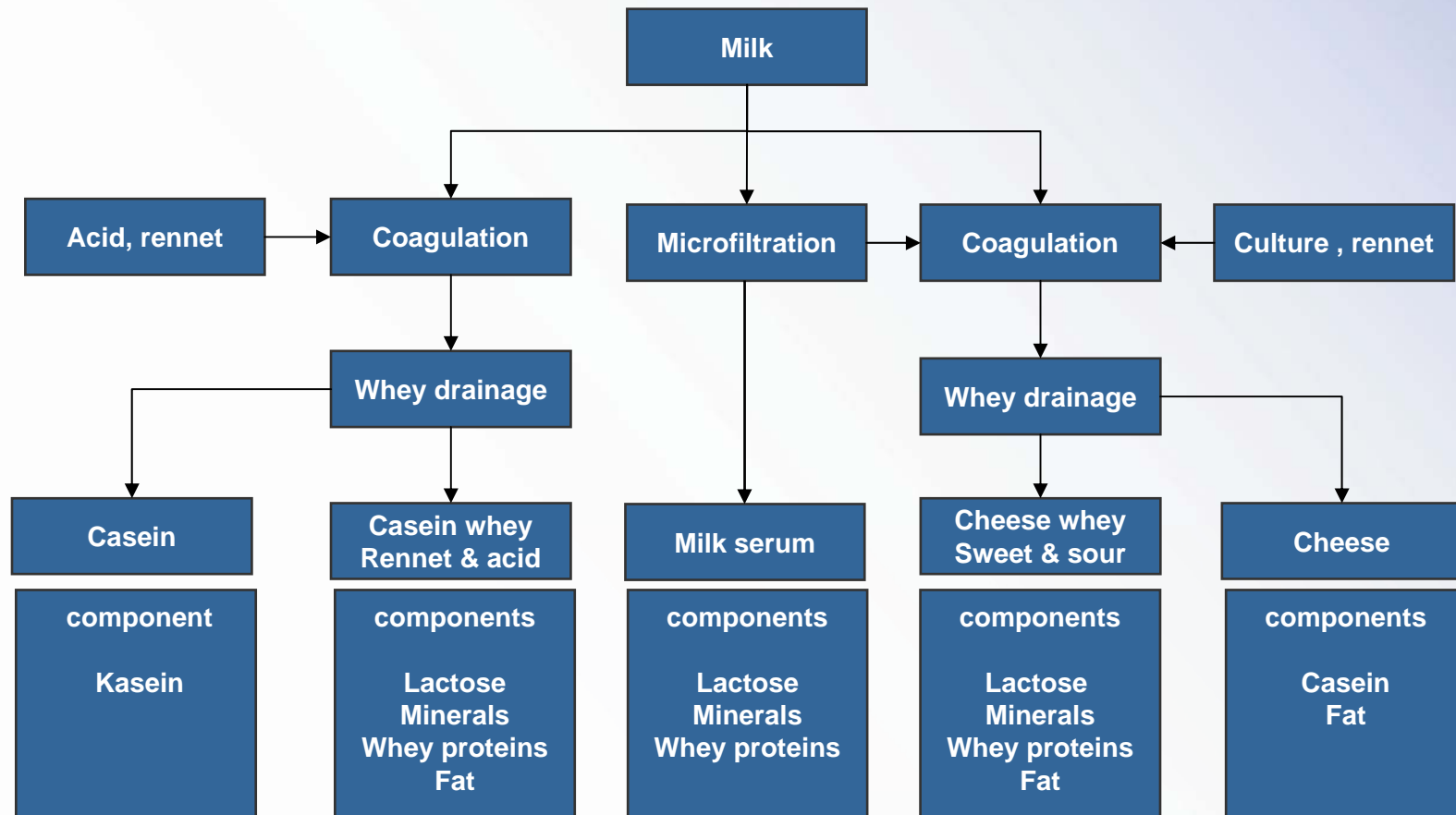
*) Estimated. **) Forecast.

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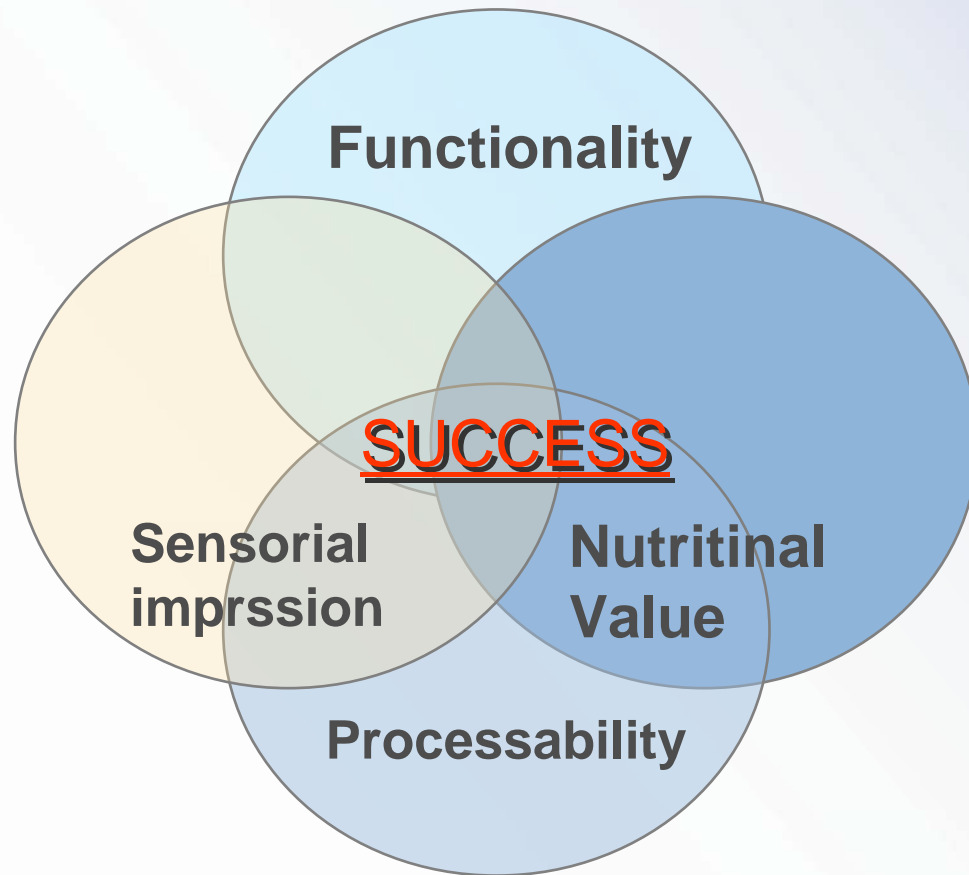
Composition of Milk and Whey



Different Types of Whey as Raw Material for Manufacturing Derivatives



What makes Whey attractive as an Ingredient for Food Applications?

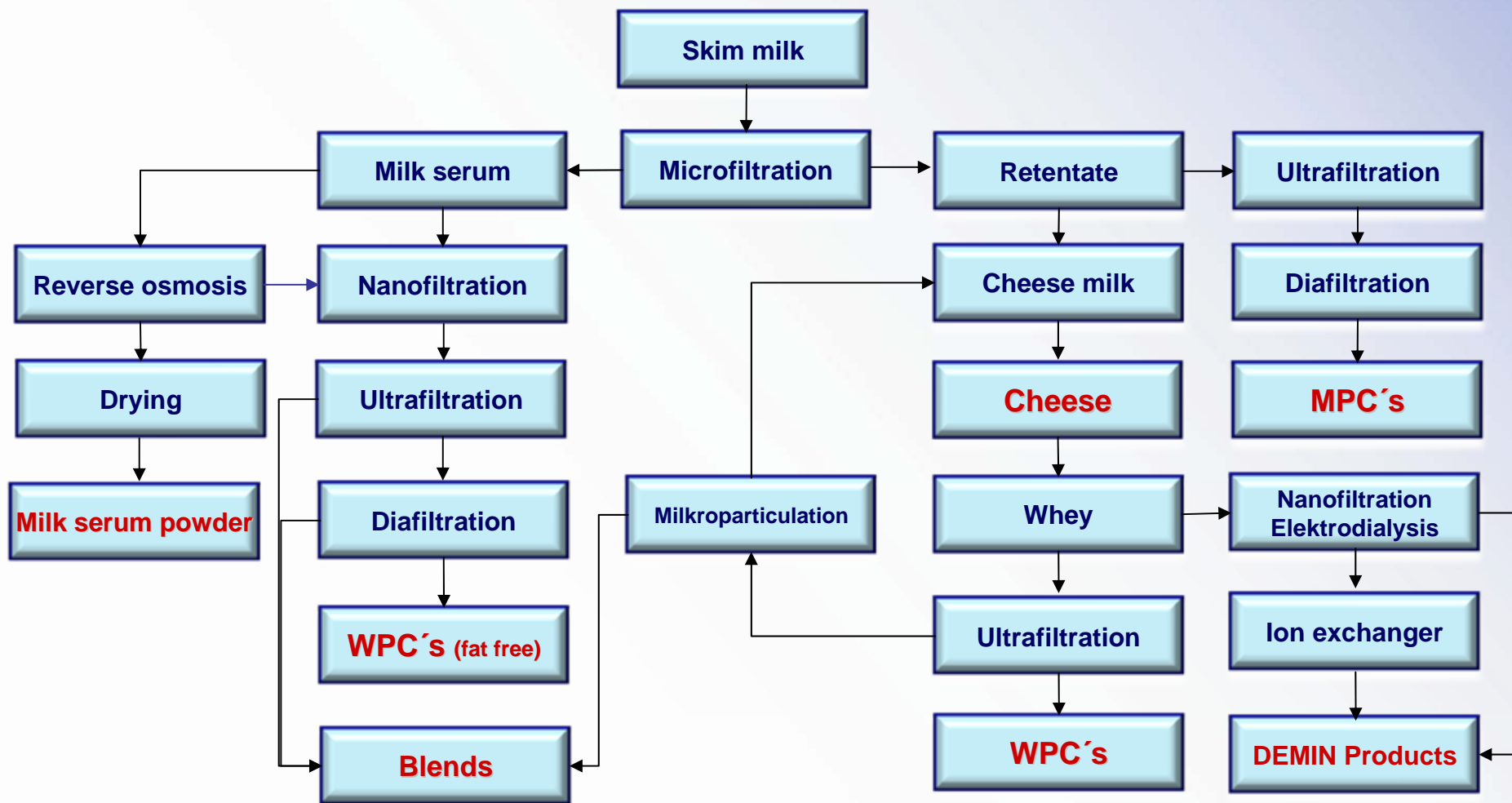


Range of Separation Techniques to improve the Functionality and nutritional Value of Whey

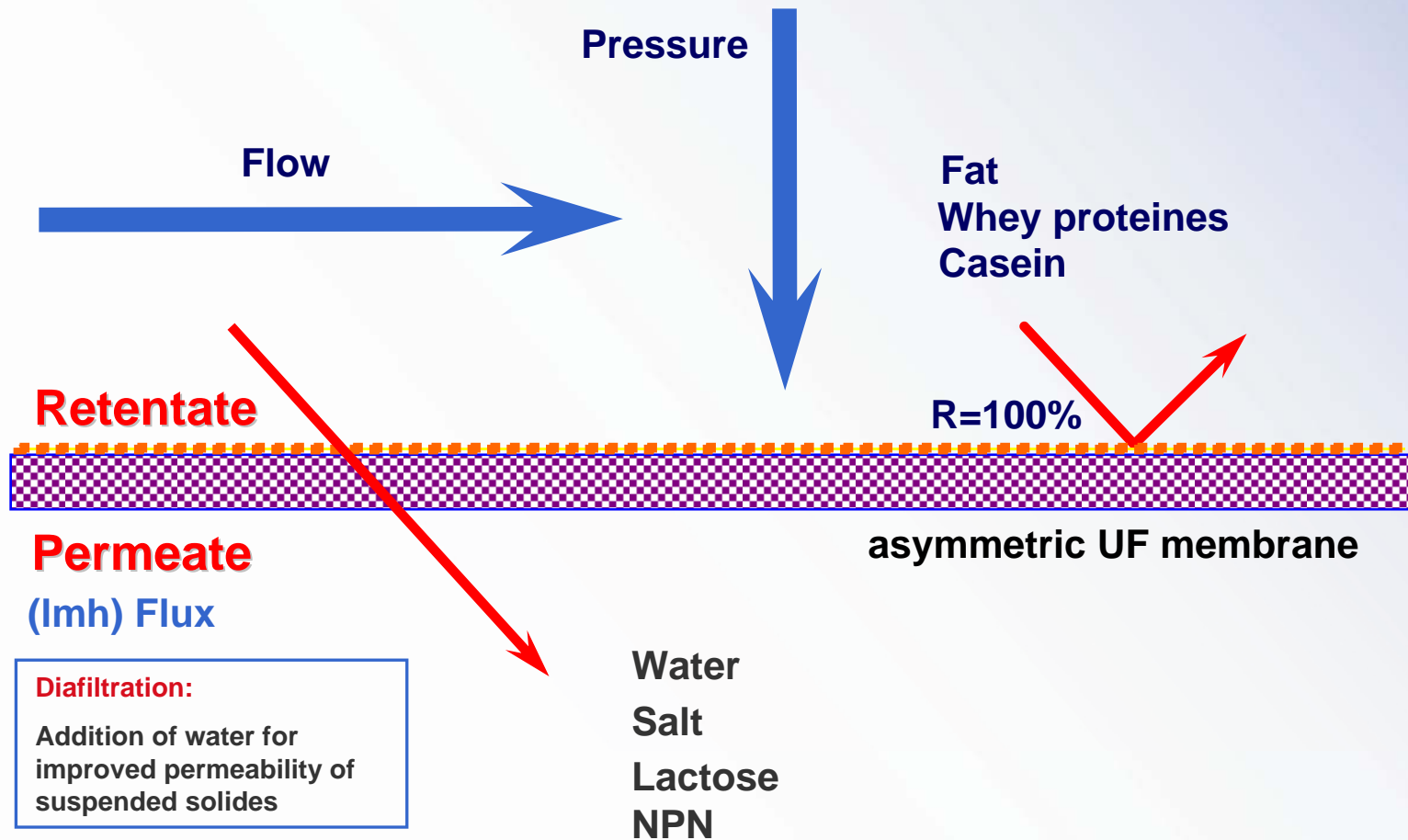
- Nanofiltration
- Microfiltration
- Ultrafiltration
- Reverse Osmosis
- Electrodialysis
- Ion-exchange
- Chromatography
- Conventional Separation
 - Evaporation
 - Precipitation
- Combination of two and more methods



Separation Techniques in Dairy Applications

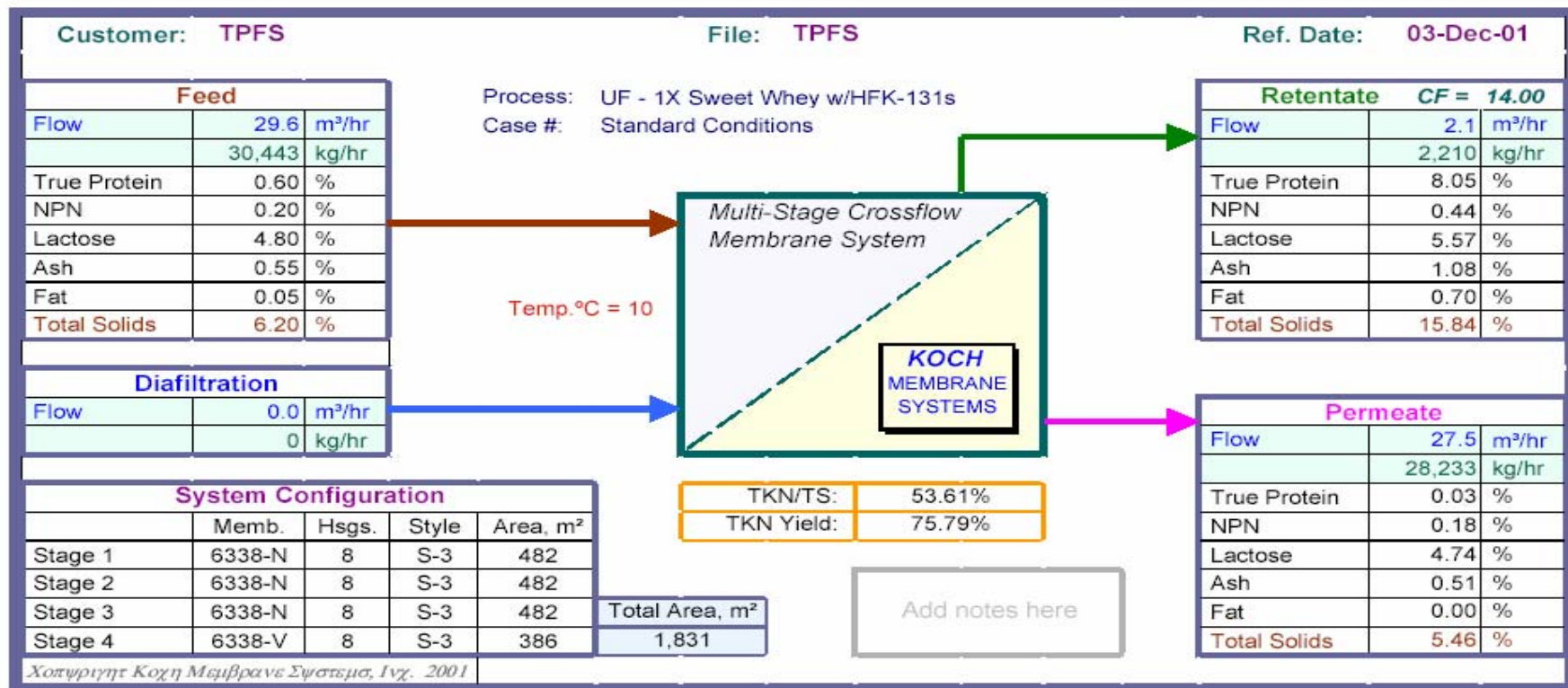


Effect of Ultrafiltration in Dairy Applications

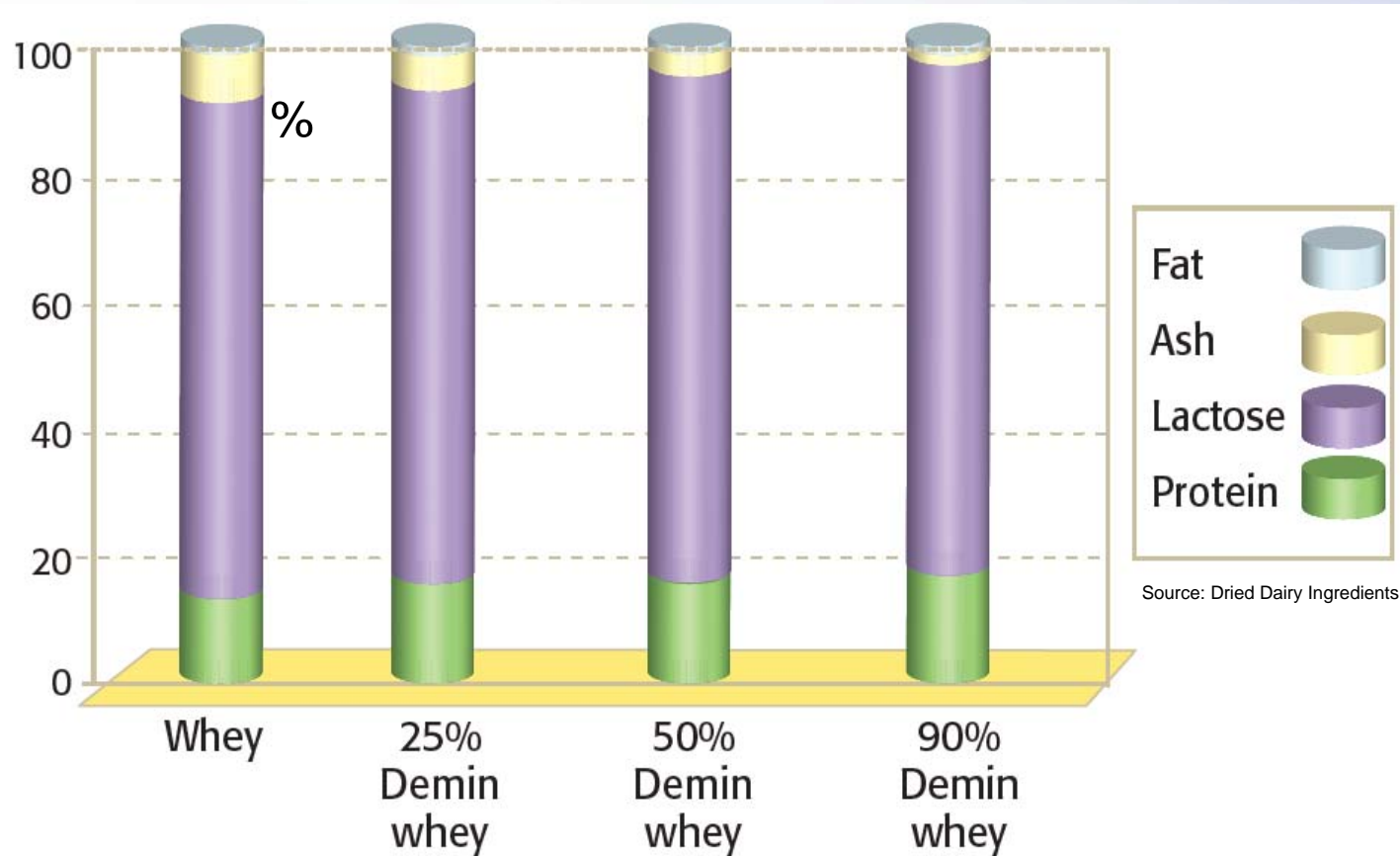


Sweet Whey Ultrafiltration

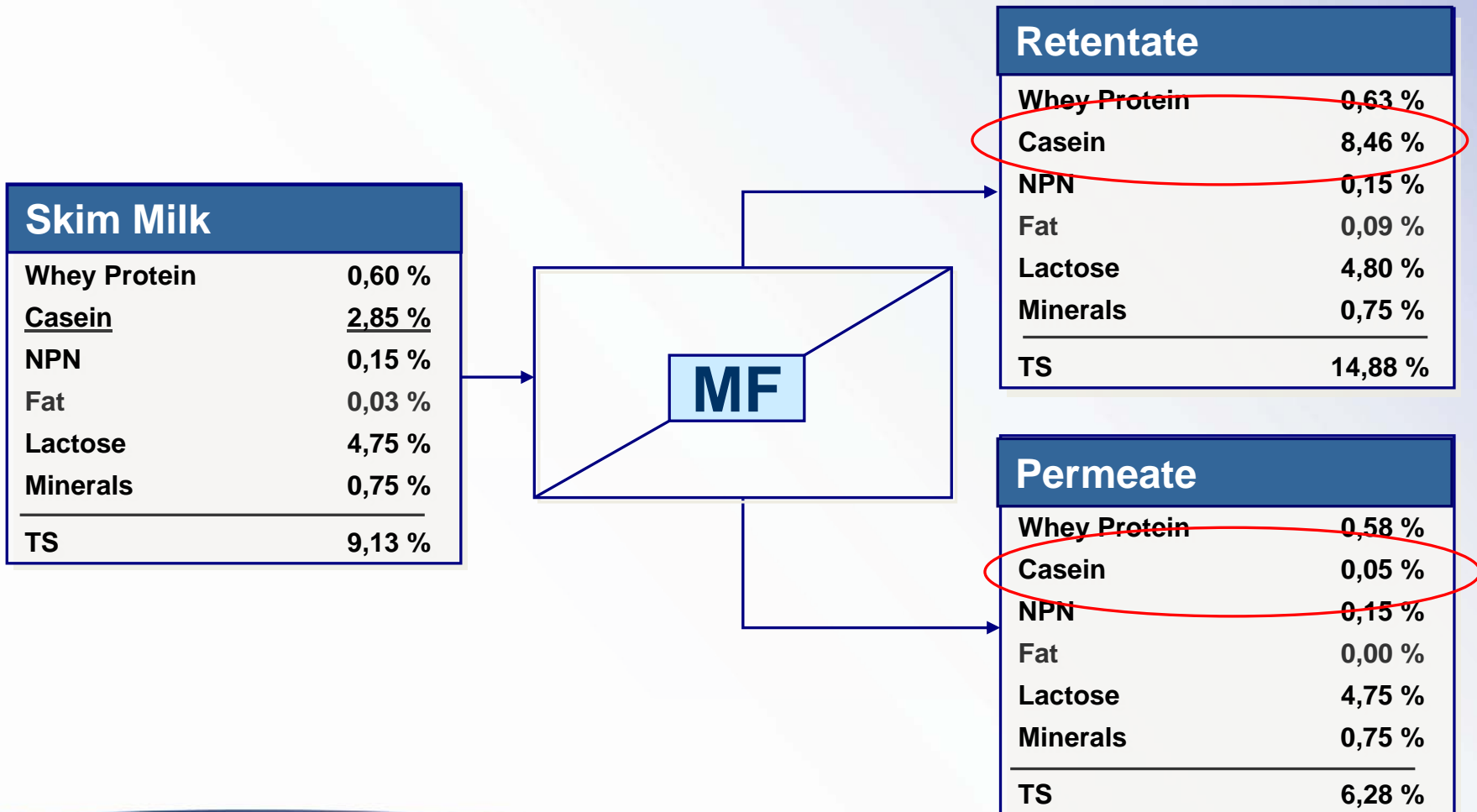
Koch Membrane Systems Stages-In-Series Dairy Program



Composition of different types of demineralised Whey Powders



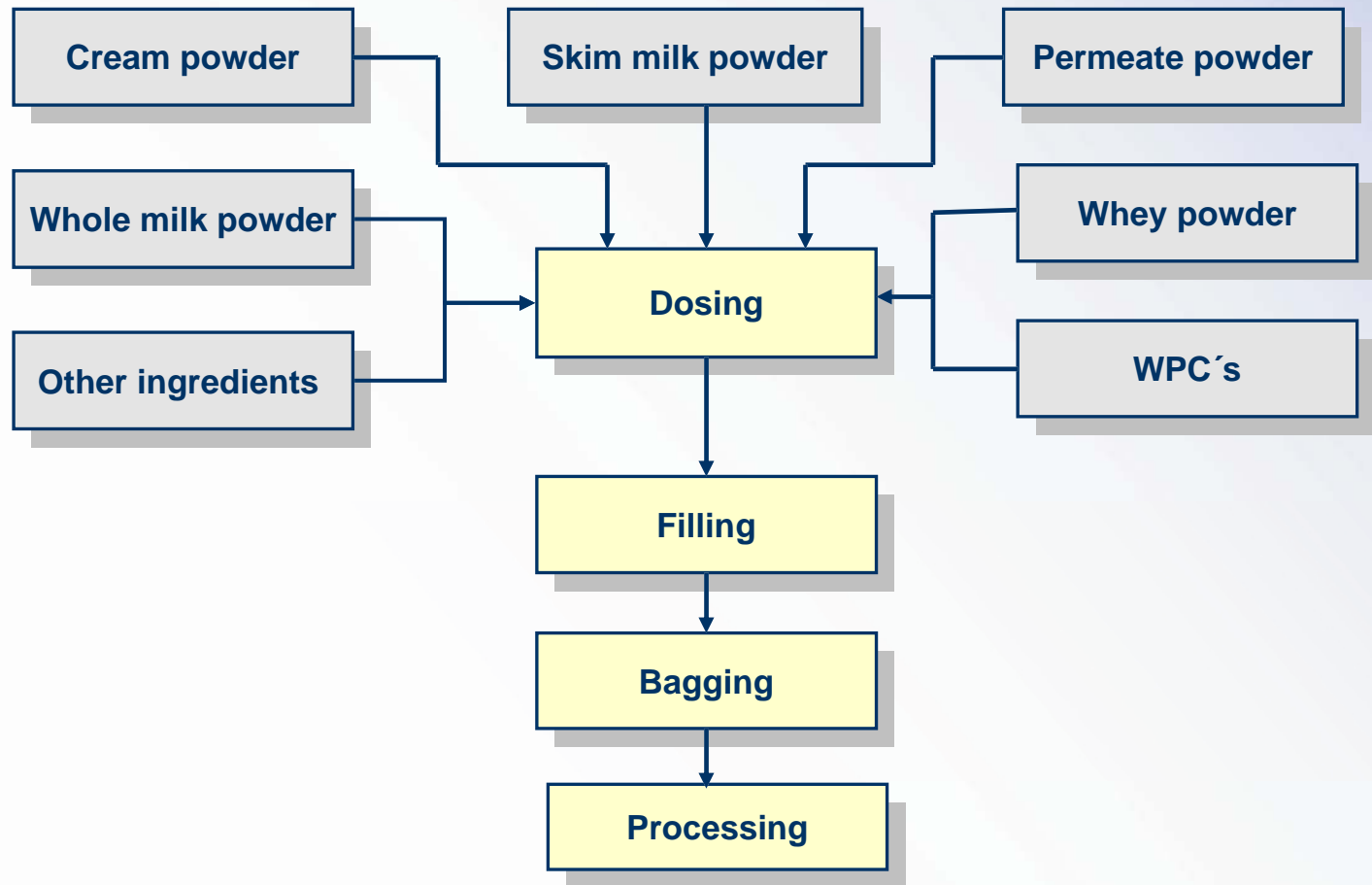
Composition of Feed, Retentate and Permeate of a 3 X microfiltered Skim Milk



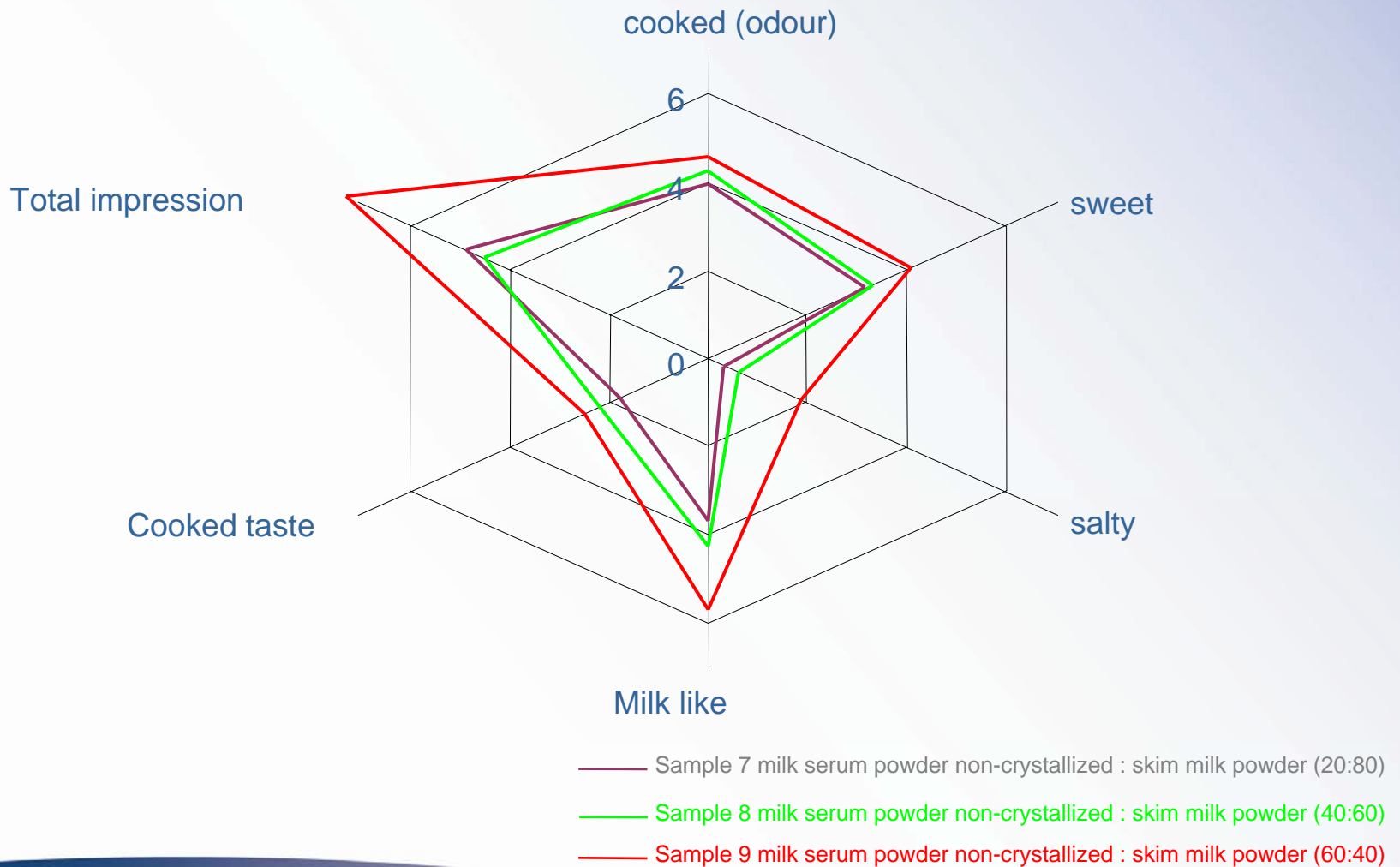
Industrial Whey Products for Food & Pharma Applications

- Sweet and sour whey powder
- Permeate powder(UF)
- Milk serum powder (MF)
- Partly demineralised Whey powders (35 – 50 - 70)
- Demineralised whey powder (90)
- Whey protein concentrates & isolates (WPC 30 – 90)
- Whey protein hydrolysates
- Protein fractions (Lactoferrin, Lactoperoxidase)
- Milk sugar (edible, refined edible, Pharma)
- Lactulose, Lactitol, Tagatose
- Hydrolysed products
- Milk calcium products
- Galactooligosaccharide (GOS)

Usage of Whey and Whey Derivatives to manufacture Blends with specific Functionalities



60:40 Blend – Milk Serum & Skim milk offers the best sensorial Result



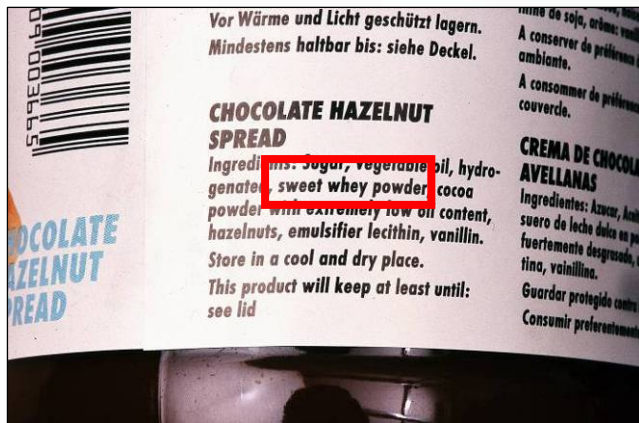
Taste Improvement

- Well balanced taste in finished products
 - Lactose in whey products acts as a flavour enhancer
 - Maillard-reaction delivers caramel sensory impression
-
- Bakery products
 - Confectionery
 - Ice cream
 - Dairy products



Reduction of Sweetness in Spreads

Options for milk and whey based products:



- Skim milk powder
- Sweet whey powder
- Permeate powder
- Lactose edible grade
- Blends



Example: Milka's White Chocolate

Ingredients:

Sugar

Cocoa butter

Skim milk powder

Sweet whey powder

Lactose

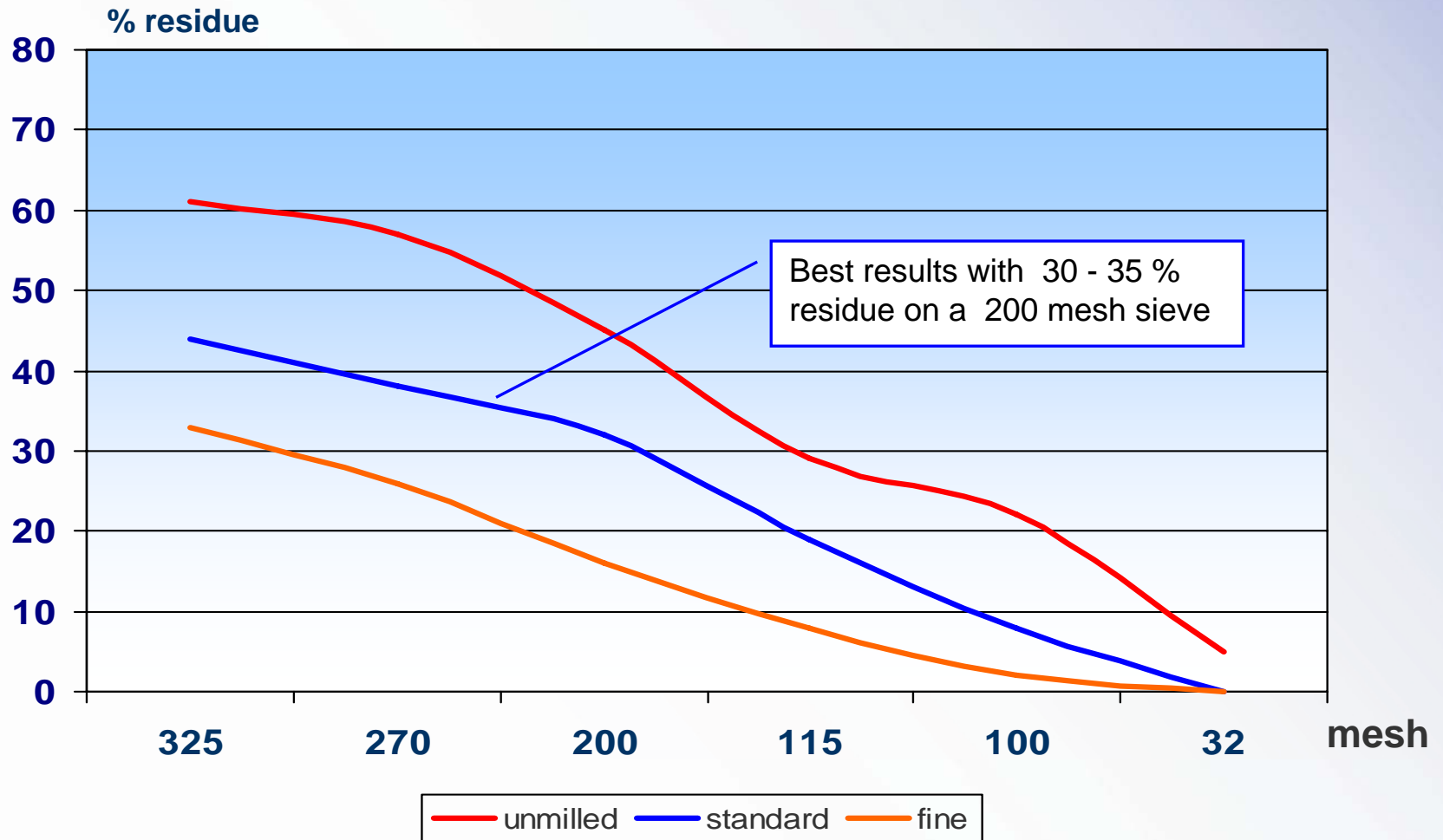
Anhydrous butter fat

Soy-Lecithine

Flavour



Importance of Particle Size Distribution of Lactose in Chocolate Manufacturing



Gelation Behaviour

- Whey proteins building irreversible gels
- High level of water binding and reduction of fat without losing positive mouth feeling
- Bakery products
- Mead products
- Confectionery
- Dairy Products



Lactose is a functional Ingredient in Meat Products, especially in fermented Sausages



The main advantages of lactose:

- Slow and controlled fermentation
 - Better controlled pH-reduction
 - Improved flavor & texture formation
 - Low sweetness
-
- Other sugars or sweetener are not able to act like the disaccharide lactose

Stabilizing Emulsions

- Supporting stability in oil – water emulsions
- Improved protein functionality depends on pH-value and mineral concentration
- Improvement of mouth feeling
- Confectionery
- Beverages
- Dairy products
- Ice cream
- Soups & sauces



Foaming Properties

- Mainly WPC and WPI
- Building foam with fine and stabil pores
- Improvement of mouth feeling
- Desserts
- Ice cream
- Confectionery
- Dairy products



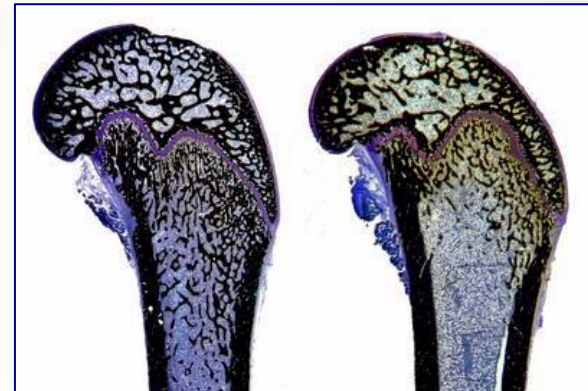
Browning Effect

- Thanks trough reaction between protein and lactose
Millard Reaction takes place
- Improvement of visual appeal
- Intensified sensorial impression
- Bakery products
- Bread and similar products



Increased Nutritional Value

- High bio-availability of all whey components
 - Can be even used for therapeutically treatments
 - Can profit from the positive and healthy image of milk
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- Baby Food
 - Specific diets
 - Dairy products
 - Bakery products
 - Confectionery
 - Mead products
 - Soups & sauces

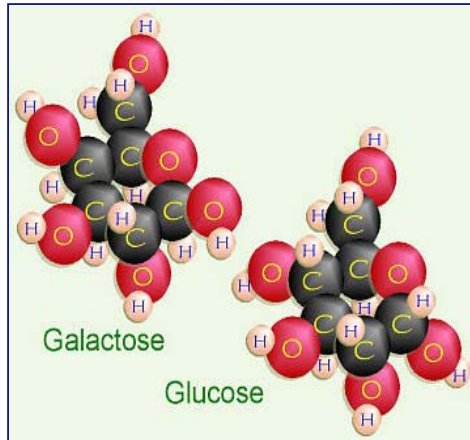


Milk Sugar as Consumer Item



- Known as an active ingredient
- Slow digestion has a pos. effect
- Activates development of a healthy gut flora
- Stimulates digestion mildly and naturally
- Does not lead to customization

Lactose Hydrolysis as Option for additional Whey Valorization



- As pre-concentrated hydrolyzed syrup
- Preferred for beverages (fruit and soft drinks and other milk based beverages) and probably even in ice cream
- In some bakery applications
- In the meantime even lactose-reduced milk powder is on the market manufactured with this kind of product

Lactose Content of Milk and whey Products

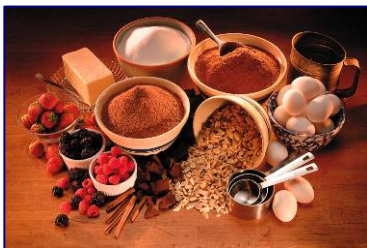
Products (%)	Protein	Fat	Lactose	Minerals	Water
Cream Powder 42 %	21,5	42,0	27,7	4,8	4,0
Whole milk powder	26,5	26,0	38,0	6,0	3,5
Skim milk powder	35,0	1,0	52,0	8,5	3,5
Whey powder	12,5	1,5	75,0	8,0	2,5
Permeate powder	3,5	1,0	83,0	8,5	4,0
Demin 50 %	13,0	1,0	80,0	4,0	2,0
Demin 90 %	14,0	1,0	82,0	1,0	2,0
WPC 35 %	35,5	3,5	50,5	7,0	3,5
WPC 30 %	30,5	5,0	53,5	8,0	3,0
Lactose edible	0,3	0,0	99,2	0,3	0,2
Condensed milk	8,4	7,5	7,9	1,2	75,0

Lactose in Babyfood Products

- Lactose cannot be replaced
- Adaptation of human milk makes Lactose necessary
- Lactose content in human milk is about 7,2 %
- But there are other options to improve the lactose content
- E.g.: Demin whey powder or other whey based products



Better Taste and Functionality for many Food Products



Ice cream

Baby Food

Confectionery

Dairy products

Beverages

Bakery items

Specific diets



... thank
you very
much for
your interest





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