Membrane Application, challenges and opportunities

Phil Evans

March 2026

Arla Foods Ingredients

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Agenda

- Arla Foods Ingredients (AFI) Overview
- Technology & Design Team
- What is whey?
- Membranes For Dairy Processing
- AFI Felinfach Factory Balance
- Common Problems and Modes of Failure
- Opportunities

Arla Foods Ingredients (AFI) Overview

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Arla Foods group structure

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Arla Foods Ingredients in numbers total 2024

225 mKG
Milk intake

2,061
Colleagues

7.8 bn KG
Whey intake

1,000 mEUR
Revenue

~86,500 MT
lactose

~55,500 MT
WPC 80
equivalents

~75,000 MT
permeate

Total Arla Foods Ingredients – incl. Advanced Nutrition Manufac… …entures.

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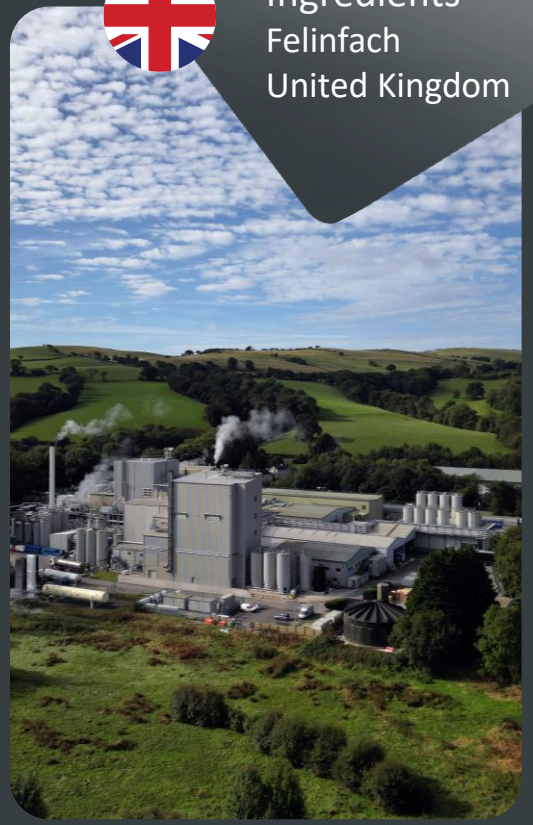
Our production units

Danmark Protein
Videbæk
Denmark

ARINCO
Videbæk
Denmark



Arla Foods Ingredients
Felinfach
United Kingdom

Arla Foods Ingredients S.A.
Porteña
Argentina

Arla Foods Ingredients
Taw Valley
MVI
United Kingdom

Arla Foods Ingredients across the world

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TECHNOLOGY & DESIGN

Anders Dalberg (ANDAB)

Project Mgmt

Anette Rosengaard (ANEKR)

Research

Behnaz R Parjikolaei (BEPAR)

Freja Mardal (FRMAR)

Ozgenur Coskun (OZCOS)

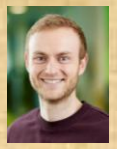
Willem van Heugten (WIHEU)

Tech & Design DK

Jakob Christiansen (JKCHR)

Katrine Andresen (KANUI)

Jens Kristian Bech (JEBEC)



Martin Kennedy (MINSE)

Niels Ottosen (NIOTT)

New

Jens Damgaard (JENSD)

Troels Andersen (TROMN)

Kenneth Nielsen (KENIE)

Anton Østerlund Brænder (ABRUZ)

Tech & Design UK

Philip John Evans (PHEVA)

Bradley Hughes (BRHUG)

Julia Pinches (JUPIN)

Clare Thomas (CLATH)

Richard Phillips (RIPHI)

Alexander Arnold (ALEAR)

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What is Whey?

Milk conversion to Cheese and Whey

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Whey Composition

Cheese and Whey from Milk

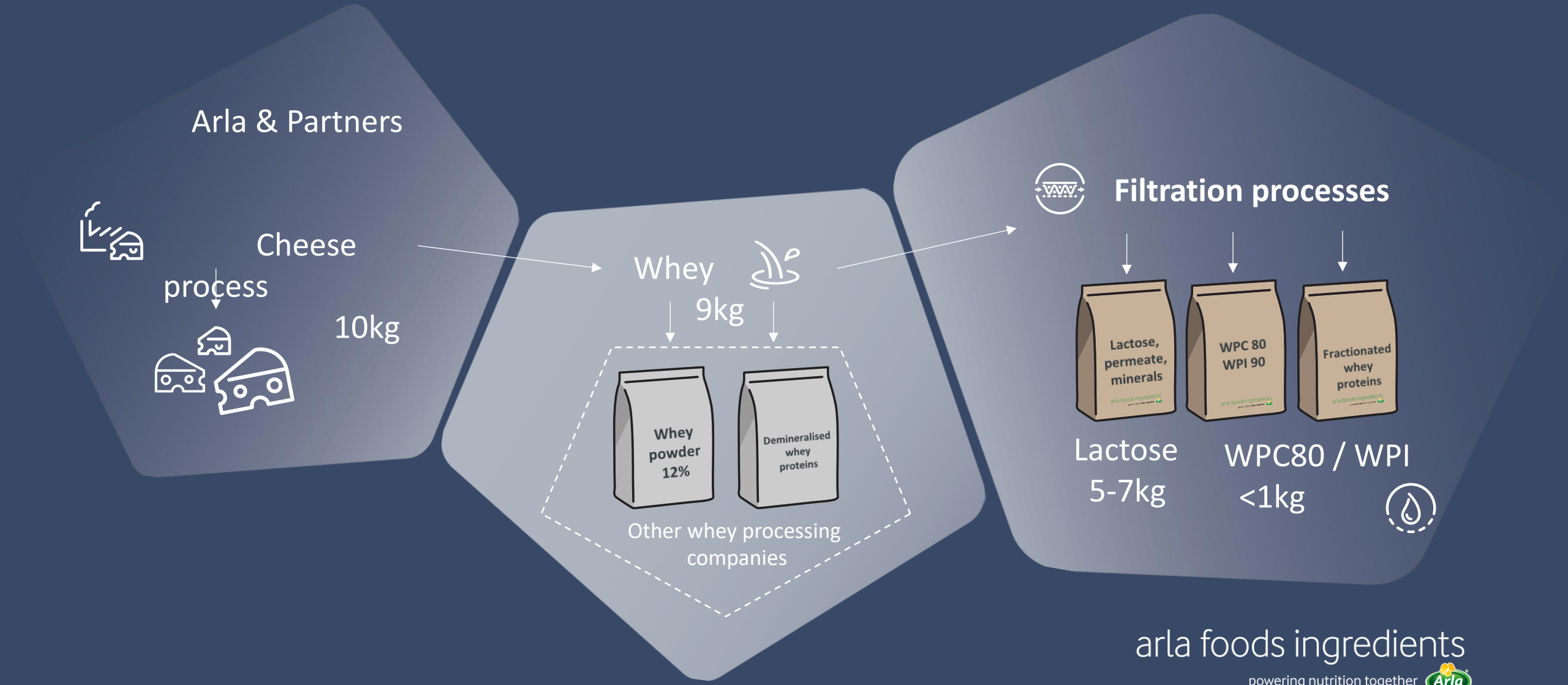
Milk	
Fat	3.80%
Protein	3.40%
Lactose	4.90%
Ash	0.70%
TS%	12.80%

Milk	
Fat	3.80%
Casein	2.65%
Whey	0.75%
Lactose	4.90%
Ash	0.70%
TS%	12.80%

Whey	
Fat	0.06%
Casein	0.00%
Whey	0.75%
Lactose	4.90%
Ash	0.70%
TS%	6.41%

Cheese	
Fat	33.00%
Casein	33.00%
Moisture	33.00%

Our ingredients value chain from 100kg of Milk



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Composition of whey

- Whey is made up a number of components dissolved, or dispersed, in water
- Components have differences in shape and size (molecular, ionic or particulate size)
- Whey can be separated into it's various components through membrane filtration

Water (93.5%)	Ash / Minerals (0.55%)	Lactose (4.8%)	Protein (0.75%)	Fat (0.05%)
Molecular Mass : 18 Size : 10^{-7}mm	Molecular Mass : ~50-250 Size : 10^{-6} – 10^{-7}mm	Molecular Mass : 342 Size : 10^{-6} – 10^{-7}mm	Molecular Mass : 10-150 kDa Size : 10^{-5} – 10^{-6}mm	Molecular Mass : >100 kDa Size : 10^{-2} – 10^{-3}mm

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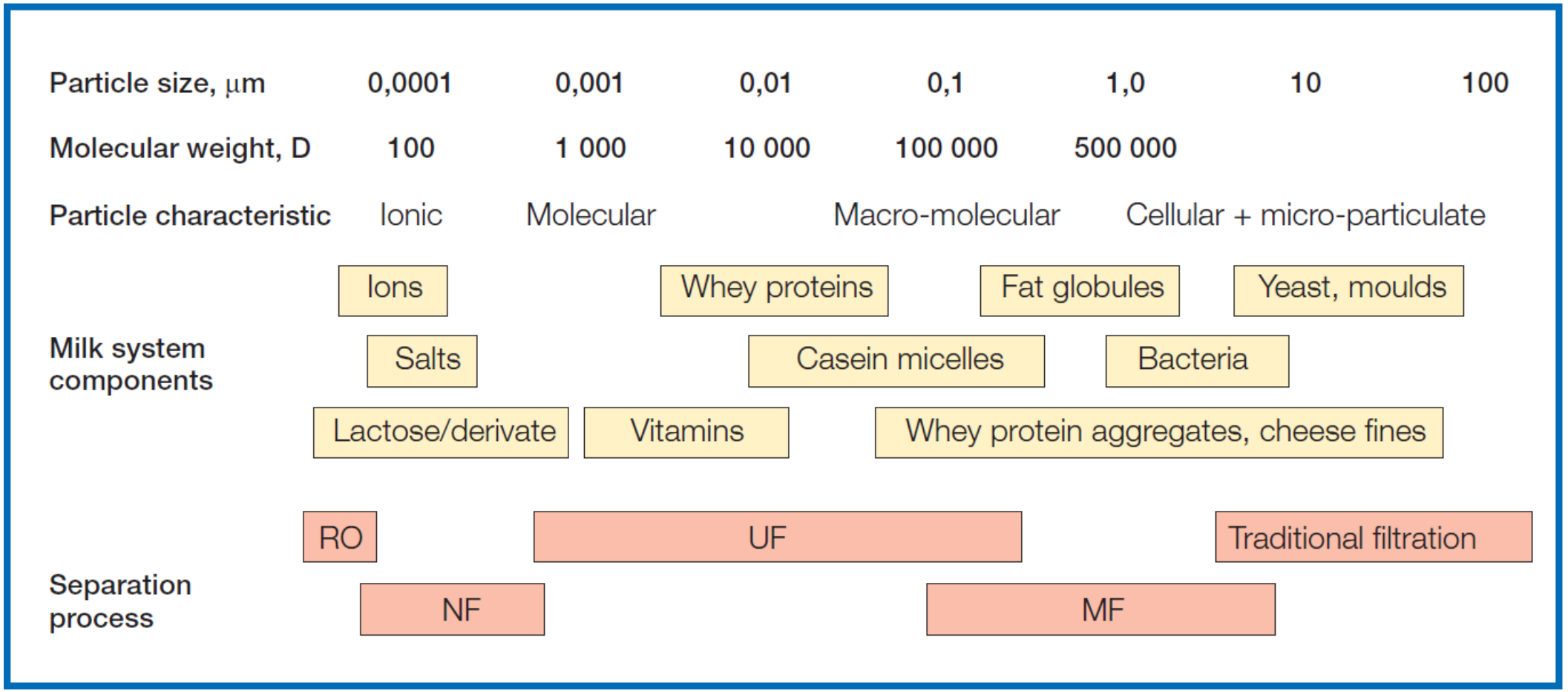
Membranes for dairy processing

Membrane Technology to Separate Whey Components



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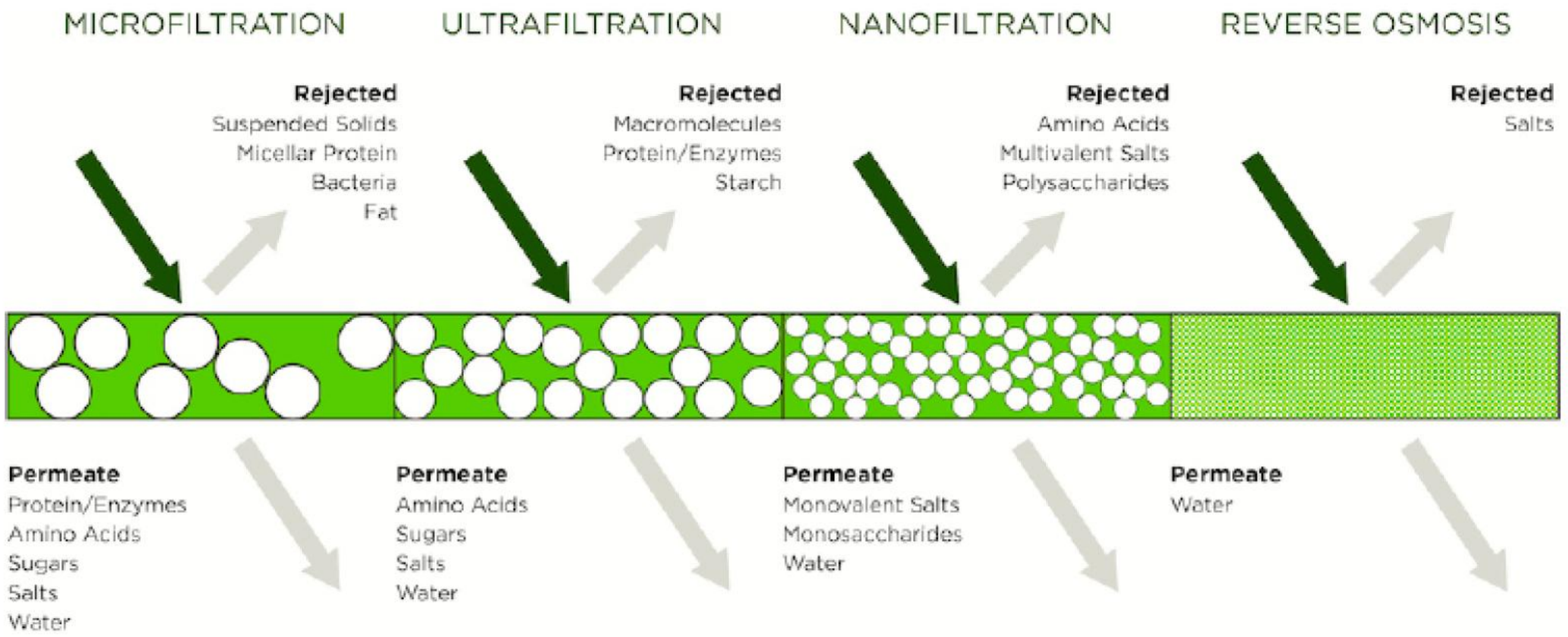
Membrane Technology to Separate Whey Components



The type of filtration *Credit: Solecta*

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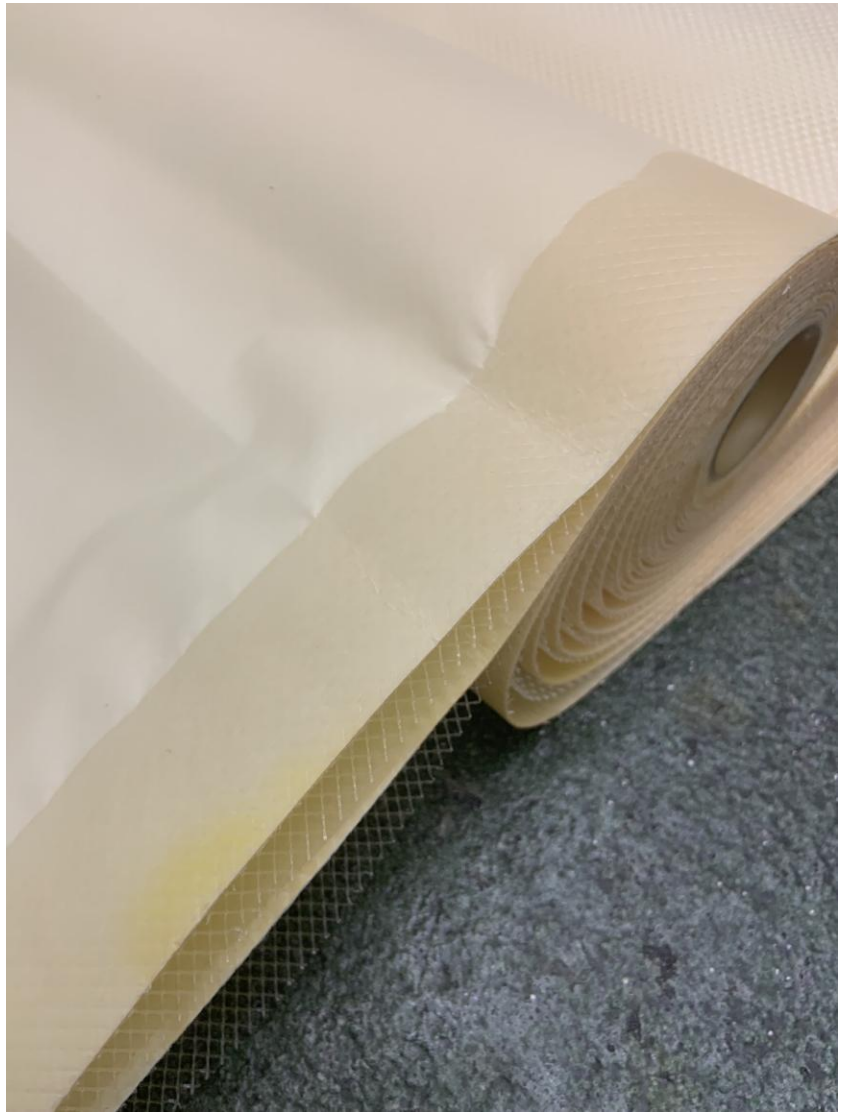
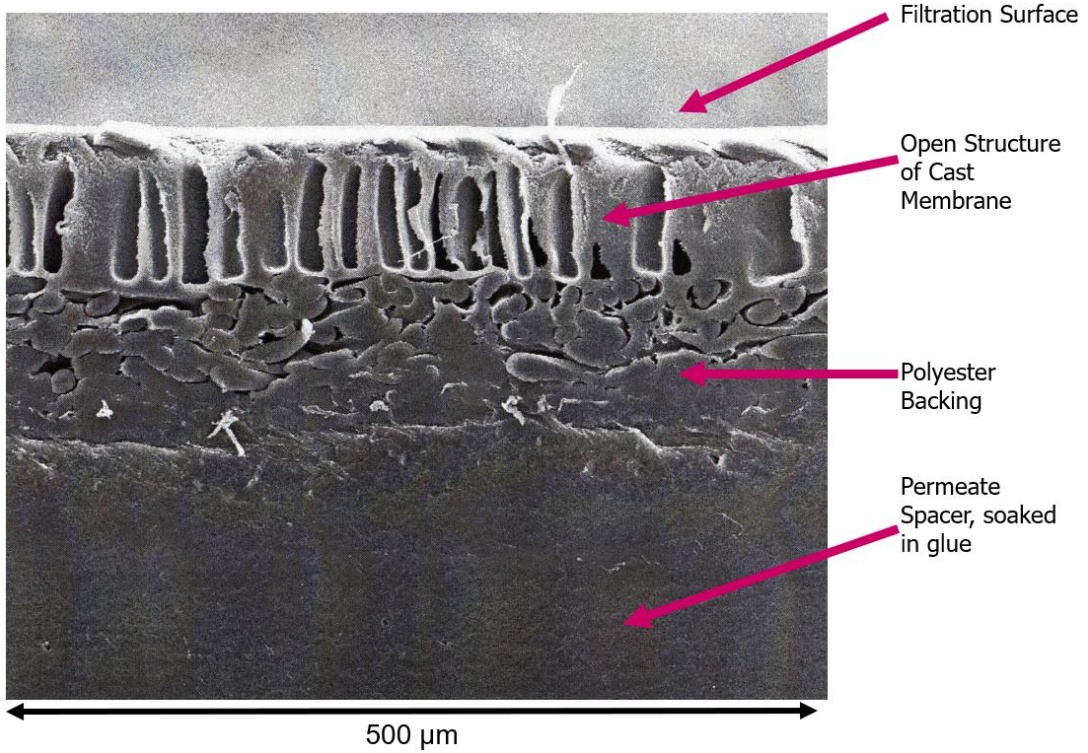
Spiral Wound Membrane Element Construction





SEM of a glue seam

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Membranes in AFI – Spiral Wound

- Spiral wound polymeric membranes are the most commonly used in the Dairy Industry (>95% of installed membrane area)

- The most economical way of maximising active membrane surface area

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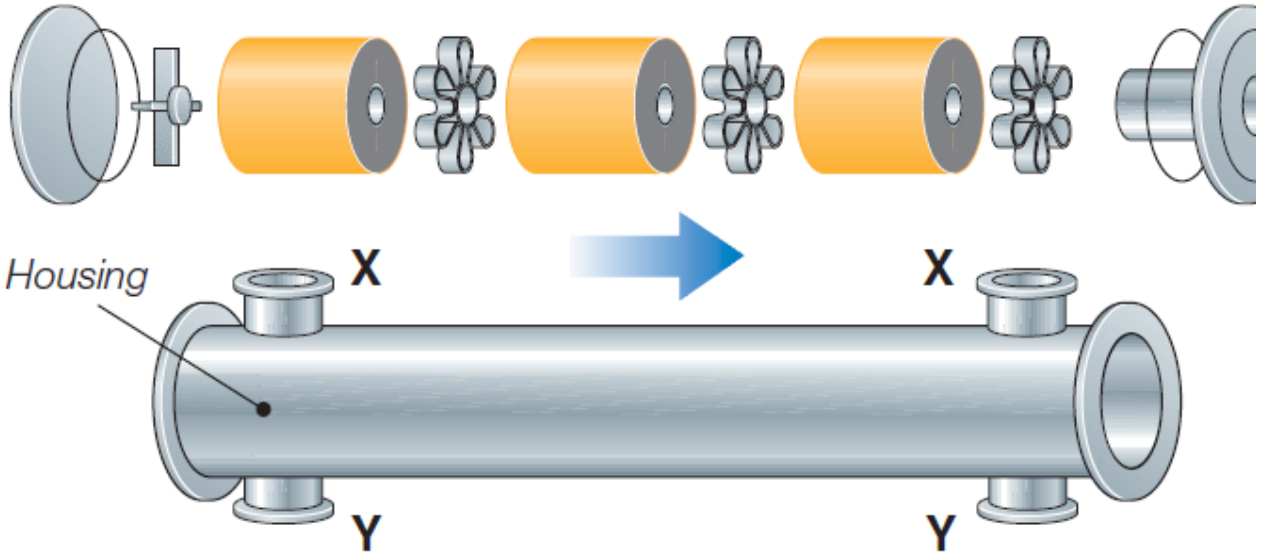
Membrane Plant Configuration



Membrane elements installed into stainless steel pressure vessels

Joined together in series (1 to 5 elements per housing)

Held in place with ATDs (Anti-Telescoping Devices)

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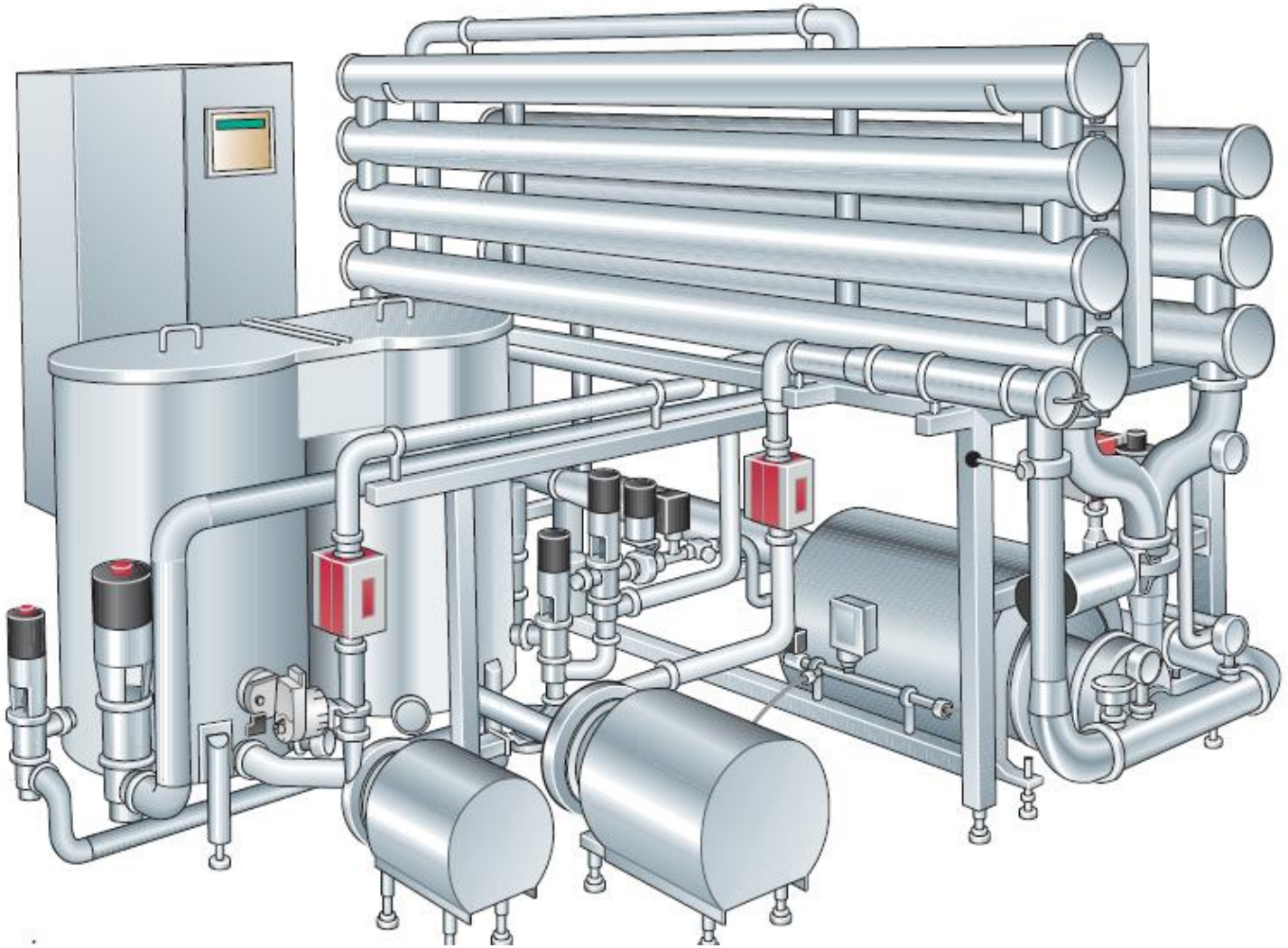
Membrane Plant – typical layout



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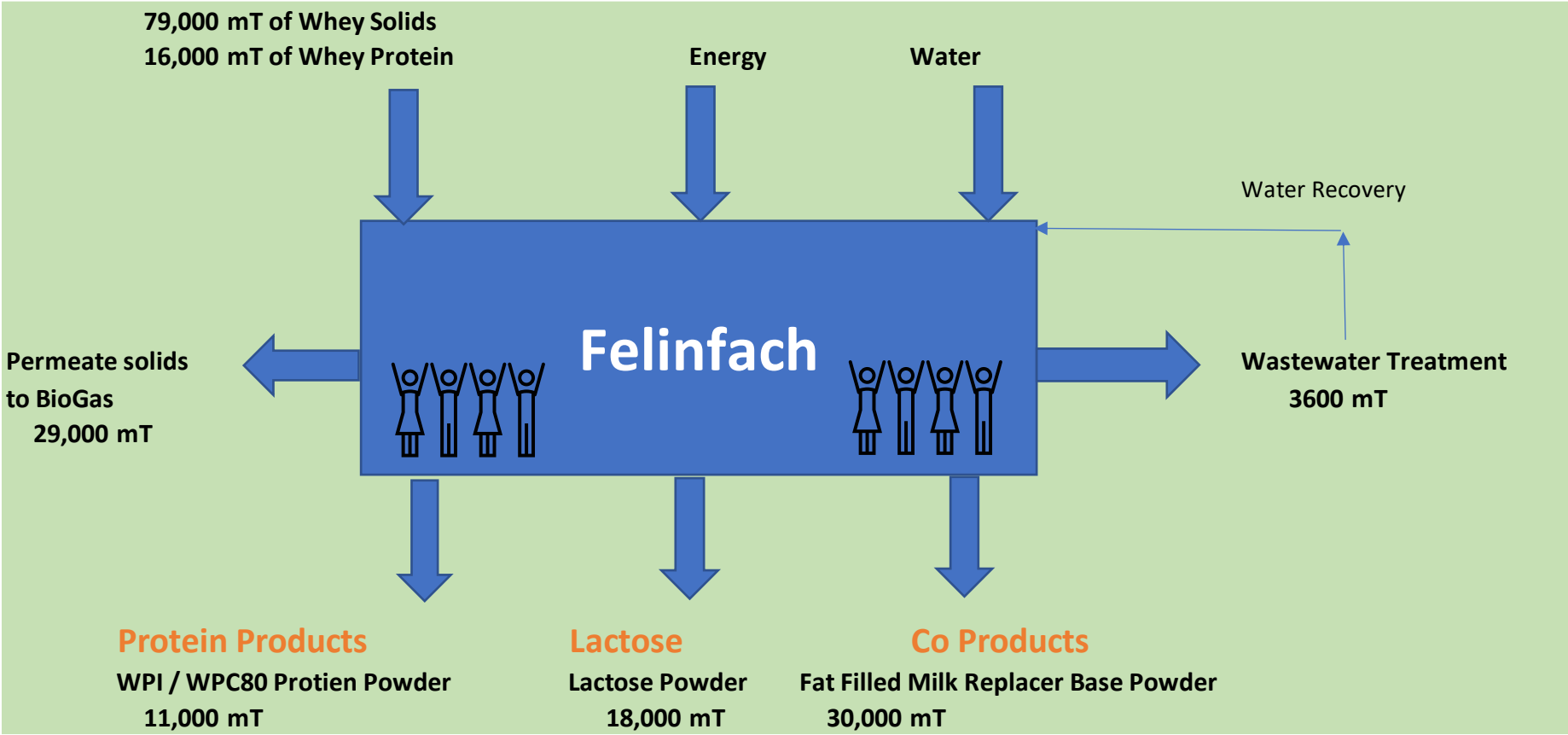
AFI Felinfach Factory Balance

AFI Felinfach Mass/Energy Balance



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Common Problems & Modes of Failure

Membrane Problems & Failures

Blistering (in glue line)	Membrane Adhesion / Delamination	Glue Adhesion	Creasing
Telescoping	Smiling	Irreversible Fouling	Permeate tube damage / cracking

Membrane Problems & Failures

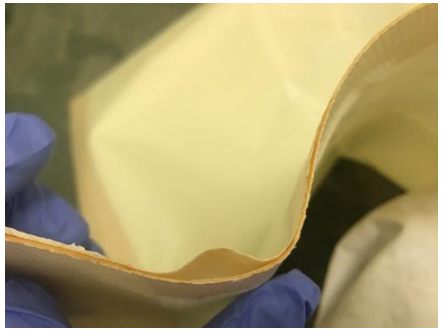
Blistering

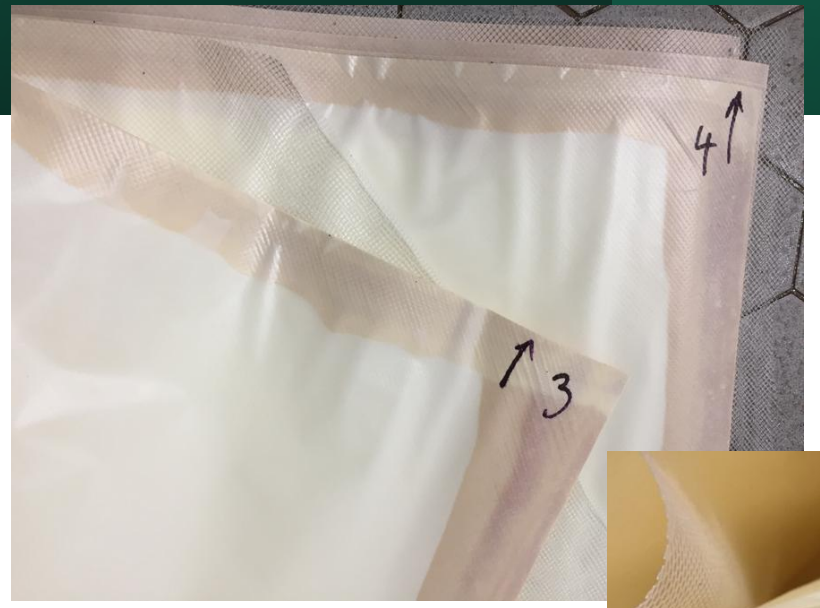
Membrane Problems & Failures

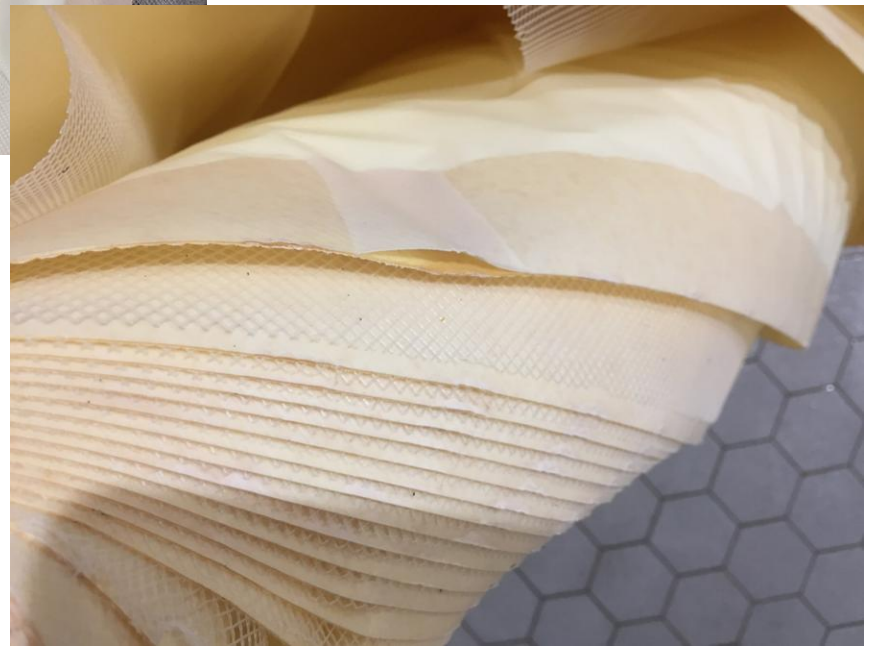
Membrane Adhesion / Delamination

Membrane Problems & Failures

Glue Adhesion







Membrane Problems & Failures

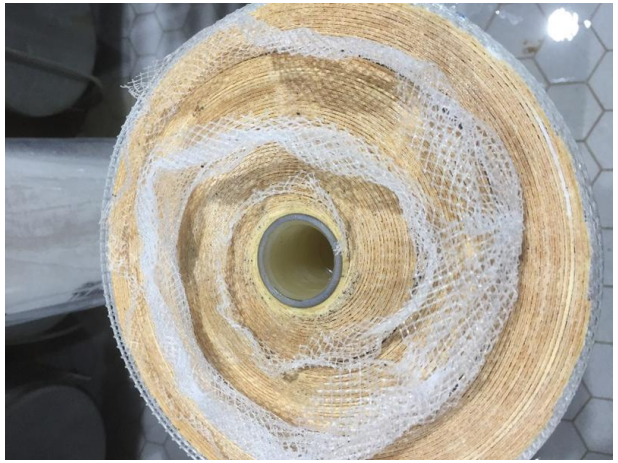
Creasing

Membrane Problems & Failures

Telescoping

Membrane Problems & Failures

Smiling

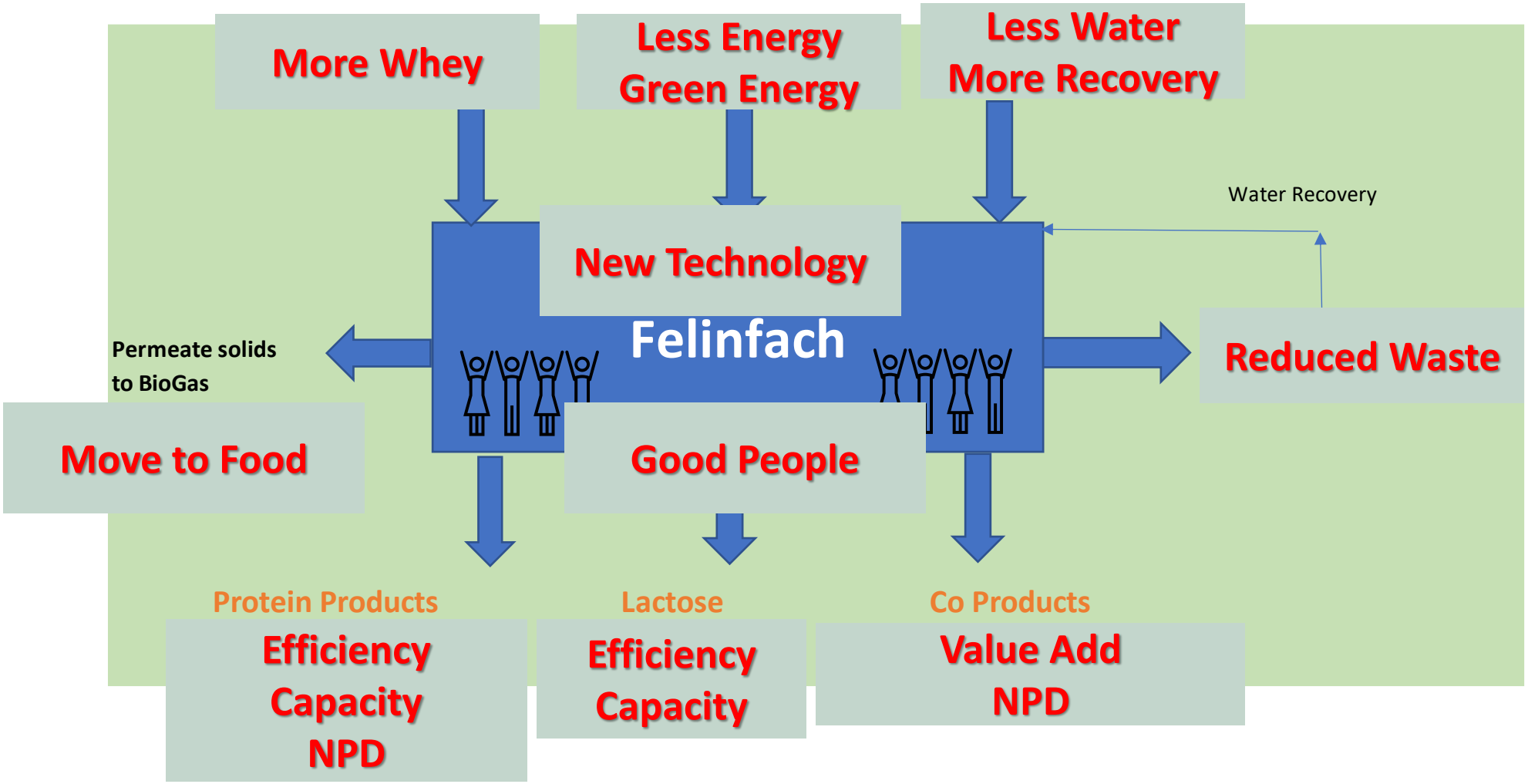


Membrane Problems & Failures

Extreme Fouling…

Opportunities

AFI Felinfach Opportunities



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What we've discussed

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Thank You

Any Questions?