
CLEANING OF MEMBRANES

A SPECIAL CHALLENGE REQUIRING SPECIAL SOLUTIONS

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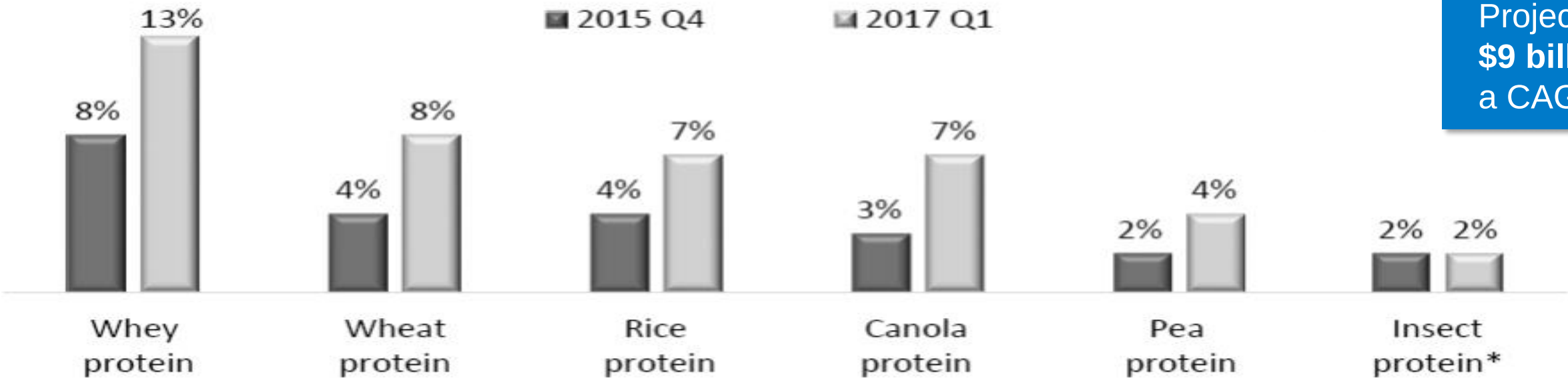
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Whey is a Major Source of Protein

Percentage of Survey Respondents Who Used Protein Sources in Past 6 Months

Global whey protein market was valued at \$6 billion in 2016;

Projected to reach \$9 billion by 2022 - a CAGR of 7.6%



Steve French, Managing Partner & Owner, Natural Marketing Institute

*2016 Q2 – 2017 Q1

Market requirements and Business Drivers

TRENDS

- **Consumer tastes are changing:** *healthier eating*, food with functional ingredients
- **Food safety:** consumer demand for *ingredient, manufacturing and label transparency* is driving increased need for processors to ensure *quality assurance*

OPPORTUNITIES

- **Dairy proteins** have nutritional and functional **advantages** compared to other protein sources*
- **Demand** is driven by the need for **recombined products, fortification, and nutrition** for infants and sensitive groups*
- Whey powders will remain the **leading dairy ingredient category** in years to come*

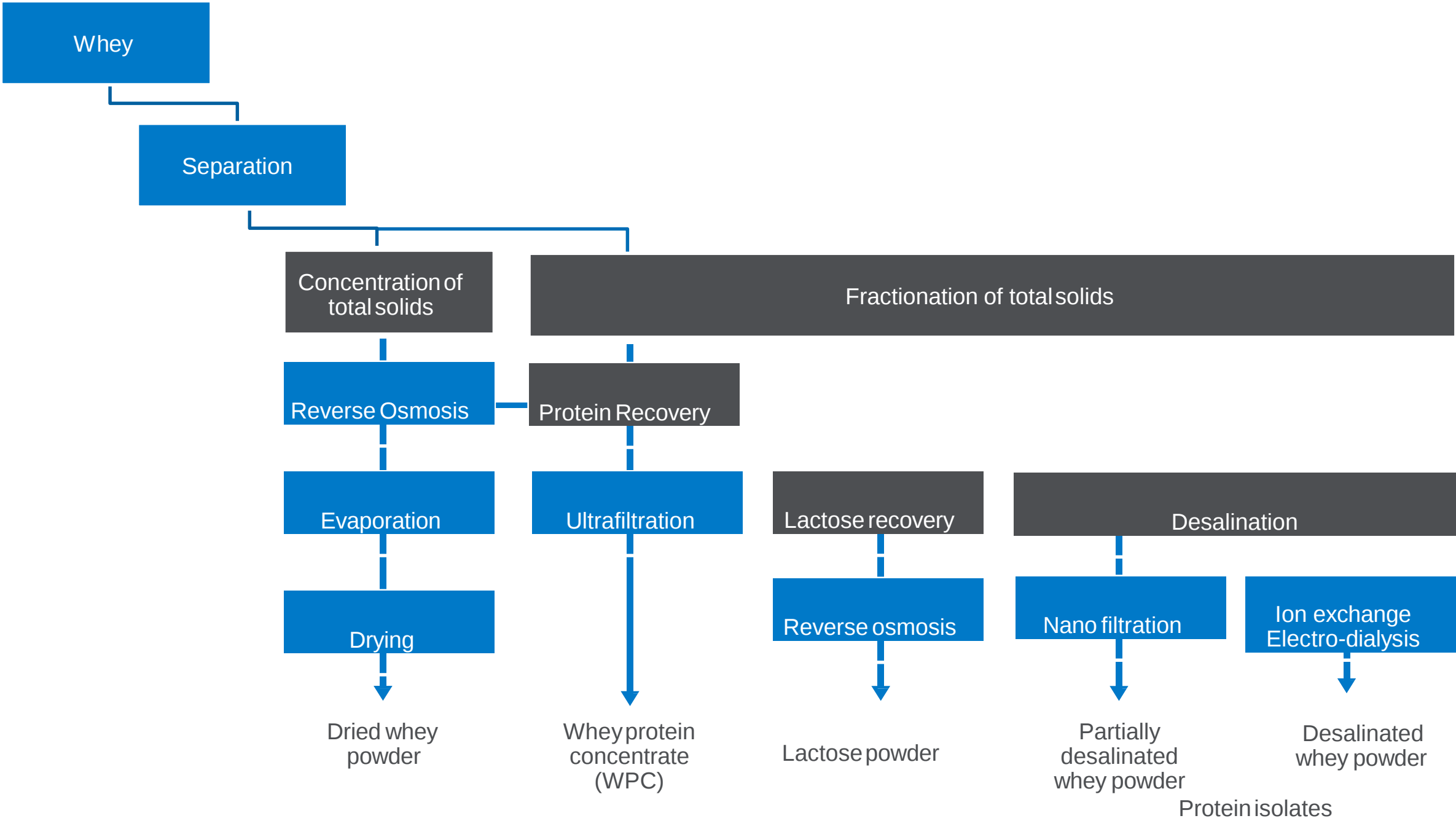
QUALITY

- Producing **high-quality** dairy products
- Residue-control, **effective rinsing**
- **Hygienic production**
Micro counts, Pathogens, Spore counts

PRODUCTIVITY

- Enhance **capacity** and CIP **efficiency**
- Optimize **membrane performance**
- **Reduce operational costs** (water, energy, chemicals & labor)

Whey processing requires membrane operations



Product	Conc. Factor (wet-dry)
Whey	20
WPC 35	58
WPC 65	108
WPC 80	133
WPC 90	156
Lact-albumine	310

Critical Plant Metrics

For Producers Using Membranes



**EFFECTIVE
REMOVAL**
of soils and
**RESIDUE
CONTROL**



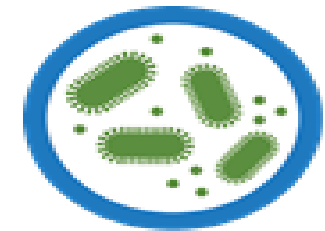
PRODUCTION CAPACITY
related to membrane
capacity and length of CIP
cycles



MEMBRANE LIFETIME;
protecting asset
investments



Ability to effectively
manage **COST OF
CHEMISTRY**



UTILITY EXPENSES
related to water, thermal
electrical energy

Membrane Cleaning Challenges

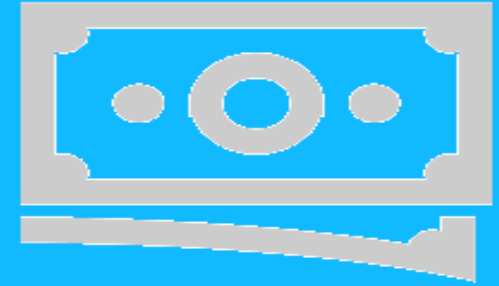
Soils can be
hard to
remove and affect
productivity &
product quality



Additional cleaning and/or
rinsing to achieve desired
results shortens
production
time



Membrane
replacement is
expensive



Troubleshooting
issues can be
difficult



Inconsistent quality puts
contracts &
brand at risk



Multi-step
cleaning
process can be
complicated



One Page about Ultrasil™ MembraneCARE 2.0

Next-generation membrane cleaning program for dairy manufacturers producing premium-quality products. It consists of newly formulated acid, alkaline, and patent-pending enzyme cleaners that help customers:

- ▲ **Increase membrane capacity** up to 10%
- ▲ **Clean faster** with enhanced rinsing, reducing CIP cycle times up to 15%
- ▲ **Reduce water and energy consumption** up to 15%
- ▲ **Reduce chemical degradation of membrane**, extending asset life up to 10%
- ▲ **Reduce dependence on surfactants** through more effective enzyme cleaning
- ▲ **Reduce environmental impact**, as the cleaners are formulated without Chlorine, EDTA, Nitric Acid or Phosphoric Acid

Ultrasil™ MembraneCARE 2.0

Alkaline

Protein and carbohydrate removal

Removes tough soils, while boosting pretreatment effectiveness and preventing equipment surfaces from blackening

Acid

Mineral descaling

Supports Protein removal
Eliminates the buildup of minerals on surfaces

Enzyme

Protein breakdown

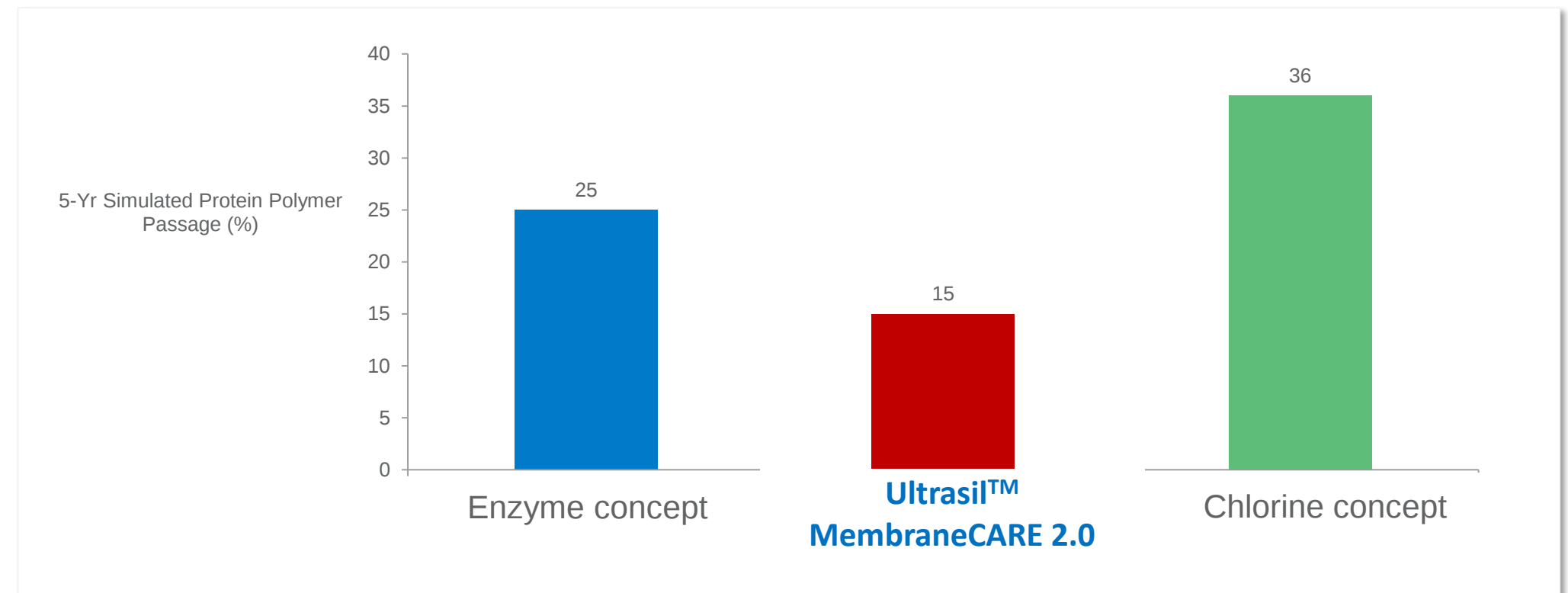
Active ingredient that penetrates soils, helping to break them up for better cleaning results

- PO₄-free, low P
- NO₃-free, low N
- EDTA-free
- Chlorine free
- No oxidizers
- Surfactant-free rinse water
- Low foaming
- Longer membrane lifetime through less chemical degradation

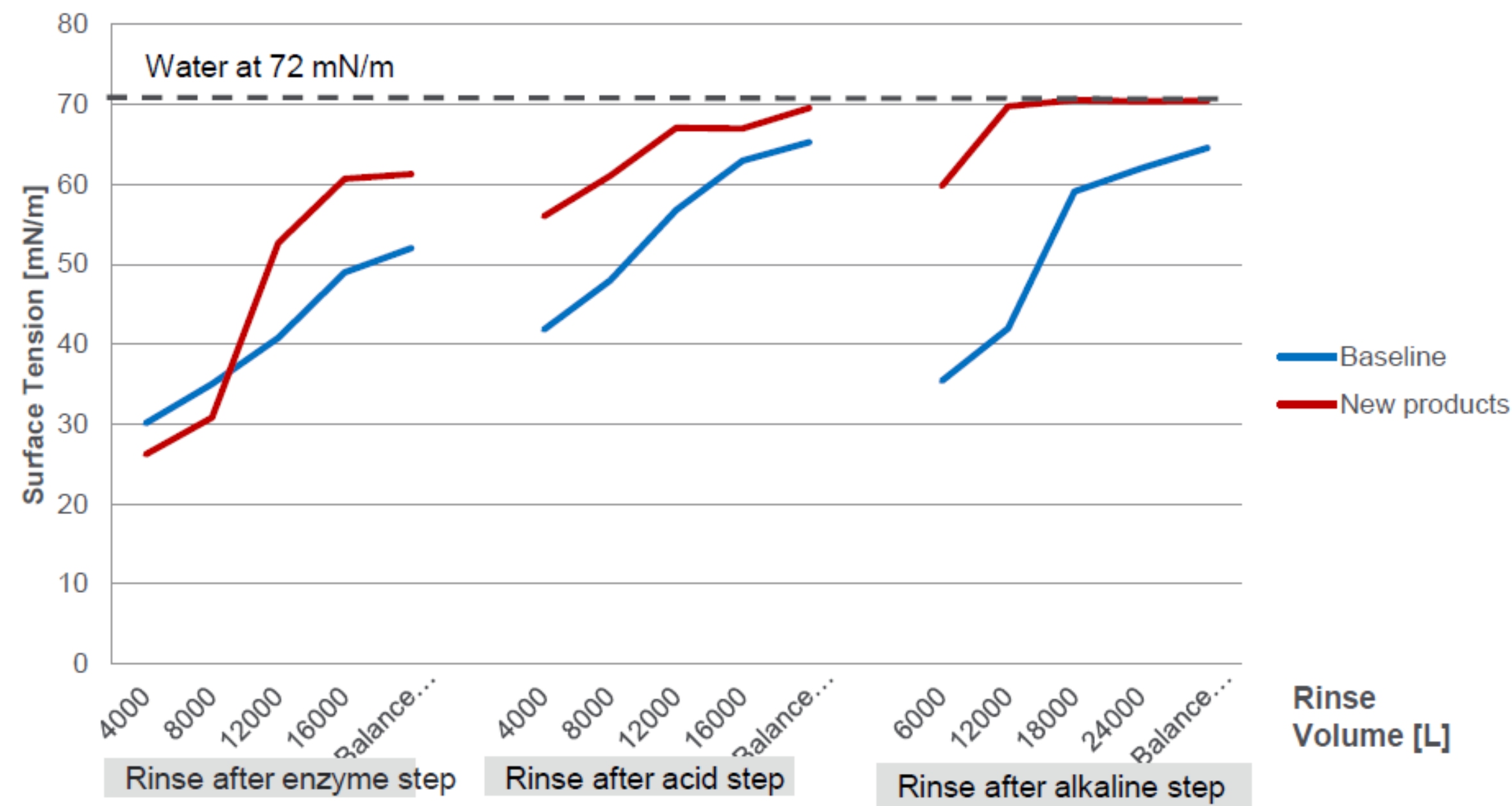
Membrane Life Extension

- Five-year simulated run using a polymer to mimic protein
- Realized a 40% to 60% performance improvement, in terms of protein passage
- Indicates the potential to extend life of membranes

Result show
average of 9
different UF
membranes



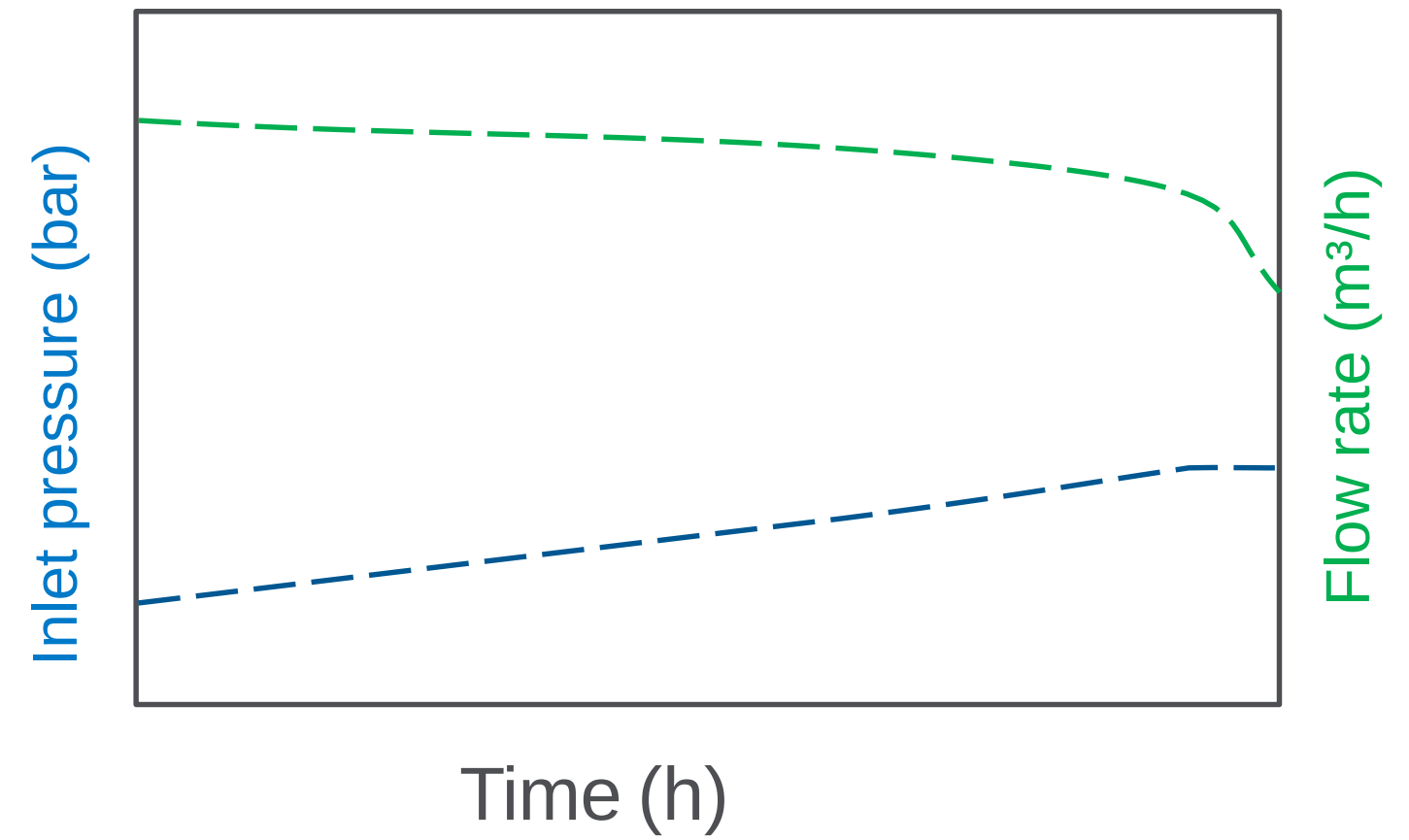
Rinsability in Membrane CIP



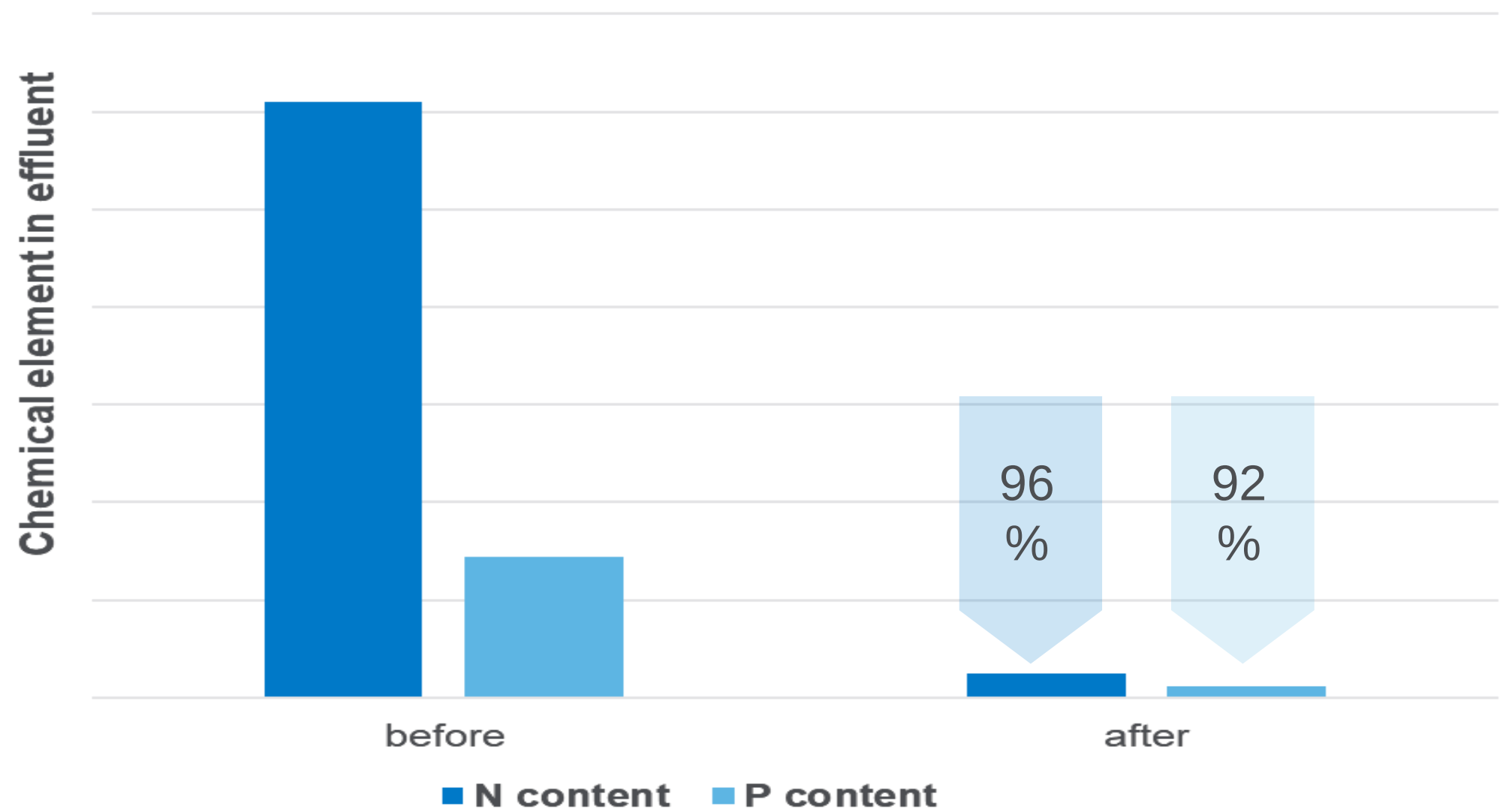
Individual results will be plant design dependent.

Productivity

- ▲ Ultrafiltration of whey is the bottleneck process
- ▲ Characterized as variable pressure crossflow filtration
- ▲ Optimize CIP downtime
- ▲ Optimize Throughput
 - Substrate filterability
 - Flow rate
 - Temperature
 - Concentration factors
 - Optimized Membrane permeability

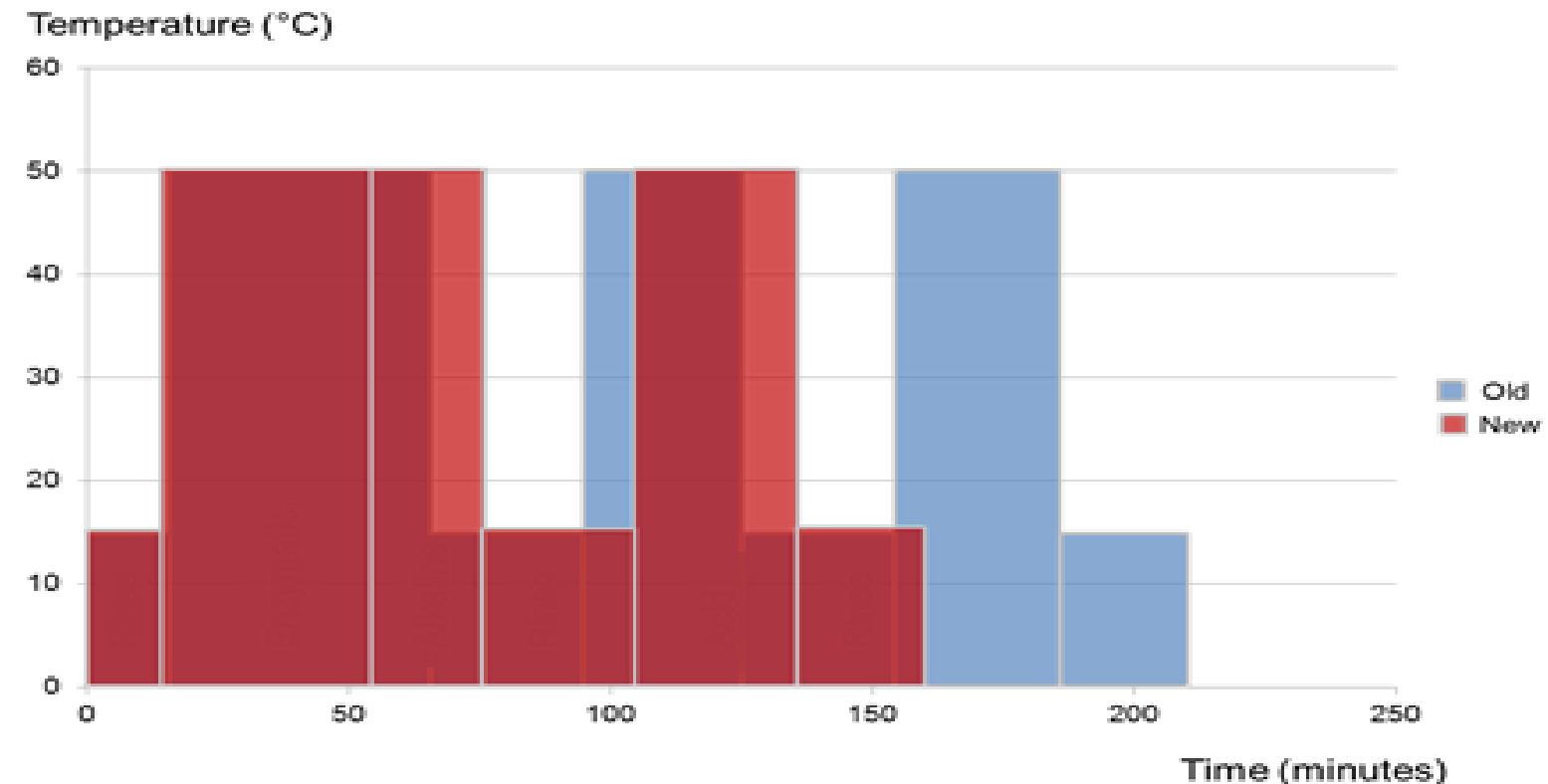


Overall Environmental Impact

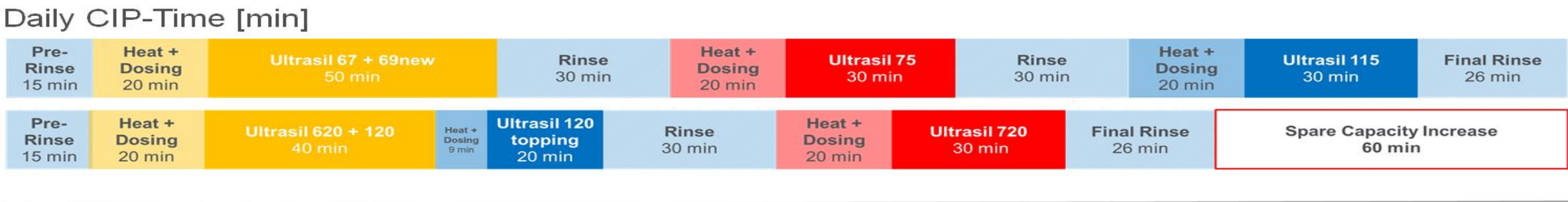


Case 1: CIP downtime optimization

- UF Plant processes sweet whey to WPC 35
- Plant processes 7 batches per week
- The CIP regime could be reduced by 22% and offers now a 60 min shorter CIP cycle
- Short CIP and less rinse offers additional savings in water and electrical energy consumptions

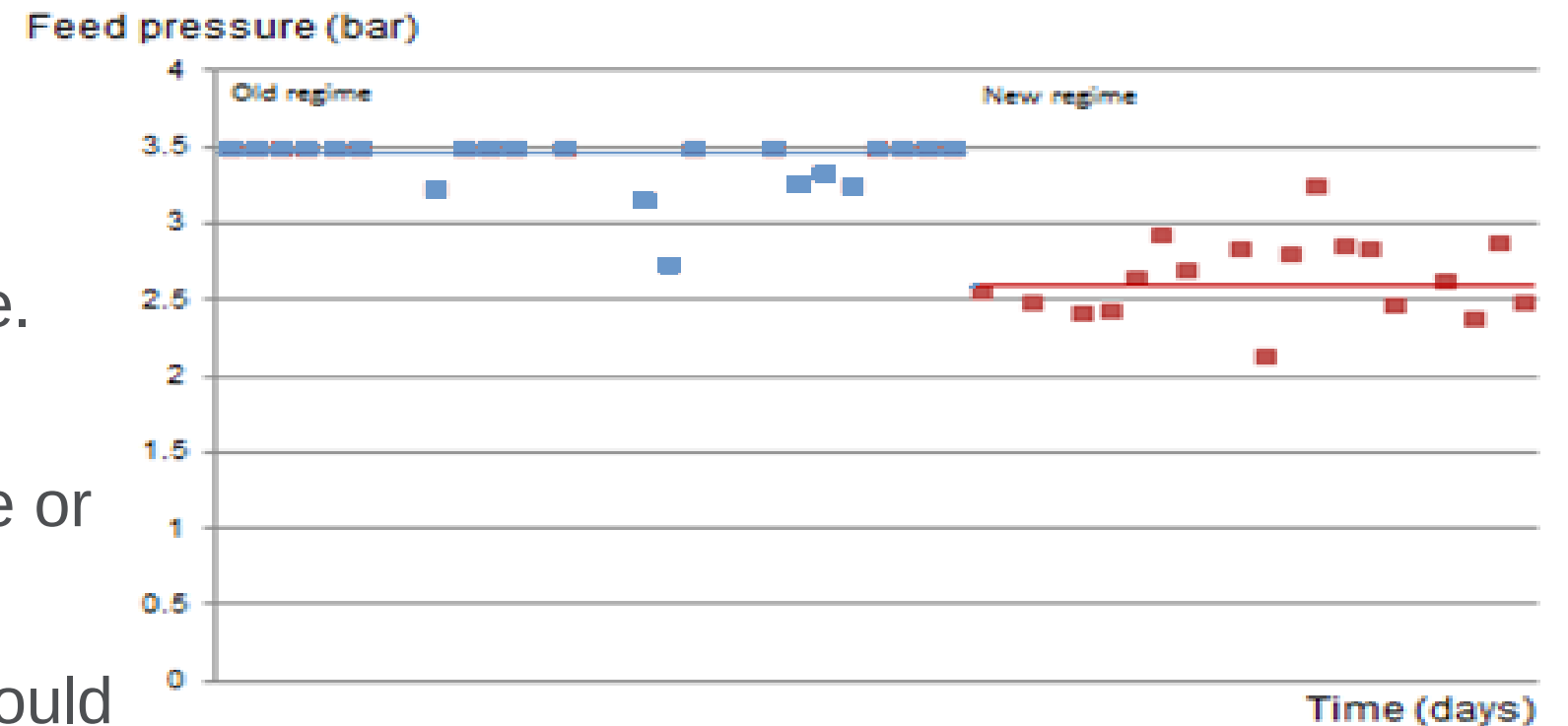


The CIP regime was updated to the new regime using UMC 2.0



Case 2: Optimization of Permeability

- ▲ UF sweet whey processing plant producing WPC 80.
- ▲ Effective removal of fouling layers improved permeability thus reduces differential pressure.
- ▲ Reduced pressure build up on UF line provides additional processing time or option to increase flow rate.
- ▲ In this case, plant extended processing and could process 8% more.



Feed pressure after 4 hours before and after optimization (incl average line) with UMC 2.0

Case 3: Foaming Behaviour

- ▲ Concentration of surplus whey in an RO plant
- ▲ High foaming was observed in the draining system after the enzymatic CIP step in the old cleaning regime.
- ▲ With Ultrasil MembraneCARE 2.0 almost no foam was observed in the drains
- ▲ EDTA in two cleaning steps could be omitted.
S



Previous Cleaning Regime



Ultrasil MembraneCARE 2.0

Conclusion

- ▲ The new generation of cleaning compounds helps to improve productivity in whey processing plants
- ▲ The new solution improves Rinsability
- ▲ Expert assessment of the situation and understanding on Customer business drivers is essential to optimize in the right direction
- ▲ Successful implementation requires a partnership approach