Who is Lyras?

Lyras is a Danish company located in Aalborg, Denmark. The company was founded in 2017 based on several years of rigorous research and development. Lyras was founded on an ambition to prove that microbial inactivation in milk could be done efficiently using UV-light instead of pasteurization.

Our goal is to: accelerate the global reduction of CO_2 emissions within the processing industry

Todays agenda

01 **What is raslysation?**

02 **Optimizing raslysation for whey**

03 **Whey trials at production facility**
Microbiology and protein structure

04 **Native whey proteins**

05 **Going further**

01 | What is raslysation?

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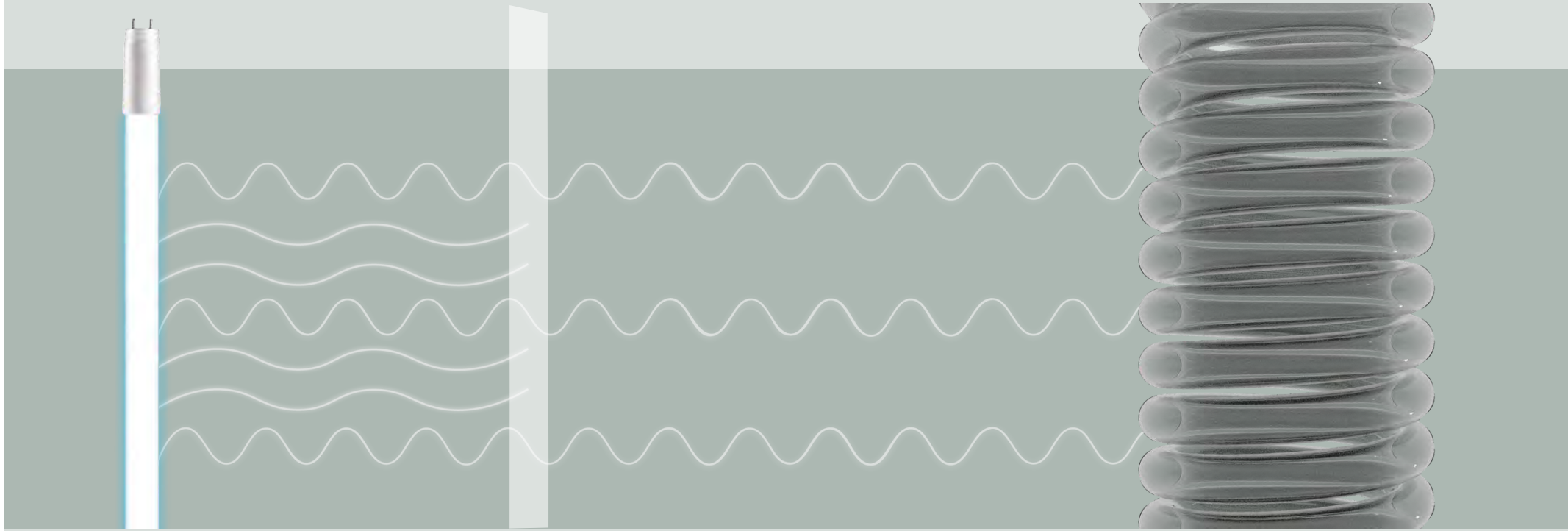
WHAT IS RASLYSATION?

Raslysation is a sustainable alternative to conventional pasteurization. By using UV-light instead of heat the technology will efficiently disinfecting liquids and drastically lower energy use.



GERMICIDAL UV-C LAMP

FILTER

COIL

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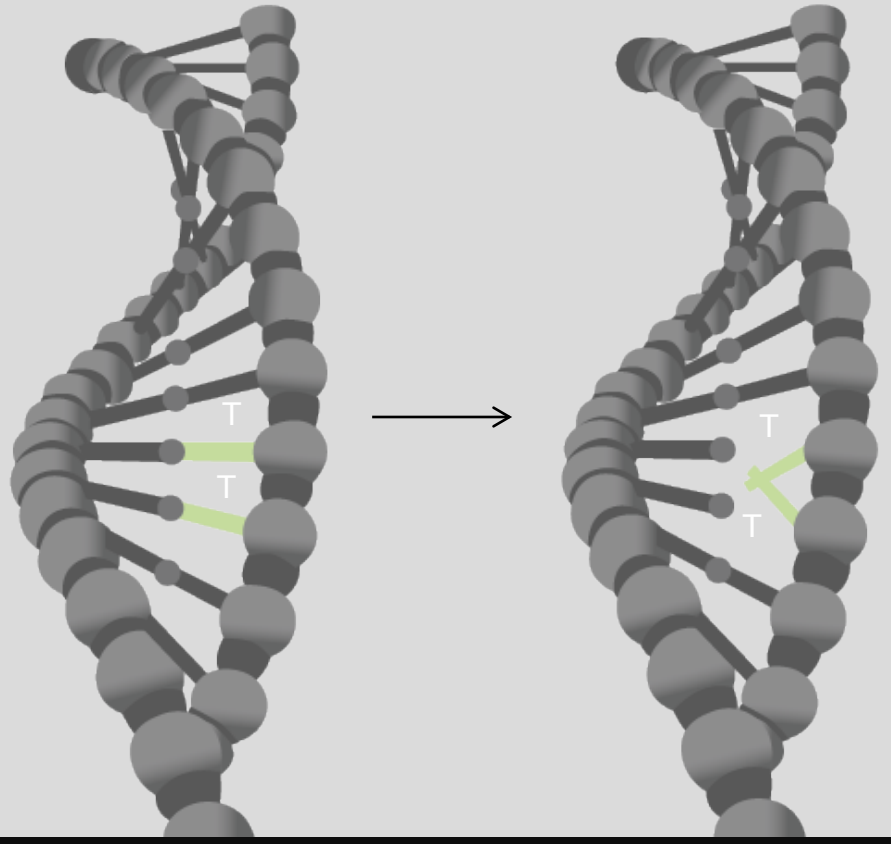
WHAT IS RASLYSATION?

Inactivation of microorganisms

DNA STRUCTURE
BEFORE

DNA STRUCTURE
AFTER UV-light



Cross-linkage between two pyrimidine bases

Alters metabolism and replication

Thereby causing cell death

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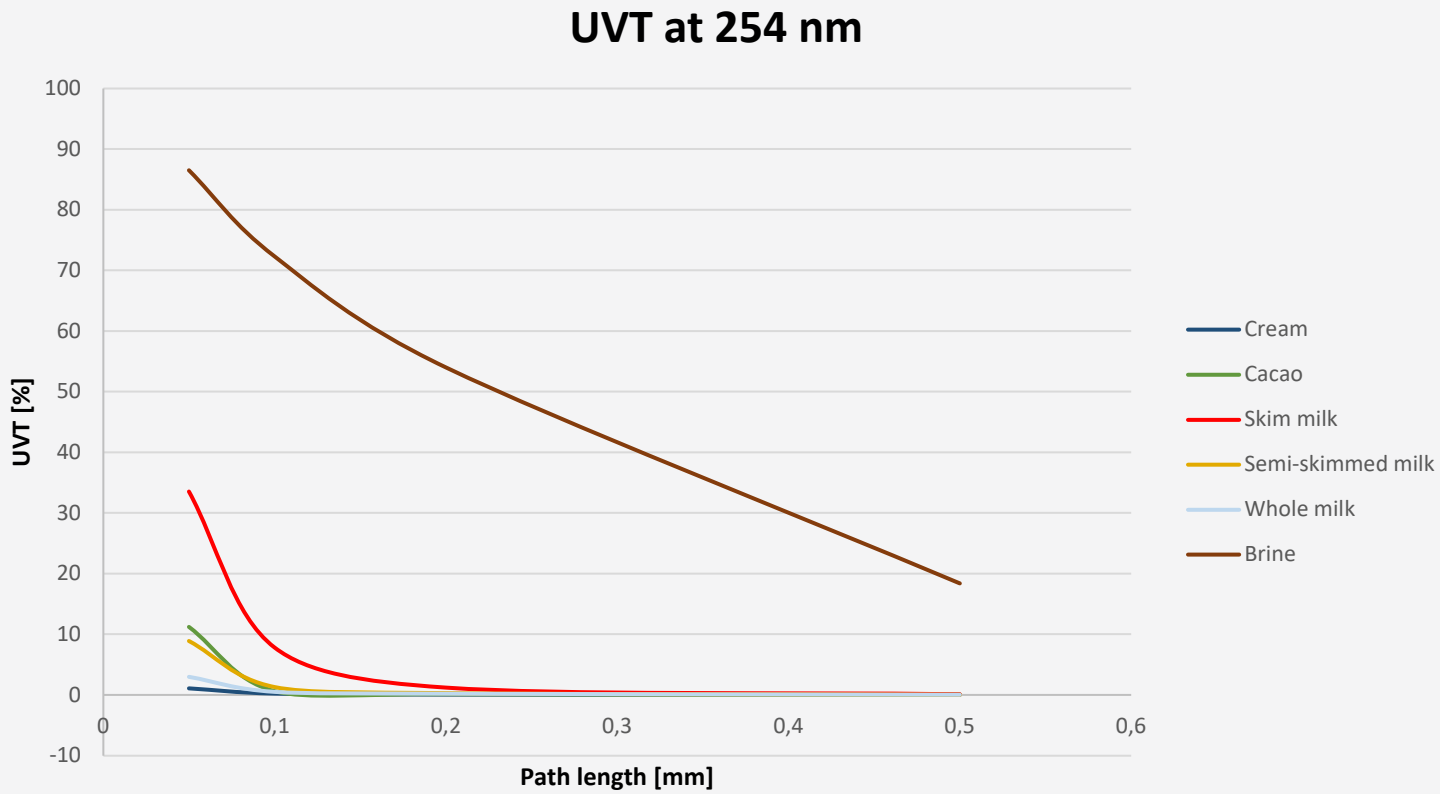
WHAT IS RASLYSATION?

UVT is an important factor in ensuring the right product treatment



02 | Optimizing raslysation for whey

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WHY IS IT INTERESTING TO LOOK AT WHEY TREATMENT?

- Traditionally heat treatment is used to control the microbiology
- Non thermal treatments are interesting in the production of high-quality whey products

HEAT TREATMENT: DRAWBACKS

- High energy and water consumption
- Changes to protein structure – denaturation and aggregation
- Maillard reactions
- Oxidation

RASLYSATION: ADVANTAGES

- Low energy and water consumption
- No thermal effects
- Mild treatment of whey proteins

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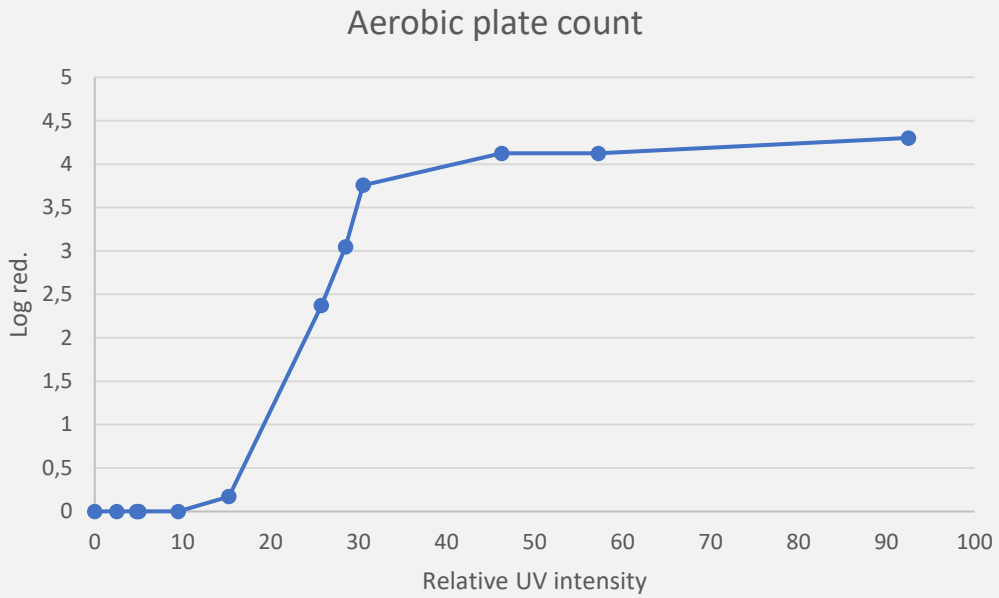
OPTIMIZING RASLYSATION FOR WHEY



Each microorganism will have a specific inactivation curve

03 | Whey trials at production facility

TRIALS AT PRODUCTION FACILITY

- Comparing raslysation and pasteurization of whey
  - Microbiological reductions
  - Effect on whey proteins – three-dimensional structure and photooxidation
- Compare raw whey from different milk treatments

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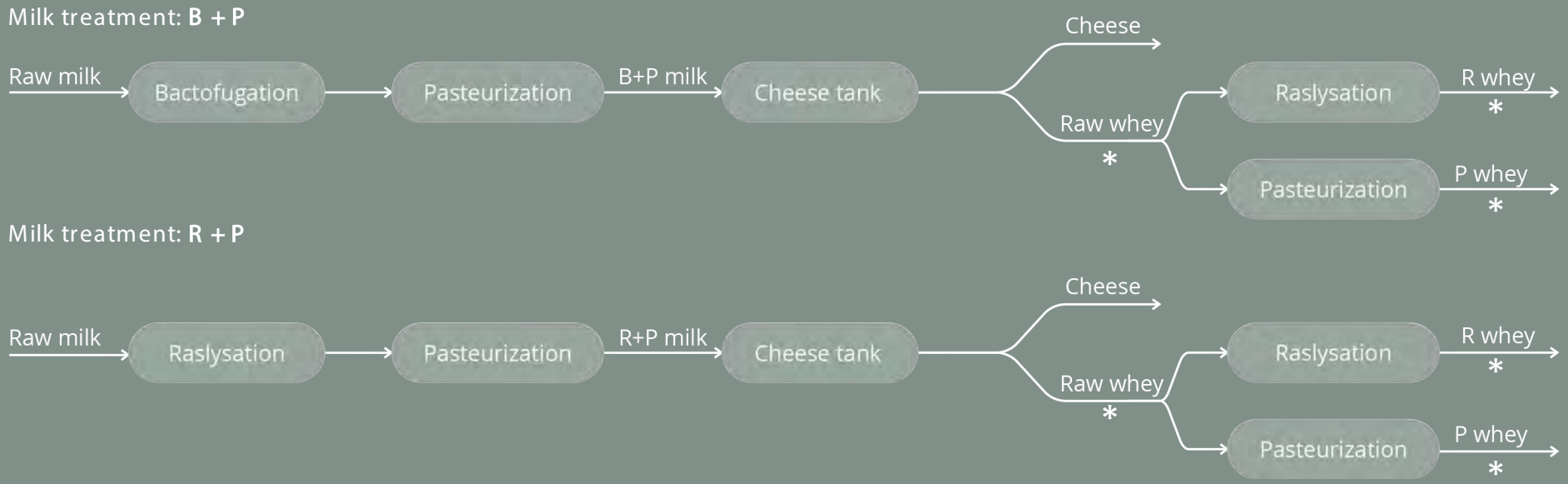
EXPERIMENTAL SETUP

*Triplicate sampling, 6 production days



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RESULTS: WHEY MICROBIOLOGY

Microbiological analyses	Raw CFU/mL	Pasteurized CFU/mL	Raslysed CFU/mL
Aerobic plate count	>300000	13	16
Coliforms	1549	<10	<10
Enterobacteriaceae	3684	<10	<10
Thermophilic Plate Count	248	<10	<10
Thermoduric	155	51	35
Yeast	19	<10	<10
Anaerobic Sulphite Reducing Bacteria	131	<10	<10

CONCLUSION: Only aerobic plate count and thermoduric show counts above detection limit → No statistical difference between UV and P.

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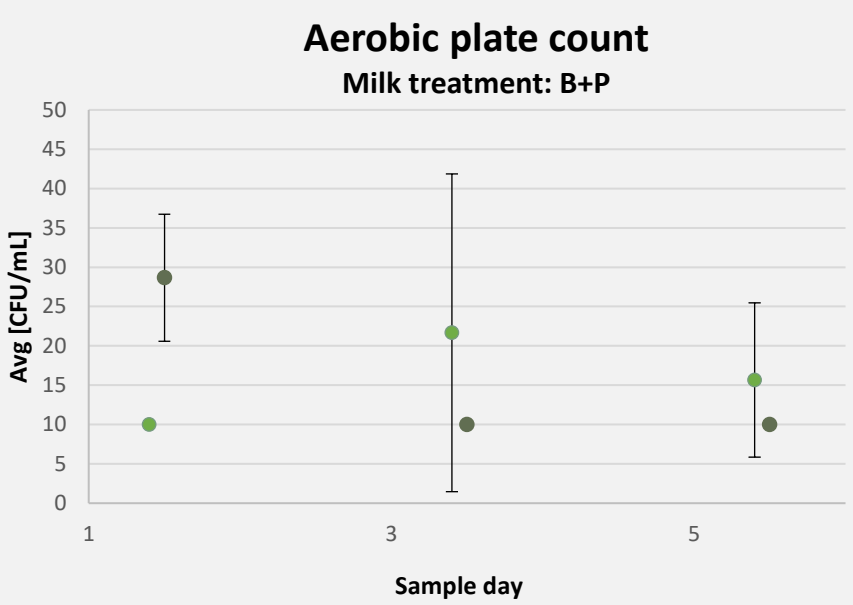
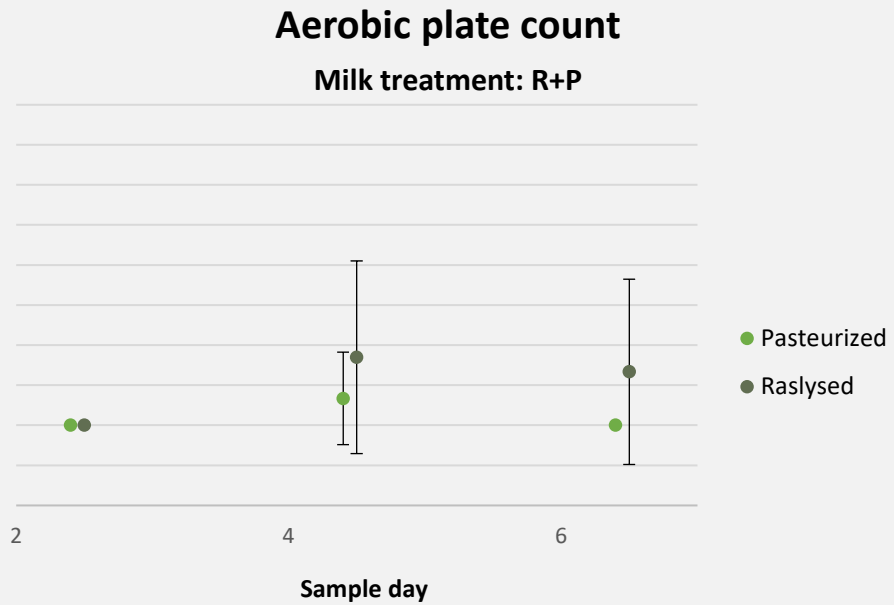
RESULTS: WHEY MICROBIOLOGY





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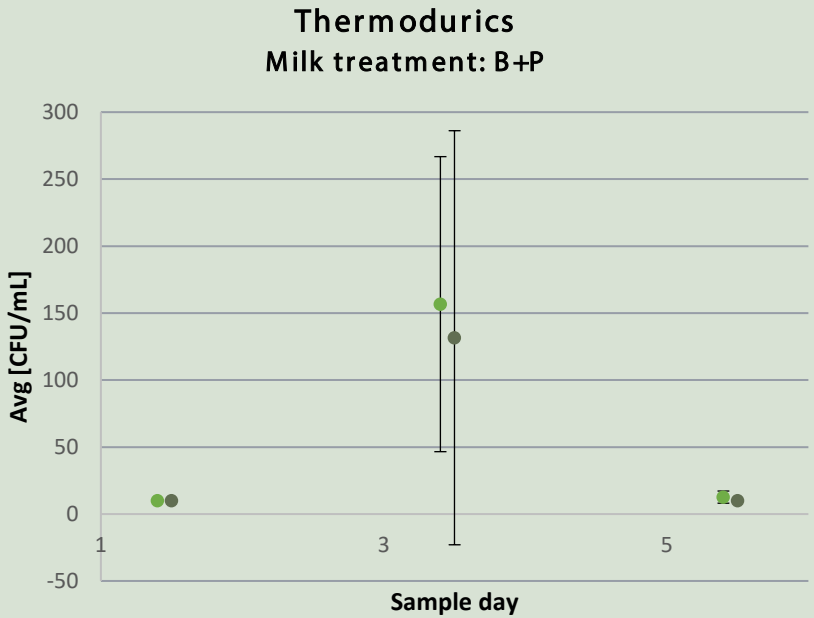
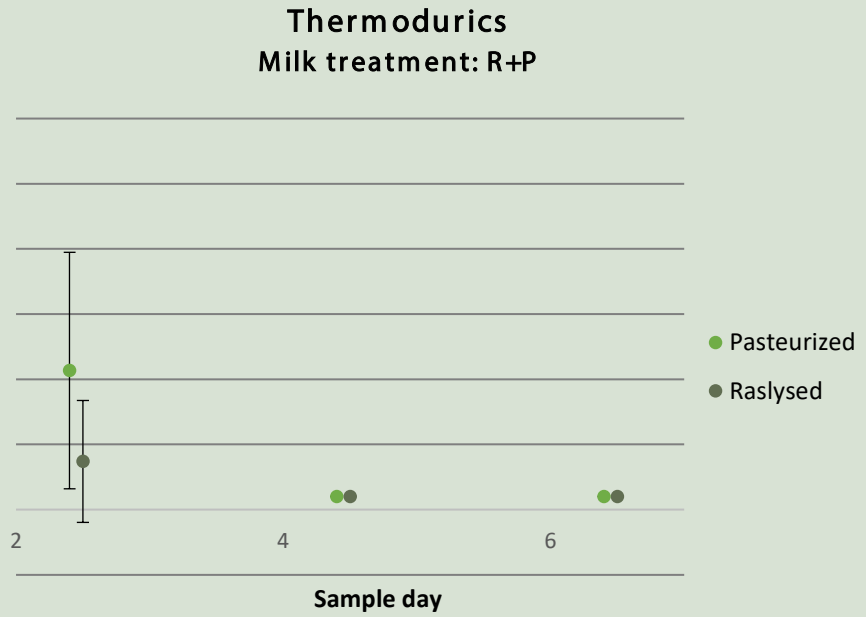
RESULTS: WHEY MICROBIOLOGY





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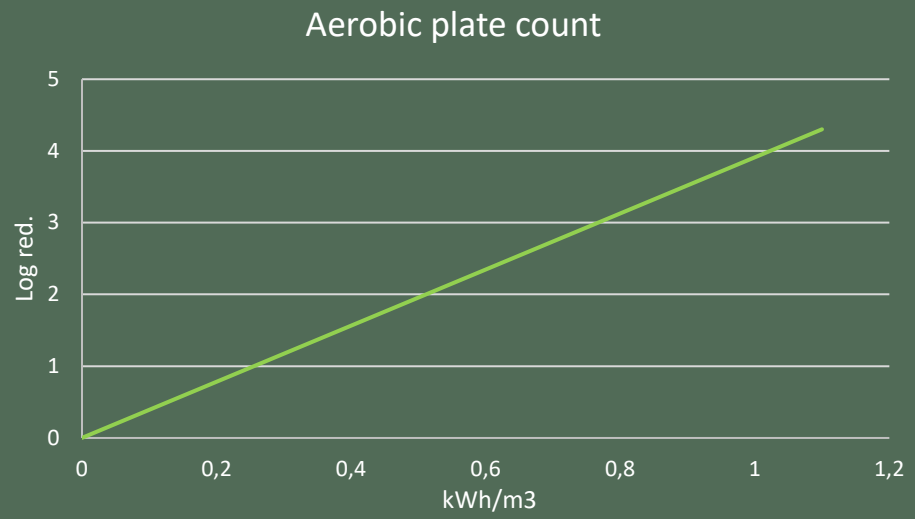
ENERGY CONSUMPTION: WHEY



Pasteurization
Assumed energy consumption of 10-12 kWh/m^3

Raslysation
Depending on the microbial reduction requirements, 1-3 kWh/m3

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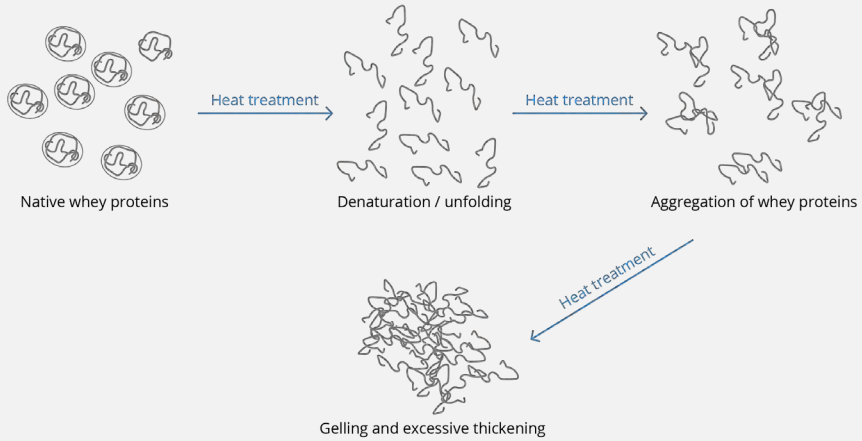
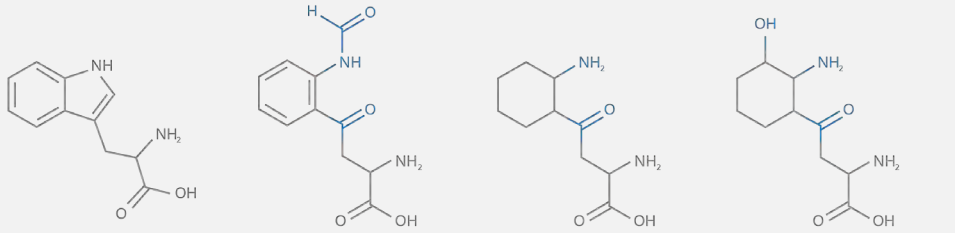
WHEY PROTEIN STRUCTURE

Denaturation/aggregation



(Patel and Patel, 2015)

Oxidation



(Hipper, 2022)

→ Change the nutritional, functional and biochemical properties

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WHEY PROTEIN STRUCTURE ANALYSED BY TECHNOLOGICAL INSTITUTE

Protein oxidation

- Mass spectrometry (LC-MS/MS) → identifying modified peptides
- Tryptophan fluorescence spectroscopy → measure loss of fluorescence due to oxidation
- Thiol quantification assay → thiol content

Protein aggregation/denaturation

- Protein solubility test → large aggregates
- Small-angle X-ray scattering (SAXS) → medium sized but soluble aggregates
- Gel filtration chromatography → soluble aggregates

WHEY PROTEIN STRUCTURE

Conclusion from technological institute

Collectively, none of the methods used in this assignment show consistent differences between pasteurized and UV-treated whey. Based on the present data, we are not able to show a significant difference between whey from bactofugated+pasteurized milk and whey from raslysed+pasteurized milk or between pasteurized and raslysed whey.

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CONCLUSION

- Based on the applied analyses there is **no difference between**
  - Whey from the two milk treatments
  - Raslysed whey and pasteurized whey

- No difference in
  - Microbial reductions
  - Oxidation
  - Aggregation

  → Milk has been pasteurized → whey already affected by heat

04 | Native whey proteins

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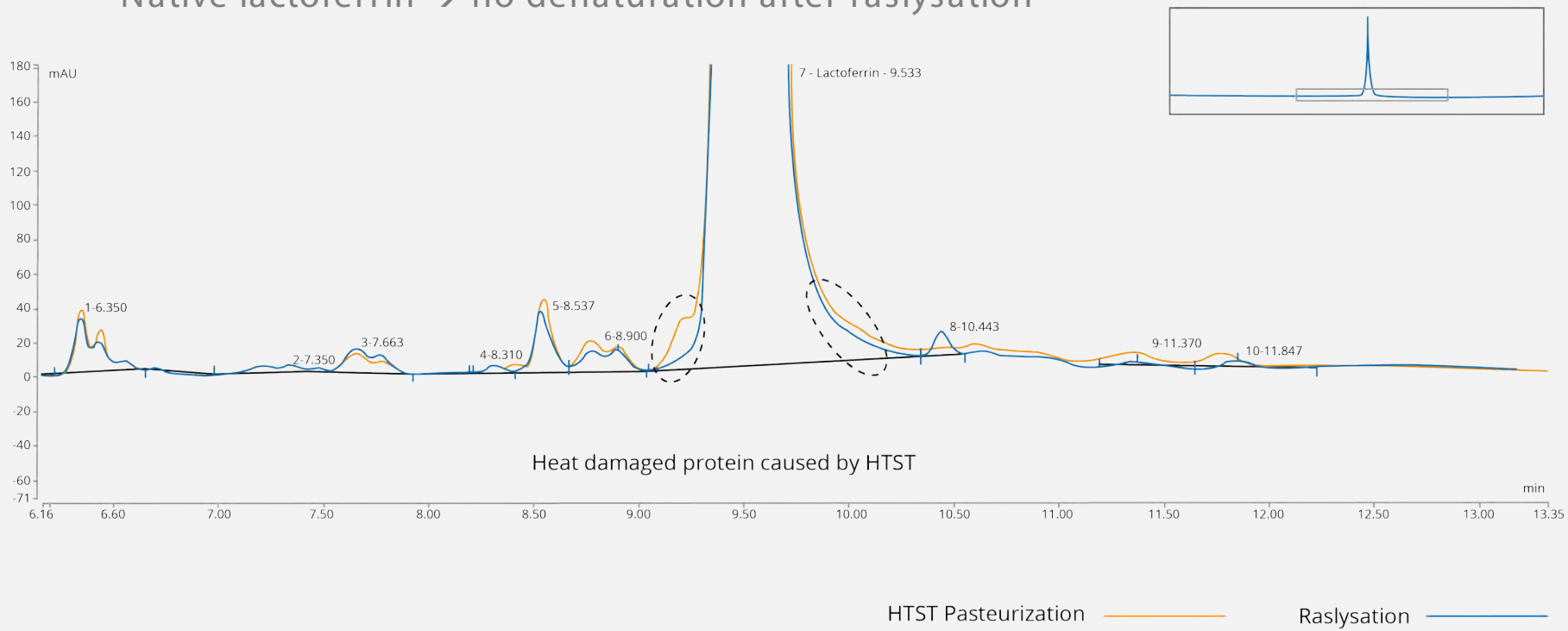
NATIVE WHEY PROTEINS

- Raslysation of heat sensitive whey proteins reduce the microbial content
- The proteins are preserved in the natural state without heat damage
- →improve bioavailability of the proteins

- Native lactoferrin → no denaturation after raslysation



05 | Going further

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