LYRAS A/S | 2021

UV technology and its effect on unwanted microorganisms

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Research Engineer

Company Description

At Lyras we develop and manufacture UV systems for the liquid food processing industry. Our innovative products provides a sustainable solution to the challenges solved by the conventional process technologies that are in use today.

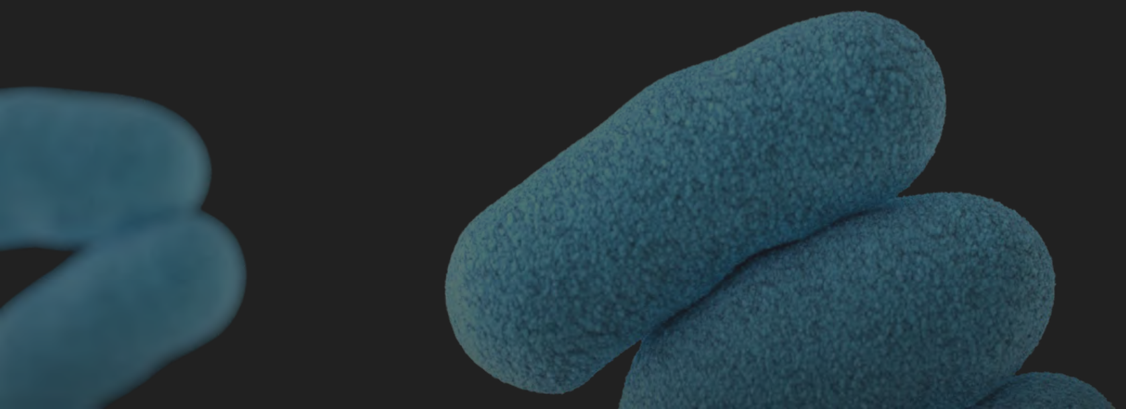
Our specialized Raslysation solutions are supported by:

- In-house R&D and production
- Specialized know-how within UV-light
- Immense testing and quality control of all shipped cold pasteurization solutions
- Unique and patented technology
- In-house lab facilities for testing of products

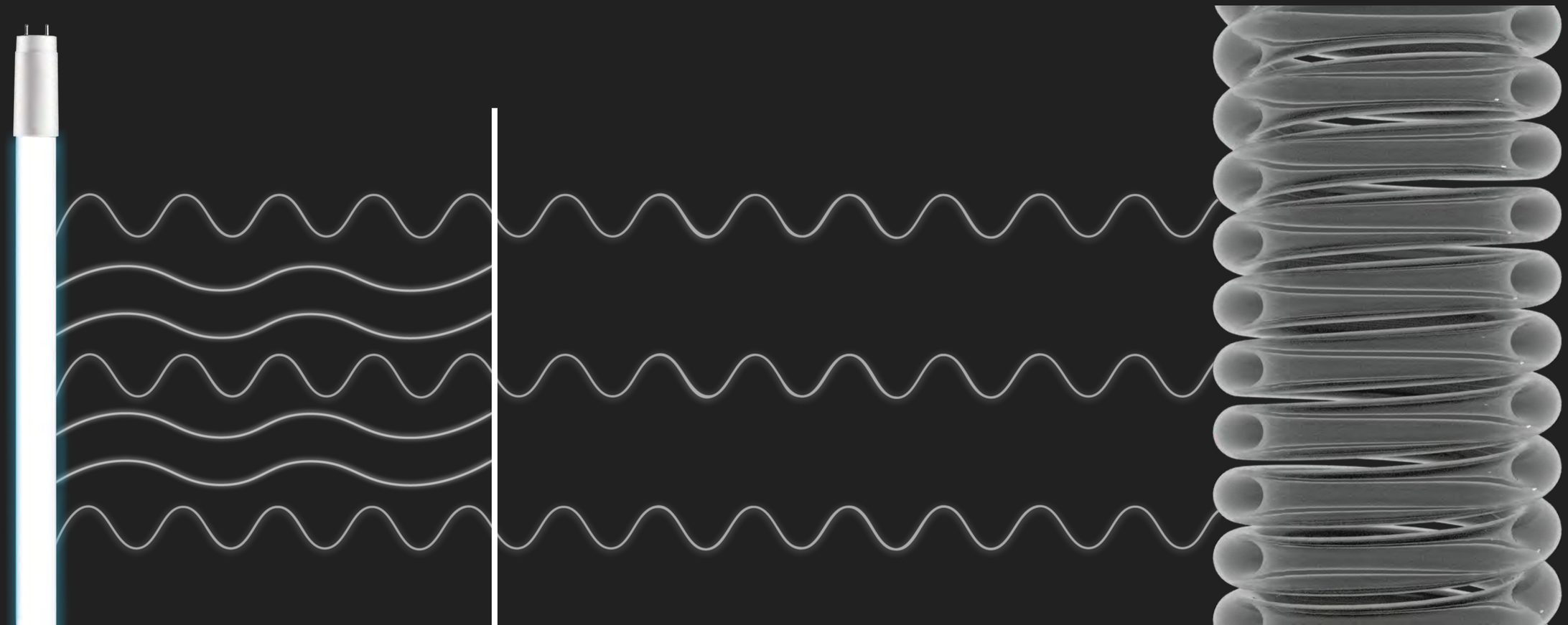
Todays Agenda

Presentation Outline

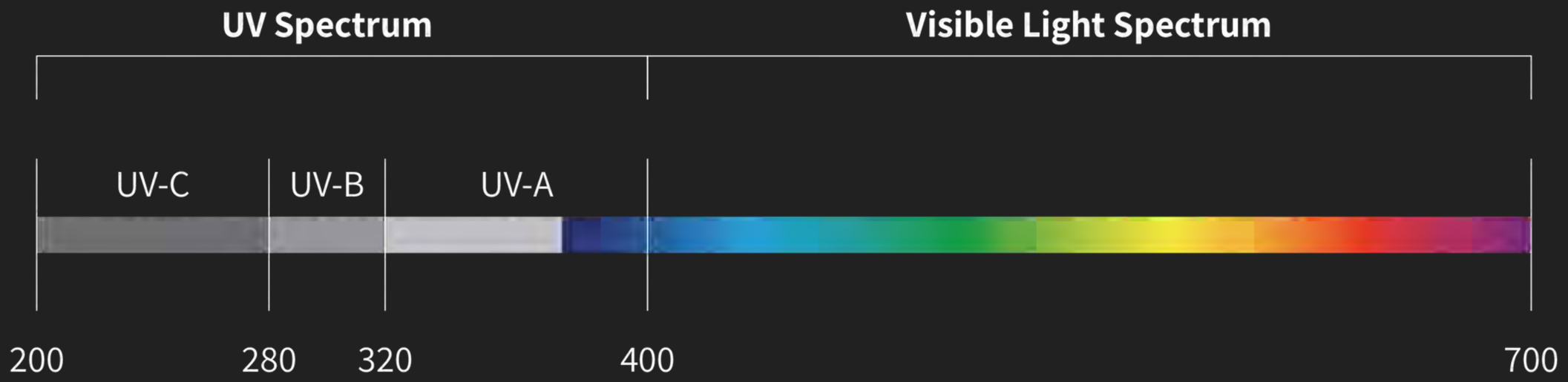
- The UV technology and the advantages
- Inactivation of microorganisms
- Factors influencing effectiveness
- Use cases and experimental data

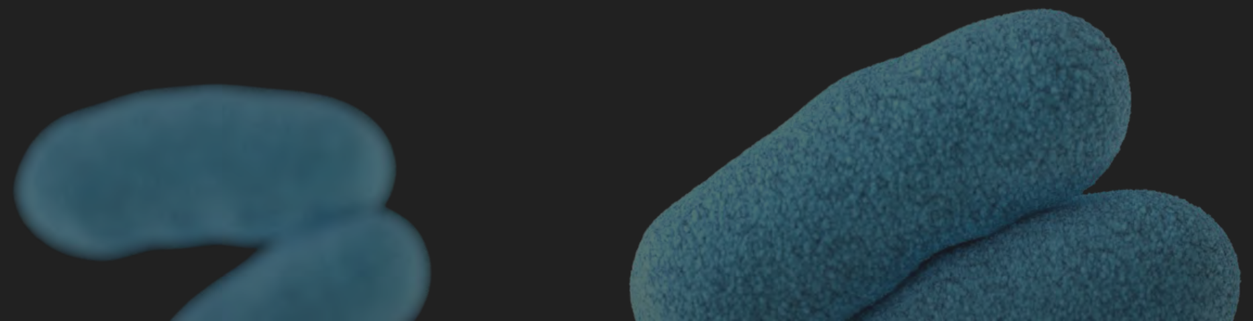


The Technology



The UV Technology



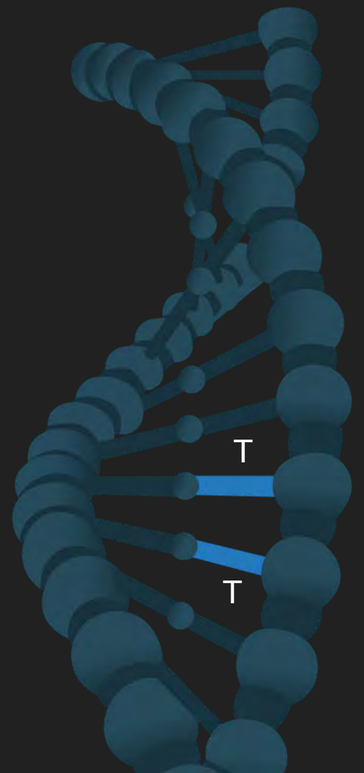


Production advantages

- Lowers the energy consumption by more than 90%
- Inactivates bacteria, fungi, spores and viruses in a single process
- Product quality – reduced thermal history
- Reduced CIP requirements – 60% less water.
- Reduction in process complexity
- Sustainable solution
- Simple plug and play solutions
- 7-14 seconds processing time

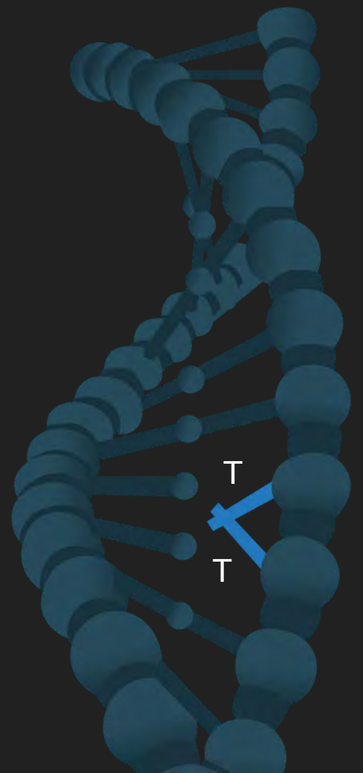
Inactivation of microorganisms

DNA STRUCTURE BEFORE



UV light

DNA STRUCTURE AFTER



Cross-linkage dimer pyrimidine

Altering metabolism and replication Causing cell death

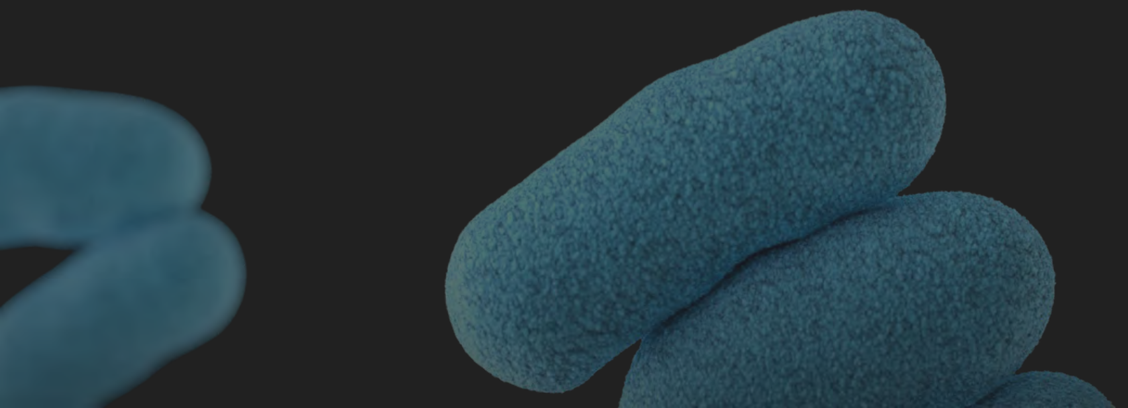
Inactivation of microorganisms

- The lethal UV dose is specific
- Microorganism characteristics

  Specie, strain, initial count, growth phase, and recovery conditions
- Gram-negative bacteria more vulnerable than Gram-positive bacteria
- Thin cell wall – easily killed

  Salmonella, E. coli
- Thick cell wall – 10 to 100 times as high UV dose

  Mold spores



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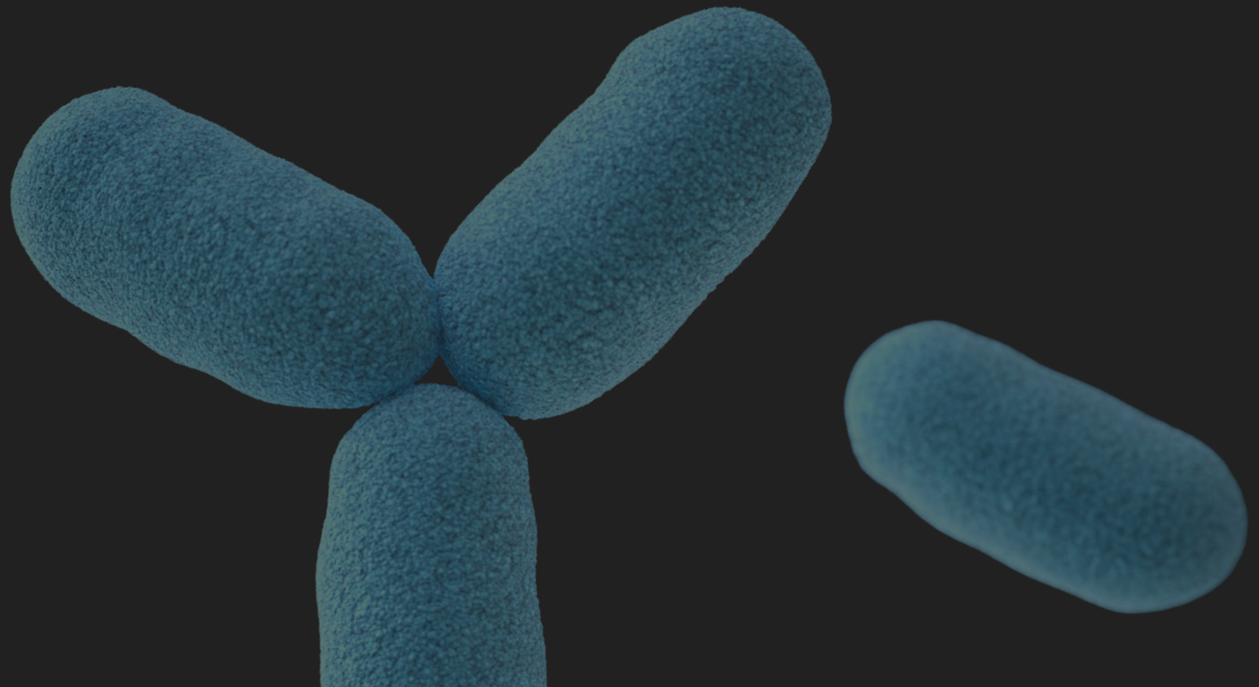
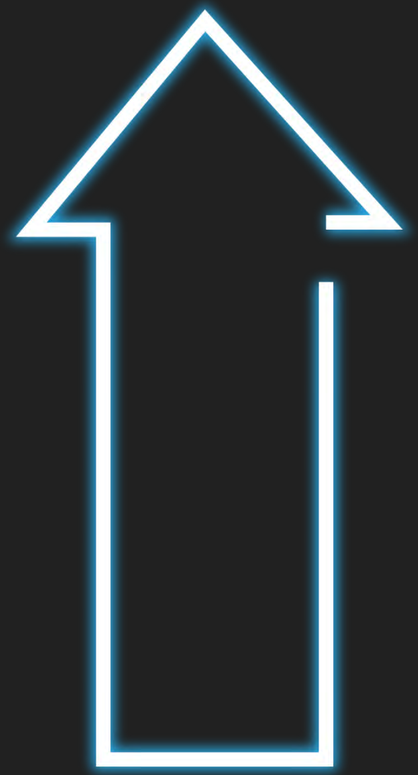
Inactivation of microorganisms





UV resistance

Fungal spores

Bacterial spores

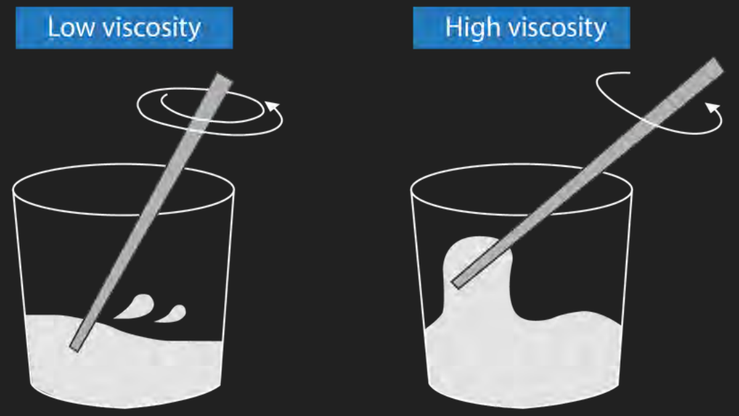
Vegetative bacteria

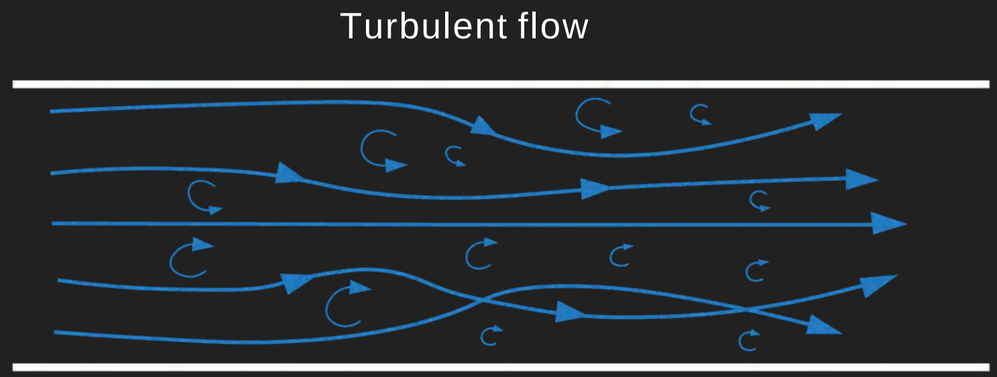
Virus

Factors influencing effectiveness

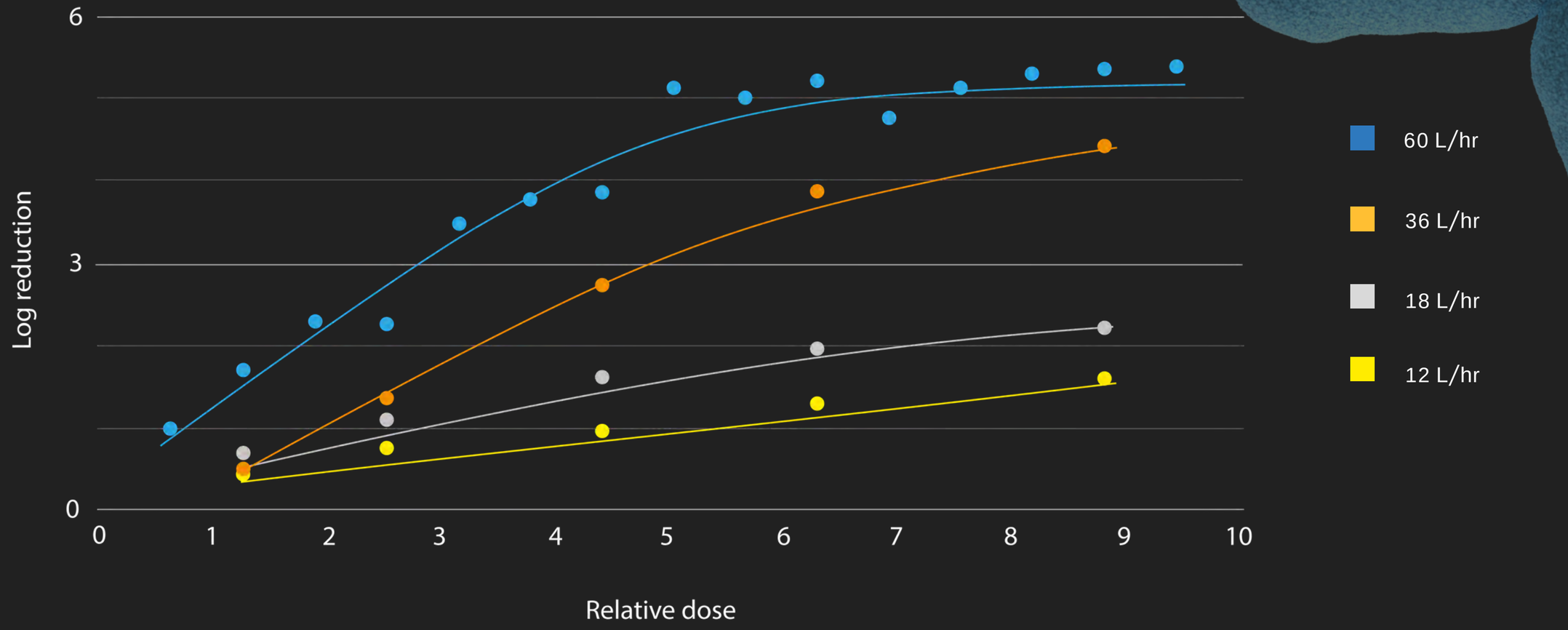
Flow pattern
- Coil size
- Coil length
- Viscosity

Product type
- Chemical composition
- Turbidity
- Viscosity

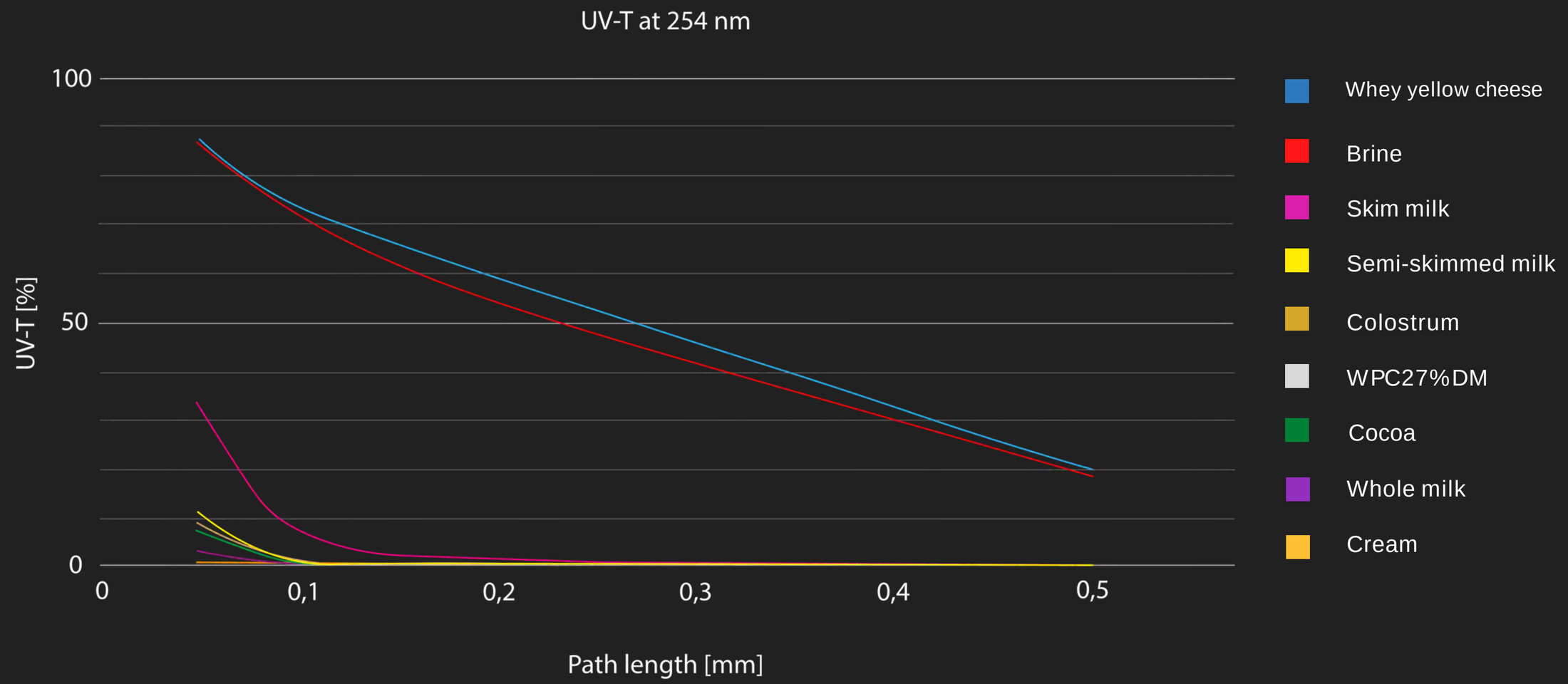




Factors influencing effectiveness Flow

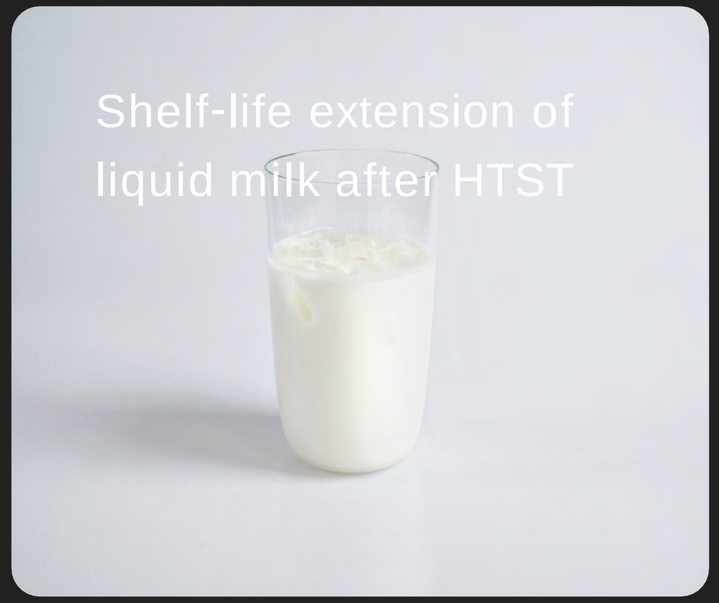


Factors influencing effectiveness UV-T



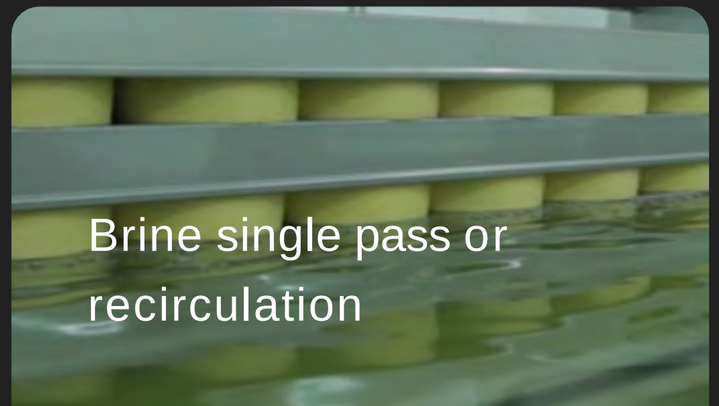
Use Cases


Cheese milk - bacteria
& spore inactivation


Shelf-life extension of
liquid milk after HTST

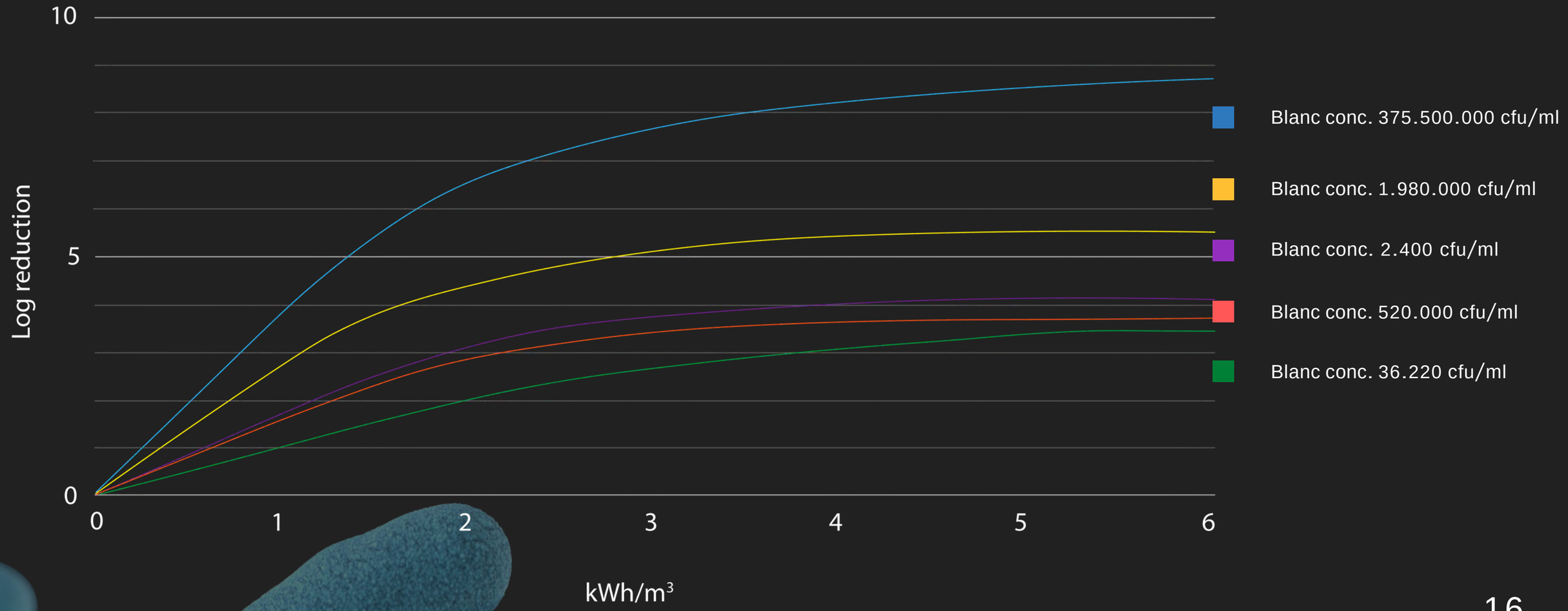

Sweet butter milk


Replacement of
thermalizer steps e.g.
sweet and acid whey


Brine single pass or
recirculation


Bactofuge replacement
for spore & bacteria
reduced milk

Raw Milk


10
5
0
Log reduction
0
1
2
3
4
5
6
kWh/m³
Blanc conc. 375.500.000 cfu/ml
Blanc conc. 1.980.000 cfu/ml
Blanc conc. 2.400 cfu/ml
Blanc conc. 520.000 cfu/ml
Blanc conc. 36.220 cfu/ml

Microbiology

Raw cow milk

Aerobic plate count		
	cfu/ml	**LOG reduction**
Blank sample	8,000	
2,04 kWh/m^3 UV light	5	3,2
3,87 kWh/m^3 UV light	<1	3,9

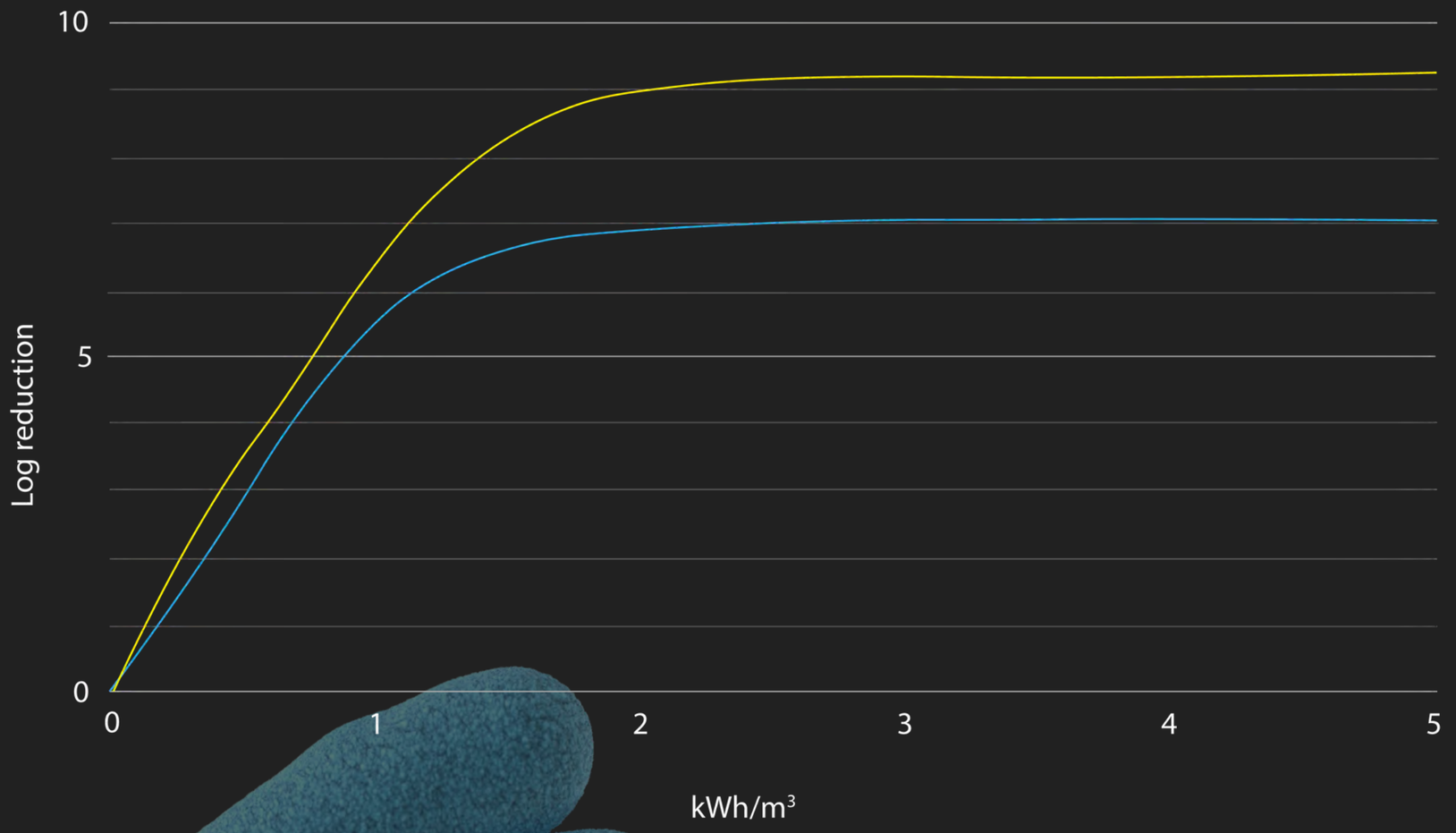
Aerobic plate count		
	cfu/ml	**LOG reduction**
Blank sample	1,980,000	
2,04 kWh/m^3 UV light	335	3,8
3,87 kWh/m^3 UV light	<10	5,3

Aerobic plate count		
	cfu/ml	**LOG reduction**
Blank sample	375,500,000	
2,04 kWh/m^3 UV light	500	5,9
3,87 kWh/m^3 UV light	<10	7,6

Aerobic plate count		
	cfu/ml	**LOG reduction**
Blank sample	190,000	
2,04 kWh/m^3 UV light	<1	5,3

Whole Whey

18



Blanc conc. 835.000.000 cfu/ml

Blanc conc. 9.800.000 cfu/ml

Sweet whey 6-7% TS

	Aerobic plate count		Enterobactor plate count	
	cfu/ml	**LOG reduction**	**cfu/ml**	**LOG reduction**
Blank sample	9,800,000		450	
1,29 kWh/m^3 UV light	10	6	<1	2,65
2,5 kWh/m^3 UV light	<1	8,92	<1	2,65

Sweet concentrated whey 17-18% TS

Aerobic plate count		
	cfu/ml	**LOG reduction**
Blank sample	350	
1,29 kWh/m^3 UV light	10	1,54
2,5 kWh/m^3 UV light	<1	2,54

Microbiology

Whey for pig feed 6-7% TS

	Aerobic plate count		Enterobactor plate count	
	cfu/ml	**LOG reduction**	**cfu/ml**	**LOG reduction**
Blank sample	835,000,000		460,000,000	
1,29 kWh/m^3 UV light	10.000	4,45	<10	8,66
2,5 kWh/m^3 UV light	<1	8,92		

Enterobactor plate – after holding for 24 hrs at 30°C		
	cfu/ml	**LOG reduction**
Blank sample	>15,000,000,000	
1,29 kWh/m^3 UV light	<10	>10.17

Microbiology

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