



Environmental Biotechnology

Managing Microbes

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Industrial versus Environmental Biotechnology



Focus on Species



Focus on Ecology



Delft School of Microbiology



Principle of Enrichment Culturing
Microbial Ecology

Martinus Beijerinck



Microbiology Laboratory Delft



Lourens Baas Becking

*"Everything is everywhere, but
the environment selects"*



Wastewater Treatment a Nature Based Solution



Stream Biofilm
Engineered Stream Biofilm



1880 - Trickling Filter
1914 - Activated Sludge

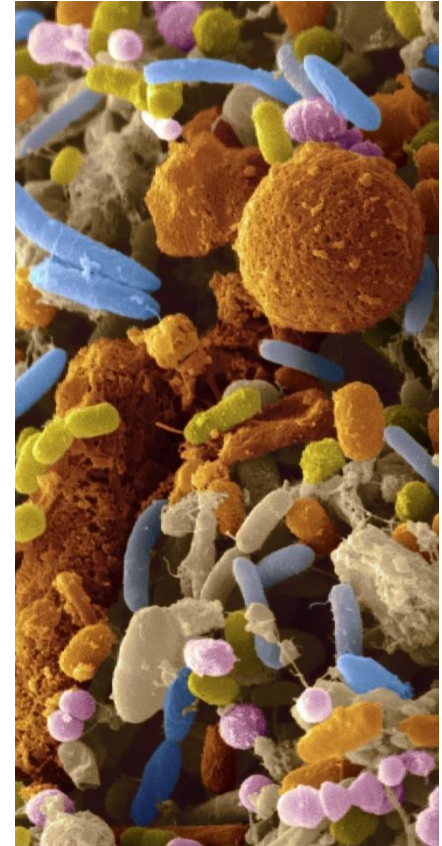


Wastewater Treatment = Managing Microbes

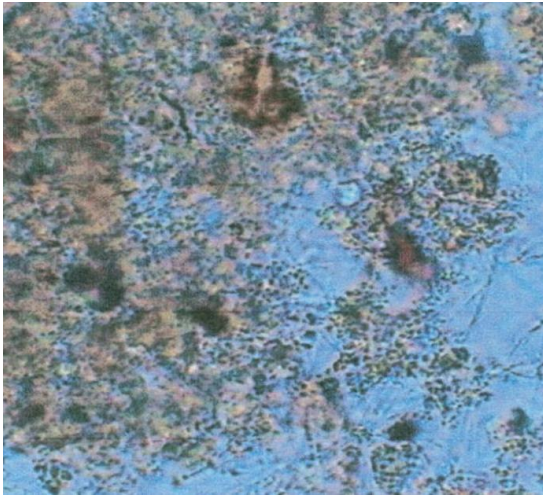
Not Activated Sludge
But a complex microbial community performing:

Nutrient Removal
Phosphate Recovery
Energy Production
Morphology of Floccs/Granules
Pathogen Control
Micropollutants
Antibiotic Resistance Minimisation
..... and many more

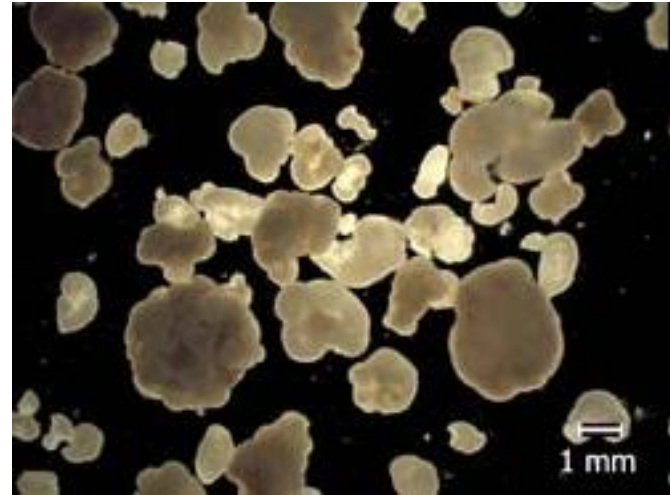
→ All in 1 process



Example: Floc versus Granule



Flocculent Sludge
Settling 1 m/h



Granular Sludge
Settling 20-50 m/h



Garmerwolde WWTP - Nereda[®]



50 % of load to old plant
Flocculent Sludge

50 % of load to Nereda
Granular Sludge

- Better Effluent
- Space Savings
- 30 % Less Energy Needed (16kWh/person/year)
- 25 % Lower Investment Costs

Nereda World Wide

Current 40 installations in 5 years

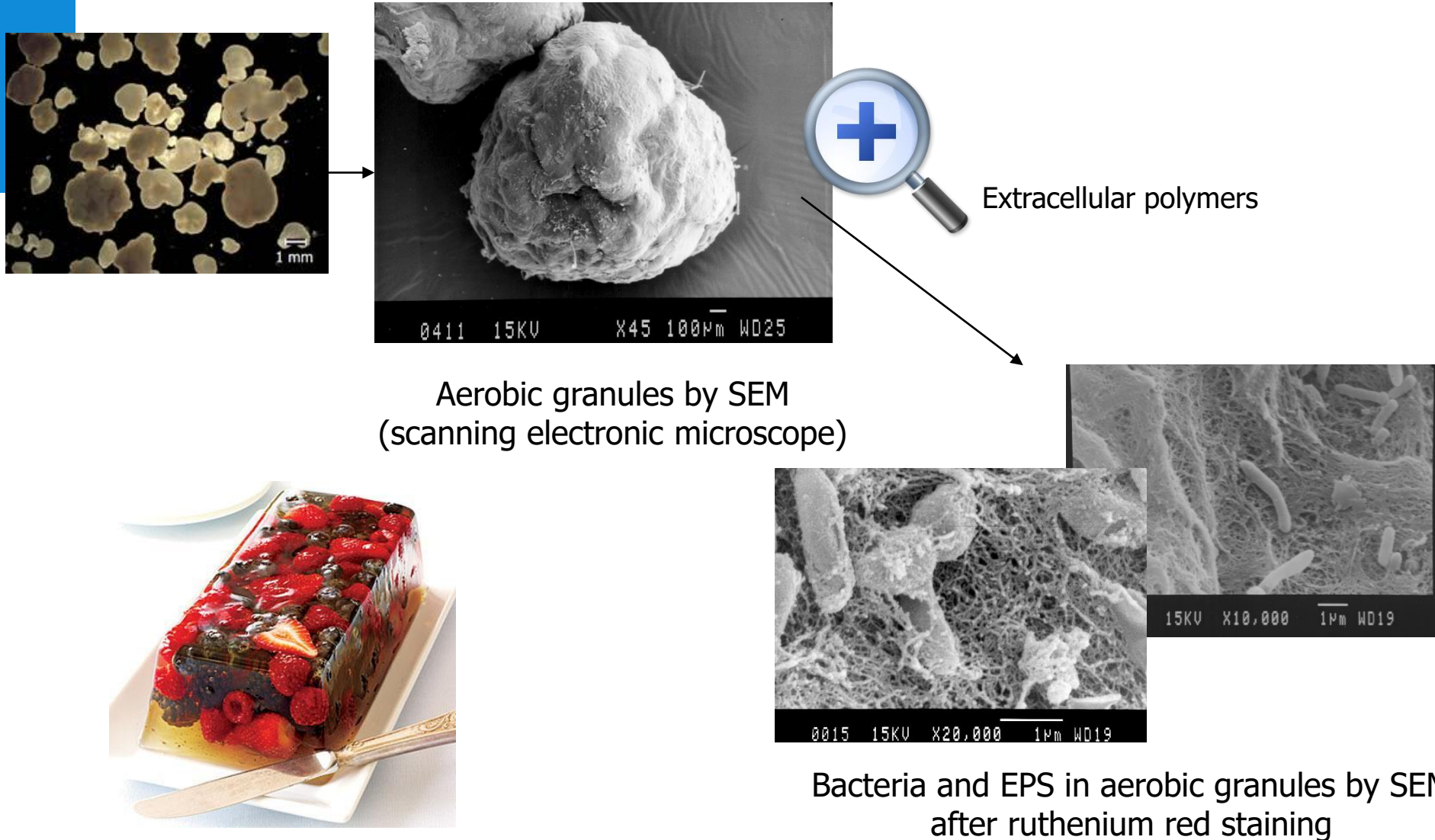


<https://www.royalhaskoningdhv.com/nereda/-/media/nereda/files/public/downloads-and-pr/nereda-references-overview.pdf>

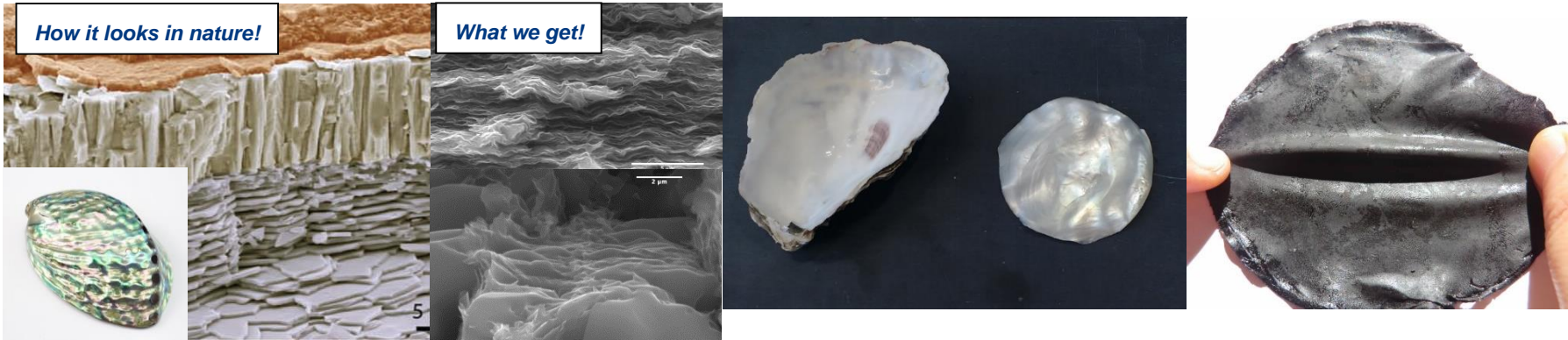
First Swedish Installation in Strömstad



Alginate-like Exopolymers (ALE) from Nereda Granules

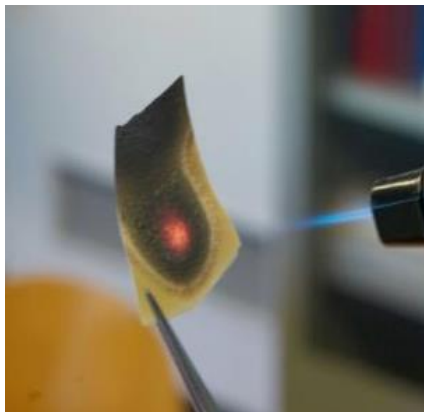


Kaamera - a New Biopolymer

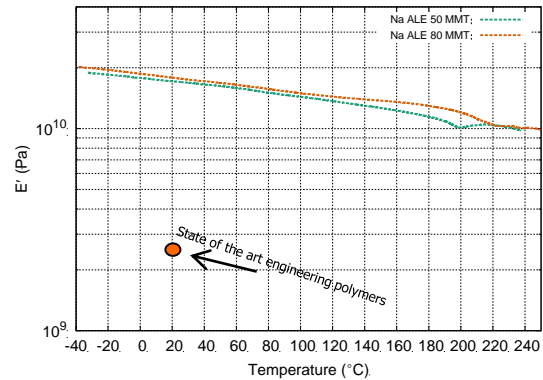


NACRE

Elastomer



Heat Resistant
Fire Proof

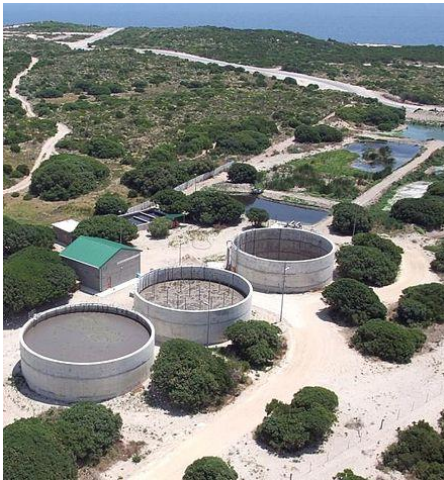


High Tensile Strength



Structural Coloration

Use of Kaumera to bind Loam



Nereda
Gansbaai
South Africa

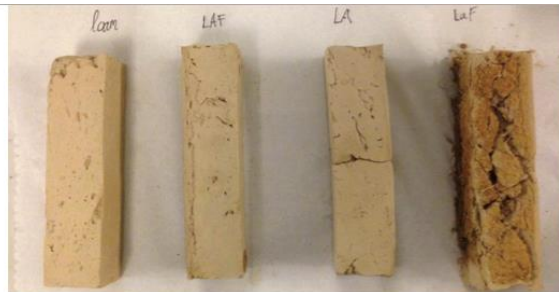


Figure 12: Pictures of the demoulded bricks

Addition of Kaumera:

- Water repellent
- Higher strength



Loam Housing South Africa

First Kaamera Recovery Demonstration Unit



Capacity: 500 ton/year start early 2019
Waterboard has agreement with commercial buyer

Environmental Biotechnology

Using nature to provide clean water, good health and work towards a circular sustainable economy

These principles can also be used to manage microbiological processes in natural ecosystems

