

› HOW HARD CAN THAT BE, PROCESSING SEAWEED

SeaSolv Kick-off | Dr. J.W. van Hal



ECN

TNO

innovation
for life

ACKNOWLEDGEMENT



- › This presentation is part of the MacroFuels project. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654010

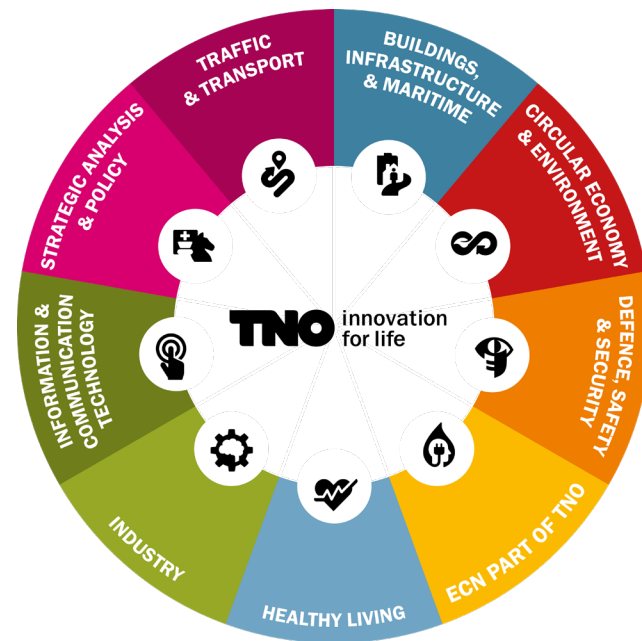
- › Dit is een EFRO project mede gefinancierd door/via Kansen voor West en de Provincie Noord-Holland.



Europese Unie
Europees Fonds voor Regionale Ontwikkeling



WHO IS TNO?





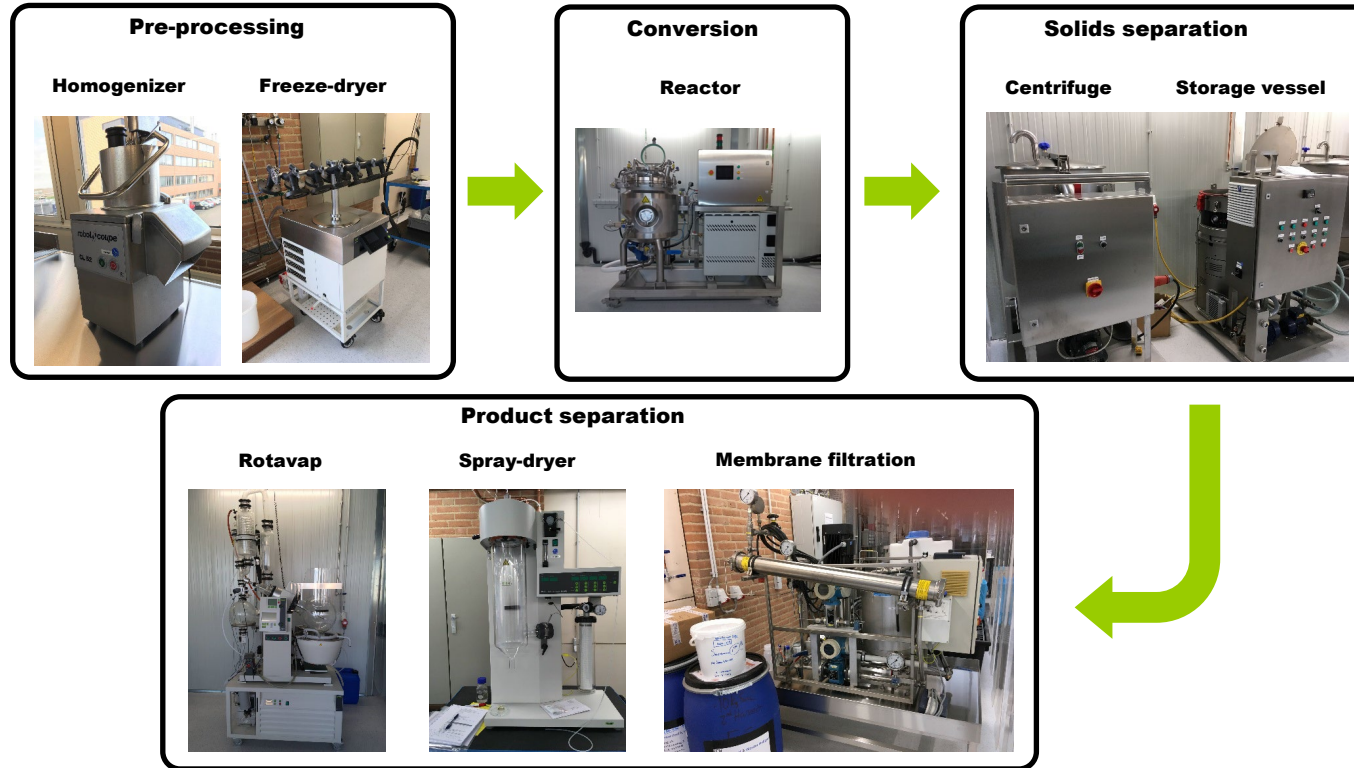
Production facility for fractions (intermediates) from seaweeds for application tests:

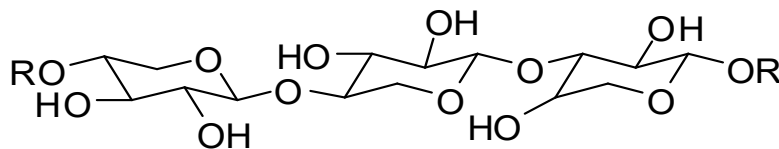
- › Use of processes developed on smaller scale.
- › Modular / flexible unit.
- › From brown, red and green seaweeds to monomeric sugars and master batches.

ECN investment, but facility also to be used for large-scale production tests within MacroFuels (2018-2019).

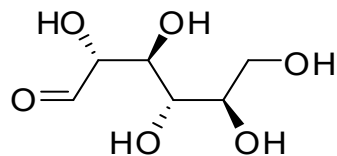
Grand opening: November 7th, 2018

<https://www.youtube.com/watch?v=Yb9JApeb7Bw>

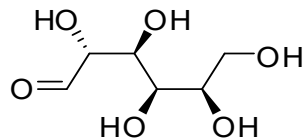




Xylan (1,3 and 1,4 linkage)

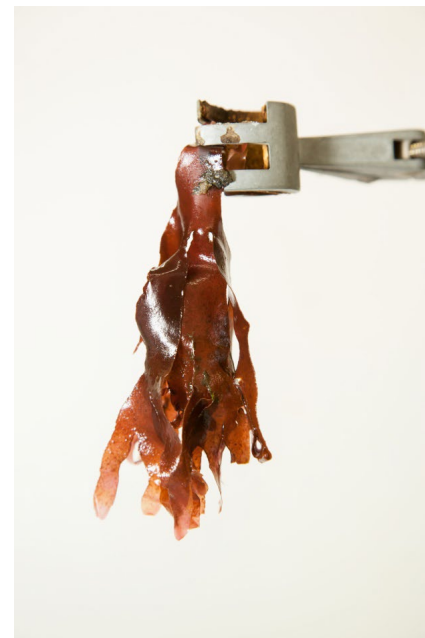


galactose



glucose

Red seaweed
Palmaria palmata (Dulse)



PRODUCING SUGAR SYRUPS

Day 1
Reaction in vessel



Slurry = 100L
Start = 5 kg dry seaweed

Day 2-3
Centrifugation/ filtration (>25µm)



Solid recovery $\approx$ 1.5 kg dry
Liquid recovery $\approx$ 80 L

Day 4
Membrane filtration



Sugar concentration $\approx$ 200%
No increase of K/Na content

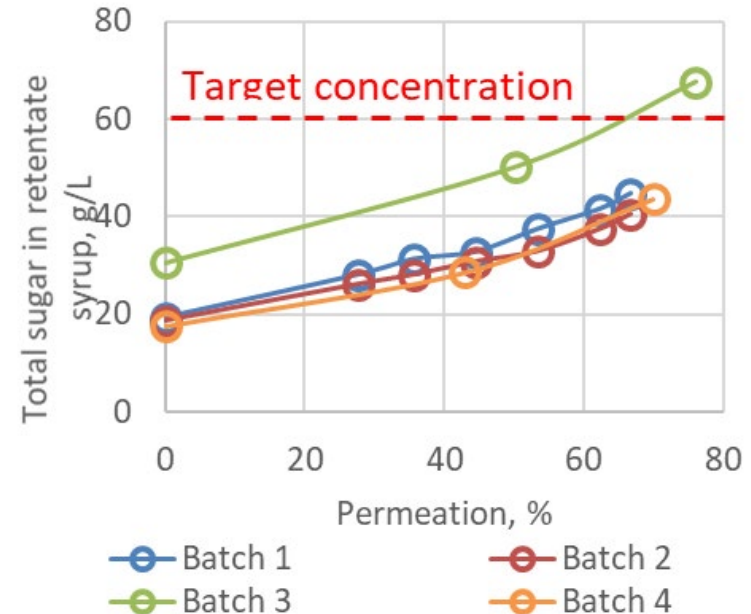
IN NUMBERS

Target concentration for fermentation

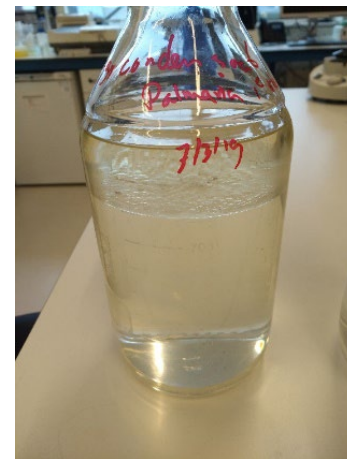
- › Sugar concentration >60 g/L
- › Process water <50%:

Acid hydrolysis of *Palmaria palmata*, 8.1% solid loading:

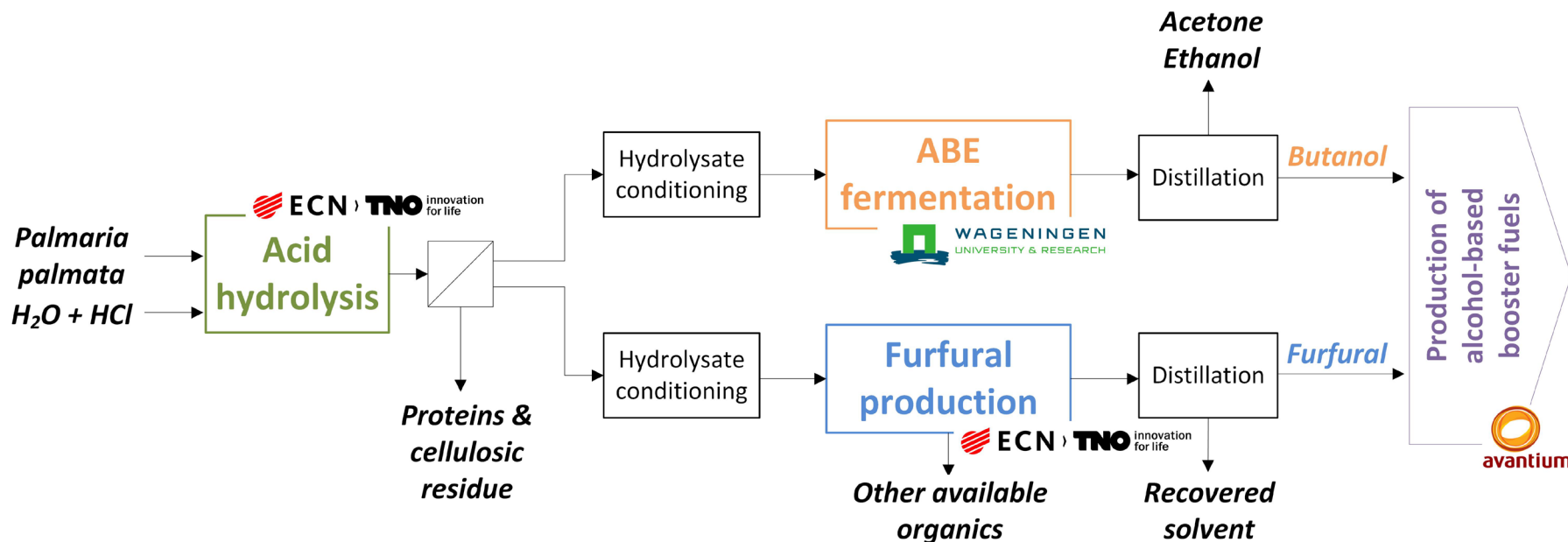
- › Hydrolysis: 30 g/L sugar
- › Membrane filtration: **67 g/L**
- › Removal of 76% of the process water



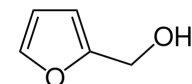
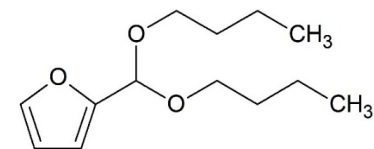
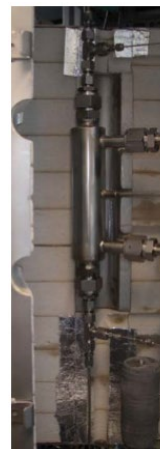
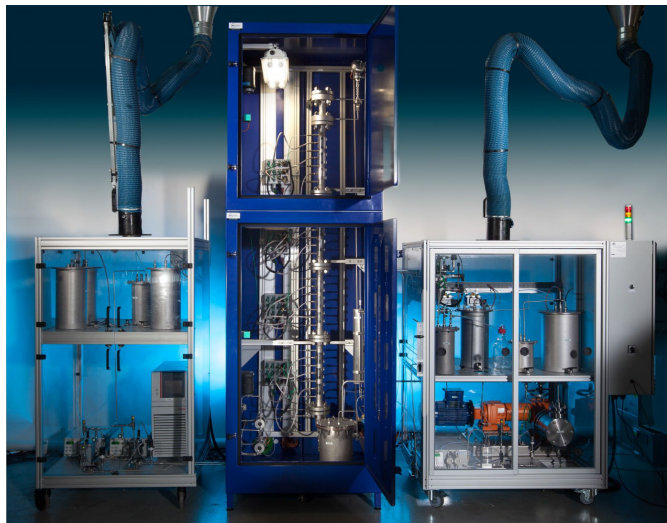
PRODUCING ABE FROM THE SYRUP



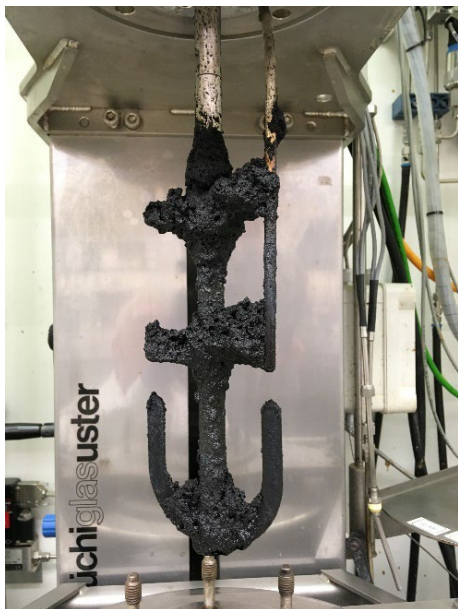
THERMOCHEMICAL CONVERSION



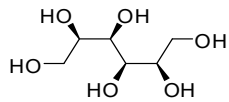
AT RELEVANT SCALE



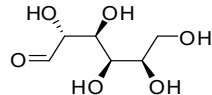
WELCOME TO THE REAL WORLD



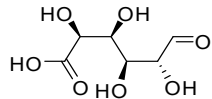
ULVA (GREEN SEAWEED)



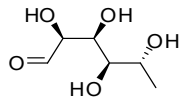
mannitol



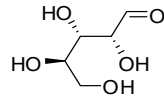
glucose



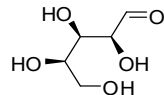
glucuronic acid



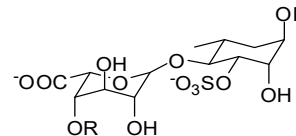
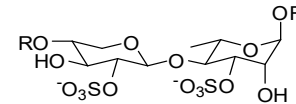
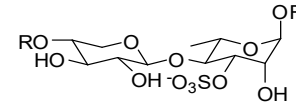
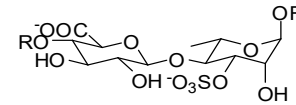
rhamnose



xylose

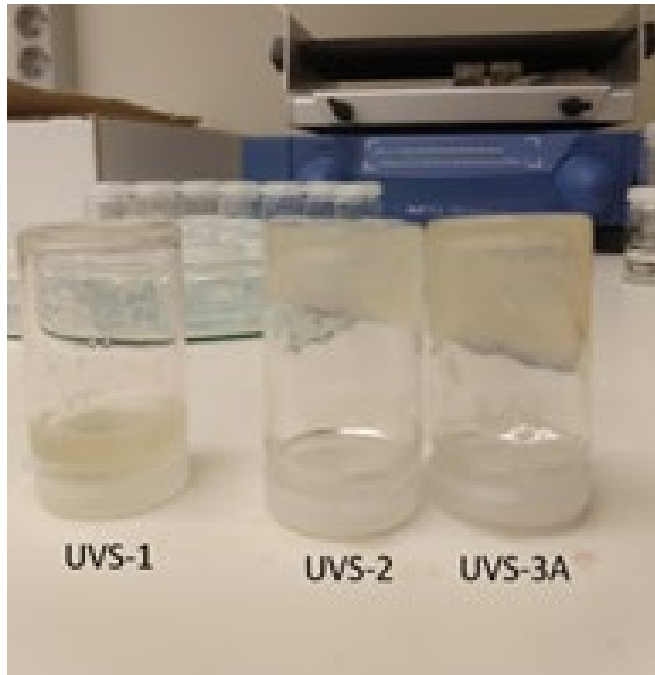


arabinose

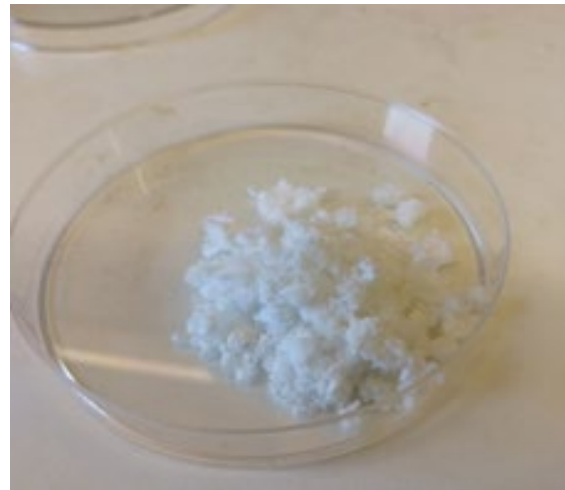


Ulvans

ULVAN



NANO CELLULOSE



BIOACTIVE EXTRACTS



ROOT DEVELOPMENT TESTS



QUESTIONS, COMMENTS?

<http://www.macrofuels.eu>

<http://www.macrocascade.eu>

<http://www.noordzeeboerderij.nl>

<https://port4innovation1.nl/>

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