

# Progress task 2.5

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# Task 2.5 Purification and Concentration of Algal Sugar Syrups



- Upgrading of sugar solutions from Task 2.3 and 2.4 **by purification** (e.g. ion-exchange) and **further concentration** (e.g. membrane filtration or evaporation of water).
- Goal: an **intermediate sugar syrup** with properties suitable for fermentation (WP3) and thermochemical conversion (WP4), with min. 60 g/l sugars for WP3 or 10-20 % for WP4.
- Feedback from WP3 (WUR-FBR, ABE fermentation):
  - 5 g/L  $K^+$  or  $Na^+$  causes 50% inhibition.
  - Target: <2g/L  $K^+$  or  $Na^+$ .
  - No additional requirements received from WP3-DTI, WP4-AVT & WP4-ECN since simply unknown. What about proteins (WP4), furans and organic acids (WP3)?



# Task 2.5 meeting 02 Dec 2016



- Main focus task: concentration of sugars.
- Iterative process between tasks 2.3/2.4, 2.5 and WP3 and 4.
  - First small-scale batches of concentrated liquors should be available for tests by mid-2017 (in order to have enough time for feedback / adaptation prior to large-scale production in 2018).
- Deviation of activities ECN and WUR-FBR:
  - ECN: membrane-based purification and concentration.
  - WUR-FBR: TBD, possibly ion-exchange for removal of salts in combination with a concentration step e.g. by simulated moving bed.
- Many seaweed-hydrolysis-purification-conversion combinations possible.
  - First, focus on combinations developed within single institute (in line with task 2.4).
  - Later, combinations of processes from different institutes (for selection of optimum process scheme (WP6) and as preparation for large-scale production in '18-'19).
  - Selection of a single seaweed feed within this meeting would help a lot!



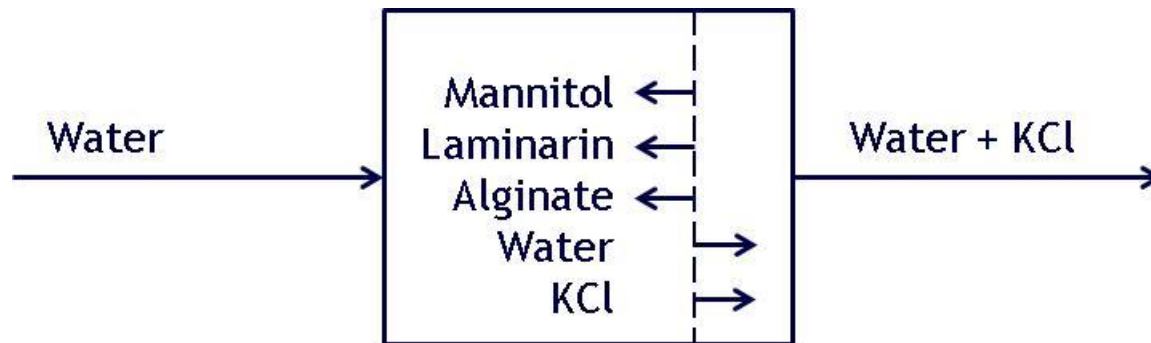
# ECN: Membrane filtration

- ECN seaweed membrane-unit:
  - Year of construction 1995
  - Retrofit 2016
  - $\pm 6\text{m}^2$
  - $4\text{m}^3/\text{h}$  crossflow
  - 4..10bar
  - Max 300l/h permeate
- Flexible set-up:
  - Removal of salt (diafiltration).
  - Mannitol-laminarin separation (Kelps) (ultrafiltration)
  - Concentration of sugars (nanofiltration?).
- Status: unit adapted & technically operational.



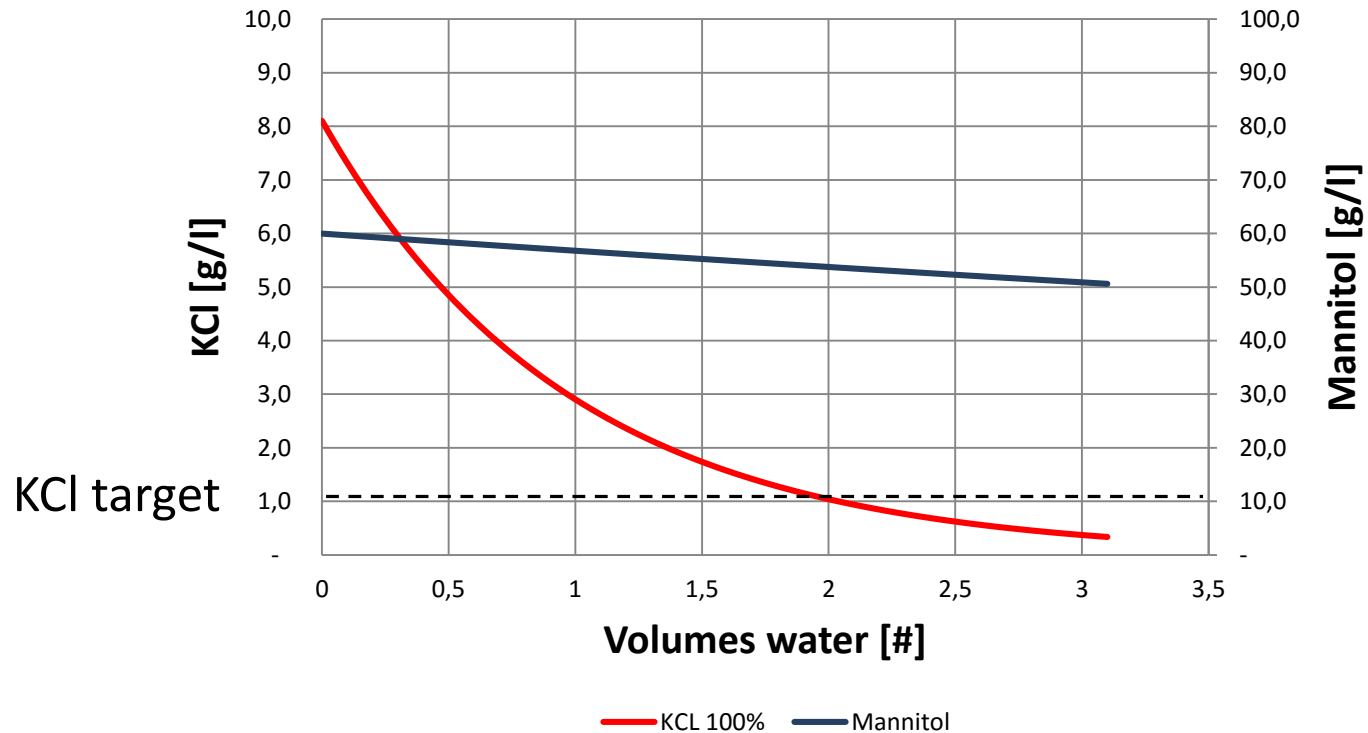
# Example: Diafiltration

- Dilution process (use of water excess)
- Removal of salts
- Using semi-permeable membrane



# First Results

- KCl permeation 70%
- Mannitol retention 95%



# Future

- Planned activities 2017:
  - Deliverable report M24 (D2.6, demonstration of method for algal sugar syrup production for thermochemical conversion and fermentation).
  - Milestone 2.3 (M24, Method for concentrated algal sugar syrup). Goal: less than 3% sugar loss (multi-step membrane-filtration may be required).
  - Tests with model components to determine separation efficiency and dependencies on operating conditions (Feb-June 2017).
  - Tests with seaweed hydrolysates (June-Sept 2017).
- Possibilities 2018-2019 large-scale production (to be discussed):
  - Purification & concentration ECN products liquors.
  - Optionally, idem for product liquors DTI/WUR-FBR:
    - Transport of 1m<sup>3</sup> container to ECN for upgrading.

# Acknowledgement



Thank you for your attention!



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