

Freeze Concentration

Bulk dewatering by film freeze concentration instead of evaporation or suspension freeze concentration, results in improved product quality and less energy consumption while having better economics



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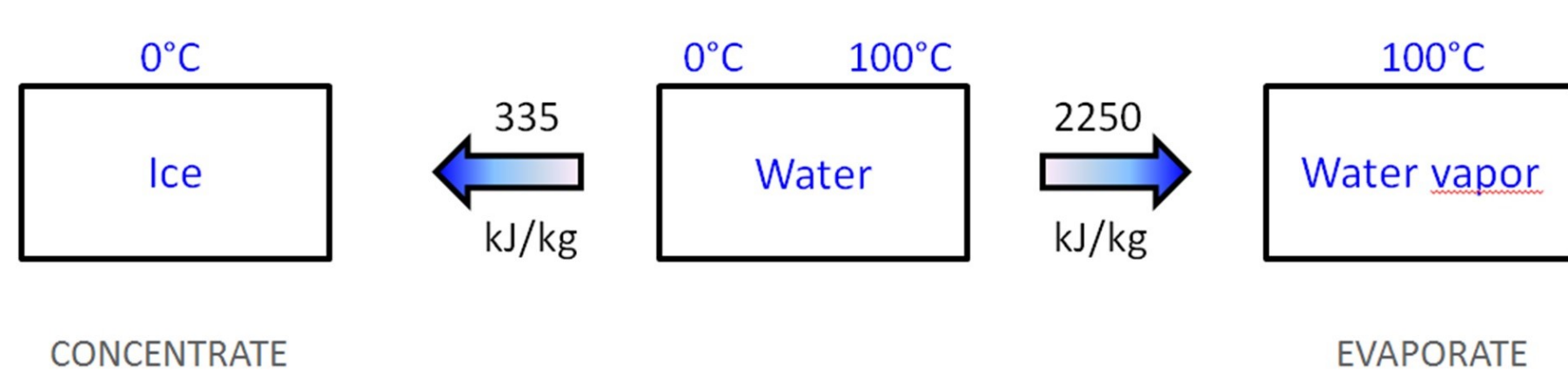
Partners ECN.TNO, ISPT, Nouryon, Royal Cosun,
Wageningen University & Research (WUR)

Budget 830 k€

Duration 2017-2021

Incentive

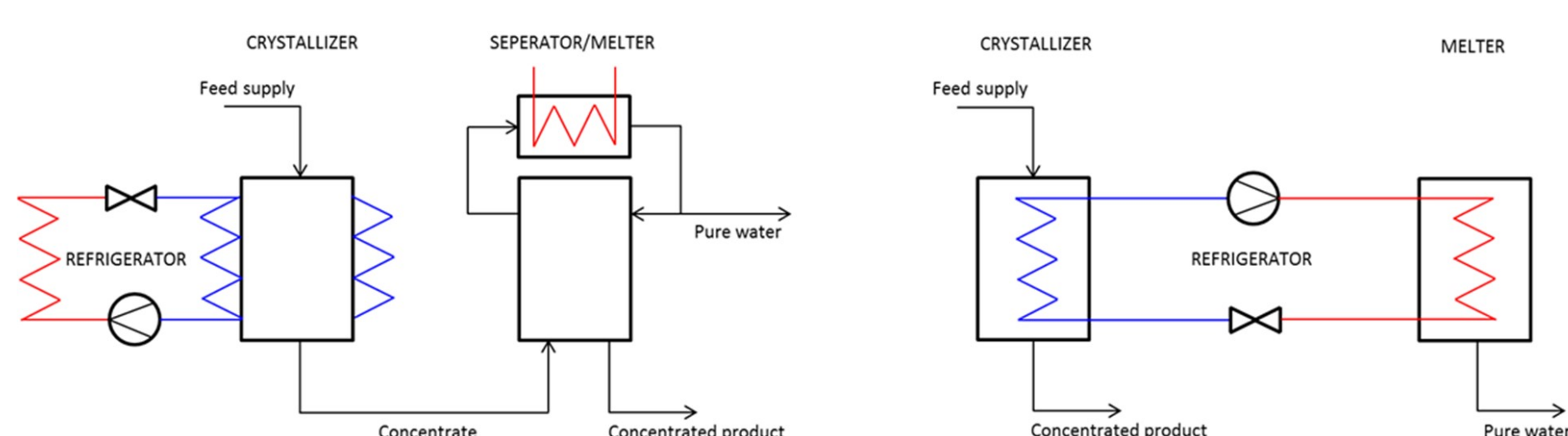
Freeze concentration is a very mild dewatering process with no selective physical losses or changes to the product and theoretically much more energy efficient than evaporation. This makes it an interesting alternative for current dewatering technologies in food industry.



Complexity and high investment cost of current suspension freeze concentration systems hampers the widespread implementation of this technology. Film freeze concentration is less complex and can be more energy efficient with equal product quality. Implementation of film freeze concentration in the Dutch food industry can save up to 15 PJ annually.

Objective

Demonstrate that film freeze concentration is an economically feasible bulk dewatering technology with intrinsic benefits in product quality and energy consumption compared to evaporation, while also being more cost effective than currently available suspension freeze concentration.



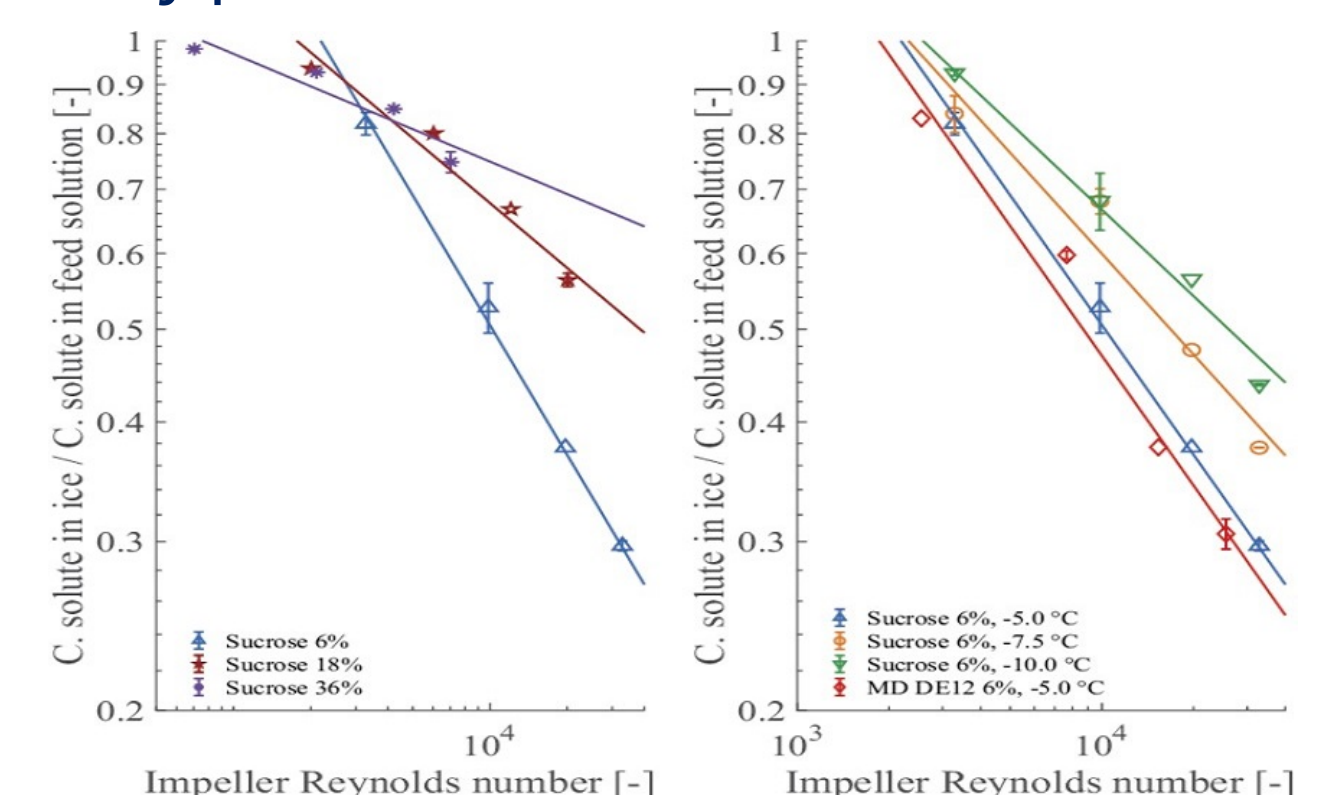
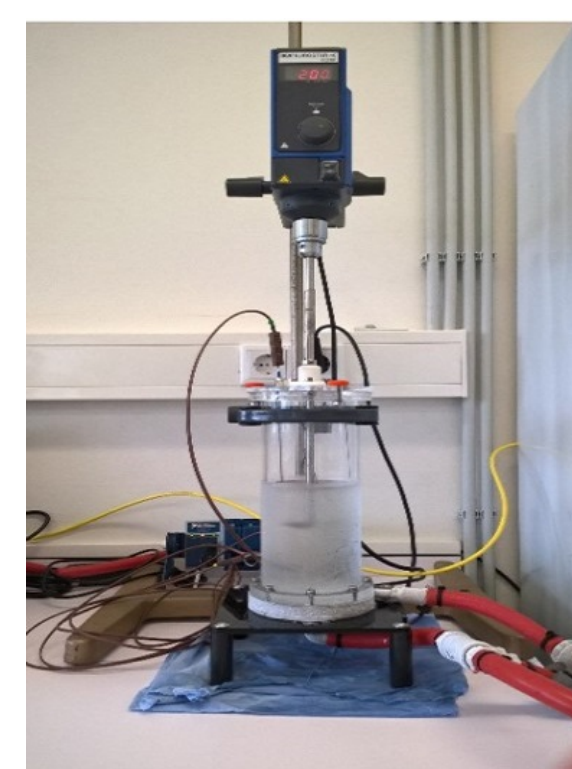
Approach

- Defining end-user demands & boundary conditions
- Determination of product and process parameters with lab scale unit
- Business case evaluation

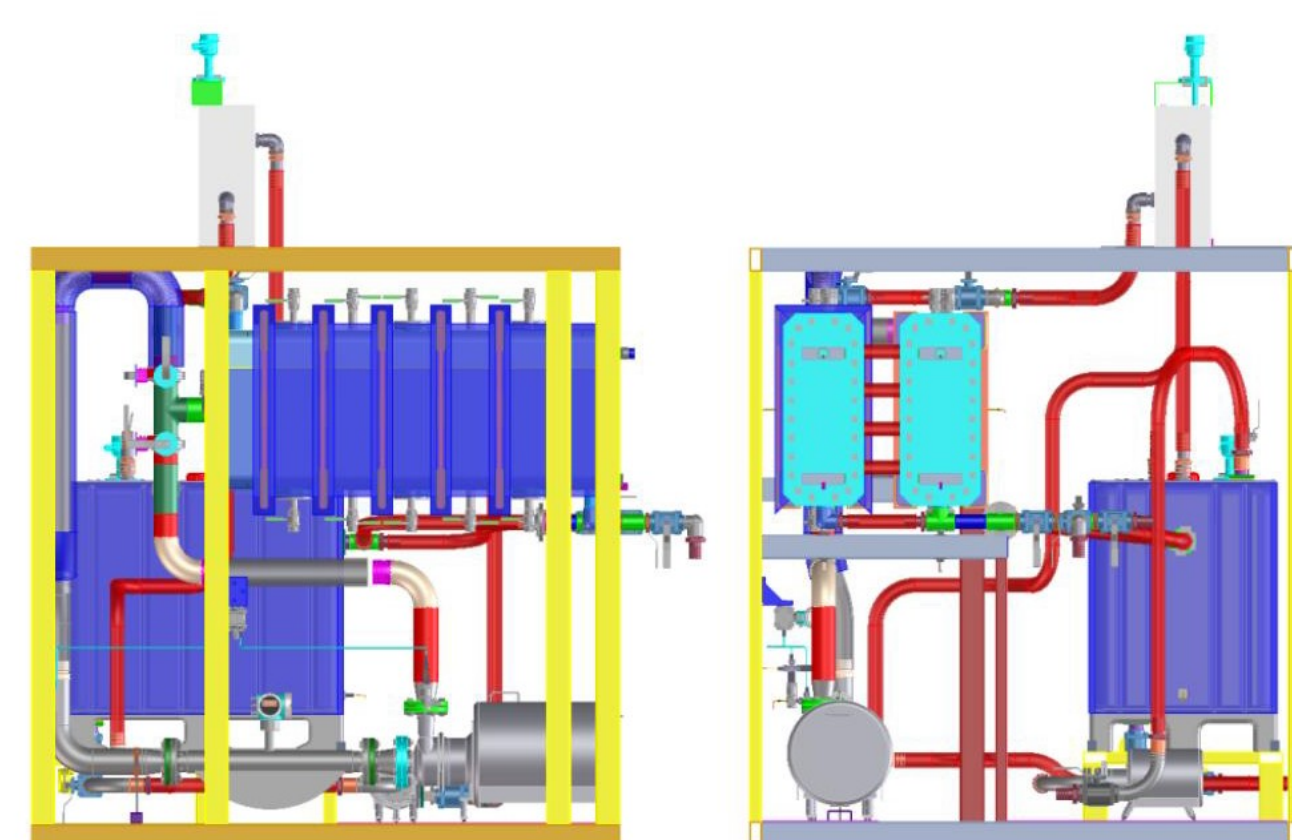
- Design and construction of bench scale film freeze concentration unit
- Testing of end-user product streams in benchscale unit

Results

A lab scale freeze cell and a numerical heat & mass transfer model is made to study ice layer formation. Experiments on sucrose and soy and whey protein are conducted.



Besides sucrose and salt solutions, also protein solutions are identified as a candidate material for freeze concentration.



Design & build requirements for the bench scale film freeze concentration unit are made and construction has started.

Next steps

- Extend lab scale experiments and study protein freeze concentration
- Commissioning of bench scale film freeze concentration unit
- Conducting experiments with sucrose-, salt- and protein solutions on bench scale unit

