

Inulin Fractionation using Membrane Cascades

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Background

	Small Sugars (mono-/disaccharides)	Sweet, undesired caloric content
	Short Chain Inulin (DP3 - 4)	Relatively sweeter and has different physical properties compare to the long chain.
	Long Chain Inulin (DP ≥ 5)	More bland taste

Inulin is a mixture of oligosaccharides which has prebiotic effect and improves food functionalities. Inulin can be produced from chicory root and may contain oligosaccharides in various degree of polymerization as well as small sugars. The functional properties as well as the nutritional value of inulin may differ as the chain length increases [1]. Therefore, besides the purification itself, fractionation of inulin into different fractions is also important.

Membrane based separation is attractive in separating natural mixtures. Previous research at the Food Process Engineering group of Wageningen University [2-3] has shown the purification of inulin using membrane processes, more specifically membrane processes, more specifically nanofiltration membrane cascades. Based on those results, this study aims to utilize the membrane cascade set up for fractionation of inulin.

Method

• Experimental Setup

Fractionation experiments are performed by using the three stage pilot scale membrane cascade equipment. The equipment has flexible connections thus various configurations can be tested. Three types of spiral wound membranes are available, namely GE, GH and GK with increasing pore size respectively. The configuration of the membrane cascade (Fig. 1) along with the variation of process condition (flow rate, membrane type, membrane area and pressure) are varied in order to get an optimum yield and purity.

• Analyses

The process parameters are controlled and recorded via built-in software in connection with the membrane cascade equipment. The concentration of inulin fractions is analyzed via HPLC.

• Modeling and Simulation

A model based on the work of Aguirre et al. [2] is developed for prediction purposes. This model is used to optimize process parameters and the cascade configuration.

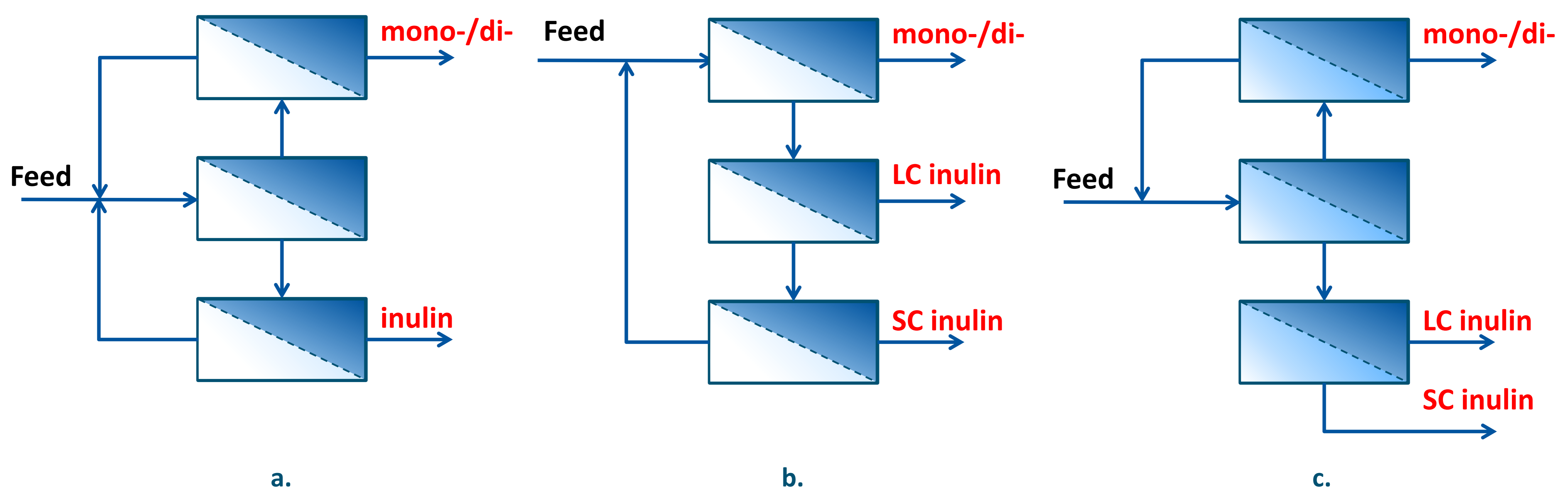


Figure 1. Three-stage cascaded membrane system for inulin separation a. Ideal cascade configuration (previous research) b. and c. Possible configurations for inulin fractionation.

Expected Results

The previous studies only focused on the total (short- and long chain) inulin, meanwhile in this research also separation of middle chain inulin is investigated. Extracting a third stream from the system may affect the system boundaries which previously identified in the ideal cascade configuration. In Aguirre's simulation, optimized conditions for the ideal cascade set up was achieved with GK/GH/GK arrangement with operating pressures of 8/17.5/20 bar at each stage respectively. The optimized conditions for fractionation purposes are expected to be different.

Acknowledgements

The authors acknowledge LPDP for the financial support in this project.

References

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