Development of membranes for forward osmosis applications in food processing

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Introduction

Forward osmosis (FO) is an emerging process for the concentration of process streams in e.g. waste water treatment, desalination of sea water or food processing. In FO, the separation occurs by the osmotic pressure difference between the low concentration feed solution and high concentration draw solution. Energy efficiency and low fouling are the main advantages of FO over current pressure-driven systems because it operates without pressure. Mild operating conditions are especially significant in food processing due to the sensitivity of nutrients like proteins that deteriorate easily.

Project summary

FO has a high potential as an efficient process to be used in concentration of dairy streams due the advantages of FO. The drawbacks of this process are the reverse solute flux from draw solution to feed solution and the internal concentration polarization which decreases the effective osmotic pressure due to the solute diffusion into porous support layer of the membrane. Thus, specifically designed FO membranes need to be developed to overcome these issues. Polydopamine (PD) is a mussel inspired adhesive protein which is formed as a thin film coating via spontaneous self-polymerization of dopamine after oxidation under basic conditions. It adheres onto various organic and inorganic surfaces and provides reactive sites for secondary reactions to immobilize additional layers. In this study, the immobilization of zwitterionic layers onto the PD coated membranes will be investigated to enhance the antifouling properties of the membrane.

Project goals

The goal of the project is to develop membranes for FO processes to achieve low fouling and better performance in whey processing. The project has different aspects to focus on: membrane preparation, membrane characterization to study the properties and membrane process performance evaluation. Therefore, it is applicable for both students from the materials and from process technology track. The project can be discussed further in detail by taking your interest into consideration.

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