

Circular recovery of ethanol and caustic from alkaline-ethanol media at high pH using membrane techn

Publieke samenvatting / Public summary

Aanleiding

The main operational costs of the process are related to the recovery of the (anti)solvent, for which now traditional techniques like distillation are used. Membrane technology, however, has proven its potential as a separation technology to reduce energy consumption and process costs. Additionally, the milder conditions in membrane processes in comparison to traditional separation methods (e.g. distillation) can help to preserve the functional and organoleptic properties of ingredients. However, little knowledge is available regarding the use of membranes in alkaline-alcohol media at high pH. In this project, the partners intend to investigate the feasibility of using and implementing nanofiltration (NF) membranes to recover alkaline-ethanol solutions from process streams consisting of a mixture of water, ethanol, caustic and food ingredients. Novel NF membranes developed in the project will also be evaluated in high pH solution applications in the chemical industry. Furthermore, the use of pervaporation technology is considered for the recovery and purification of ethanol from (potentially azeotropic) water-ethanol mixtures.

Doelstelling

In this project, the following objectives have been defined, which contribute to making production processes in the food, biotech and chemical industry more circular, flexible and energy-efficient. • Investigate and develop nanofiltration membrane(s)

Projectinformatie / Project information

Projectnummer / Project number

TKITOETKI2023_Recircanol

Subsidiebedrag / Grant amount

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Algemene informatie / General information

Penvoerder / Secretariat

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(modules) that can be used in alkaline-ethanol media at high pH for the purification and recovery of ethanol and caustic. The membranes are characterized by high rejections of target ingredients, constant and sufficiently high permeabilities in alkaline-ethanol media at different compositions, and high chemical stability. •

Evaluate the (techno-economic) feasibility of using the developed pH-stable nanofiltration membranes in the food and chemical industry in applications characterized by extreme pH. • Determine the feasibility of using membrane pervaporation for the recovery and purification of ethanol from water-ethanol media containing peptides, amino acids and salts.

Korte omschrijving

For the purification of ingredients in food side streams, Greencore is currently developing a process that involves the use of water-ethanol media at very high pH (>13), prior to the application of a pH reduction to obtain the separate ingredients or ingredient fractions. In a PhD project, Greencore and the University of Twente will scientifically investigate the use and performance of nanofiltration membranes in alkaline-ethanol media at high pH, including the required membrane material characterizations. The technical and economic feasibility of using these membranes to replace distillation in the first process design, thus making it more sustainable and circular, will be addressed in an EngD project. SolSep will supply and further develop the nanofiltration membranes, including a first scale-up to membrane modules, and will investigate the applicability of these membranes for the separation of other (anti)solvent-water mixtures. Nobian will test these membranes for one of their high pH processes. Pervatech will research and assess the feasibility of using pervaporation for (anti)solvent recovery in ingredient separation projects in the food, biotech and pharma industry.

Resultaat

This project should result in (a) the development and scientific evaluation on lab-scale of novel as

well as potentially suitable commercially available nanofiltration membranes and membrane modules that can be used in alkaline-alcohol media at high pH, and that are characterized by a high chemical and performance stability, leading to improved scientific insights in the required materials properties of (anti)solvent- and pH-stable membranes, (b) a better (scientific) understanding of the behavior and performance of these membranes under different process conditions, and (c) a first assessment of the technical and economic feasibility of using these membranes as well as pervaporation technology to make processes in the food, biotech and chemical industry more circular and sustainable.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.

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