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STNF - Solvent Tolerant Nanofiltration and Reverse Osmosis membranes for the purification of industrial aqueous streams

The project develops stable nanofiltration membranes that separate and concentrate components from mixed solvent/water industrial process and waste streams.

Project number	BL-20-12	Partners	DuPont, ECN po TNO, ISPT, KU Leuven, Shell, SolSep, Universiteit Twente, VITO
Project leader(s)	Veronica Gomez	Budget	2 066 k€
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Incentive

The polymeric nanofiltration (NF) membranes that are widely used in wastewater and water treatment normally show high permeability and stable rejection. These membranes could offer a more sustainable and energy efficient alternative to the technologies currently used in downstream separation by various chemical industries.

However, if a solvent is present in the aqueous feed stream, these performances are often lost due to phenomena like swelling and membrane degradation. The permeability becomes often lower and the rejection unpredictable.

Objective

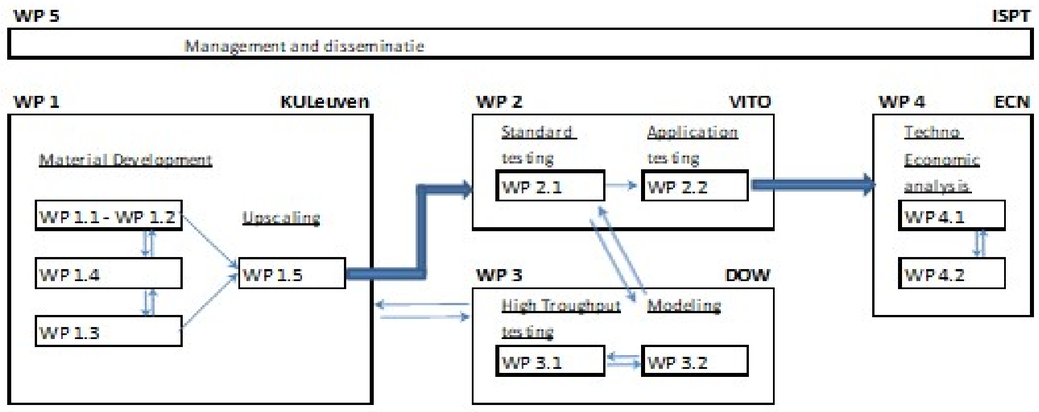
This project aims to develop stable NF membranes that can be used in mixed water/solvent process streams as an energy effective separation method.

Technical specifications include:

- A feed-flow of 10-100 m^3/hr,
- A solvent content < 20% in water, and
- A content of organic components in feed between 100 – 2000 ppm.

Approach

This project is divided into 5 Work Packages (WP). In WP 1, the membrane materials are developed and scaled up. In WP2, the membranes are tested in a standardized way using industrial model mixtures. In WP 3, the membrane performance is modeled on the basis of genetic algorithms. In WP 4, a techno-economic analysis is made that is based on test results and the understanding of the implementation and market potential. The project mangement and proliferation is in WP 5.



Results

Several membranes have been developed at KU Leuven. Then methods were developed for interfacial impregnation of the polymer on the polymeric support. SolSep is working with the KU Leuven in scaling up these membranes.

At the University of Twente, small polyethylene glycol (PEG) molecules were grafted in pores of ceramic -alumina. The first membrane tests showed promising performances. In parallel, UT focusing on developing 2D nanosheet membranes made of Covalent Organic Framework (COF) to combine the advantage of the homogeneous pore structure of COFs with the inertness and rigidity of the porous ceramic support.

VITO has tested a series of commercial reference membranes on two case from Shell. The results show promising retentions, but a decline in selectivity and flux with increasing feed concentration, as expected.

TNO will be starting their work, the techno-economic evaluation, in the beginning of 2020. Case studies include contaminated feedwater and wastewater with organic components like ketones and aldehydes.

Next steps

The next step of the project is to continue the development of the membrane materials, to start the modeling work as well as the techno-economic evaluation.

Institute for Sustainable Process Technology

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