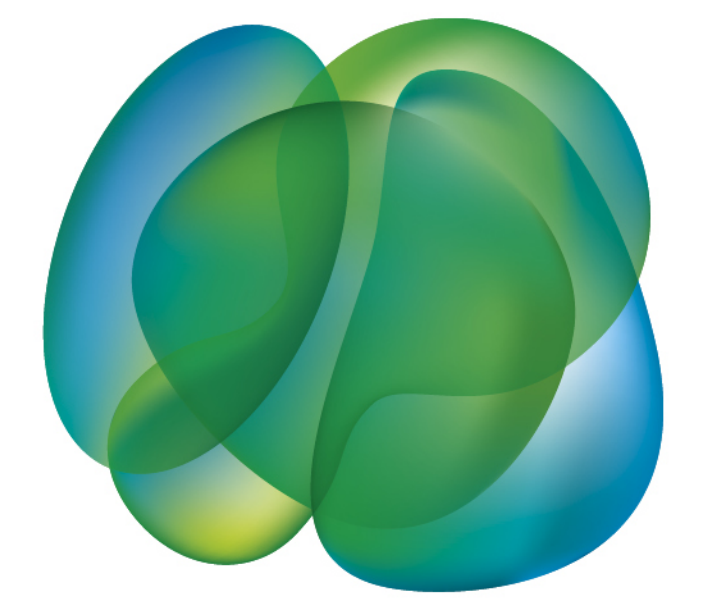


Forward Osmosis: Concentration of liquids and recovery of clean water and/or raw materials



ISPT

NL GUTS
Netherlands Separation Process Network



Project Leader:

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Partners:

DSM, FrieslandCampina, Shell, Gaz de France, Marfo, NL-GUTS

Budget:

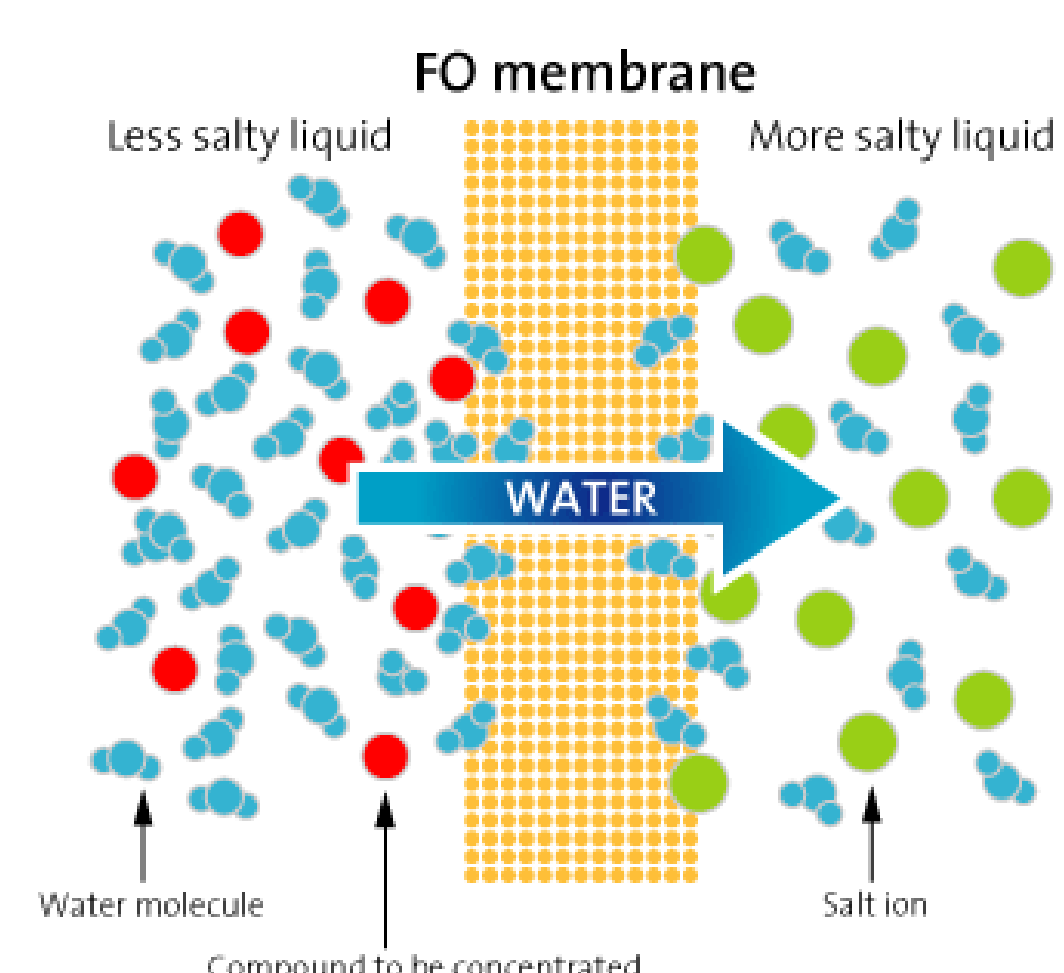
Euro 199.904,-

Objective:

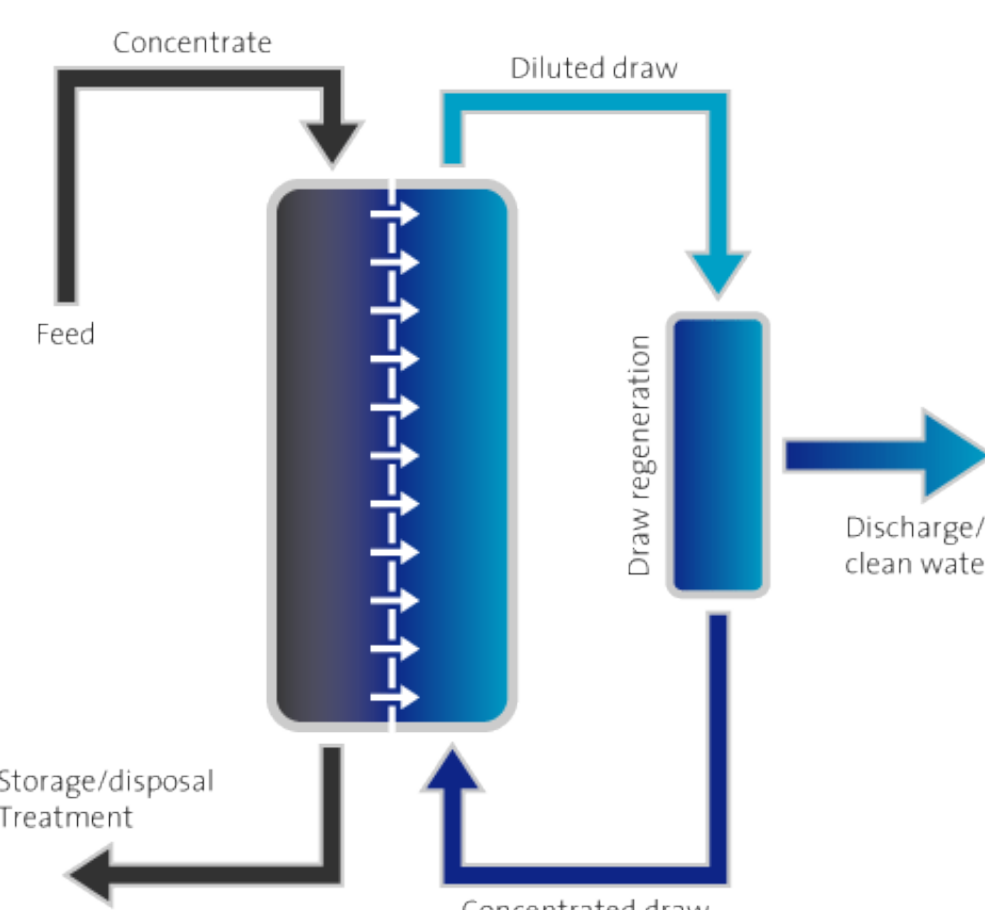
The project is focused on the commercial use of forward osmosis to concentrate highly fouling streams.

Motivation and backgrounds:

Forward Osmosis (FO) is based on the principle that water separated by a semi-permeable membrane goes from a liquid with a low osmotic pressure to a liquid with a high osmotic pressure. This process doesn't take any energy or pressure to happen. FO is a low fouling separation process. FO membranes rejects organics, minerals and other solids, similar to RO, but doesn't have the typical fouling problems.

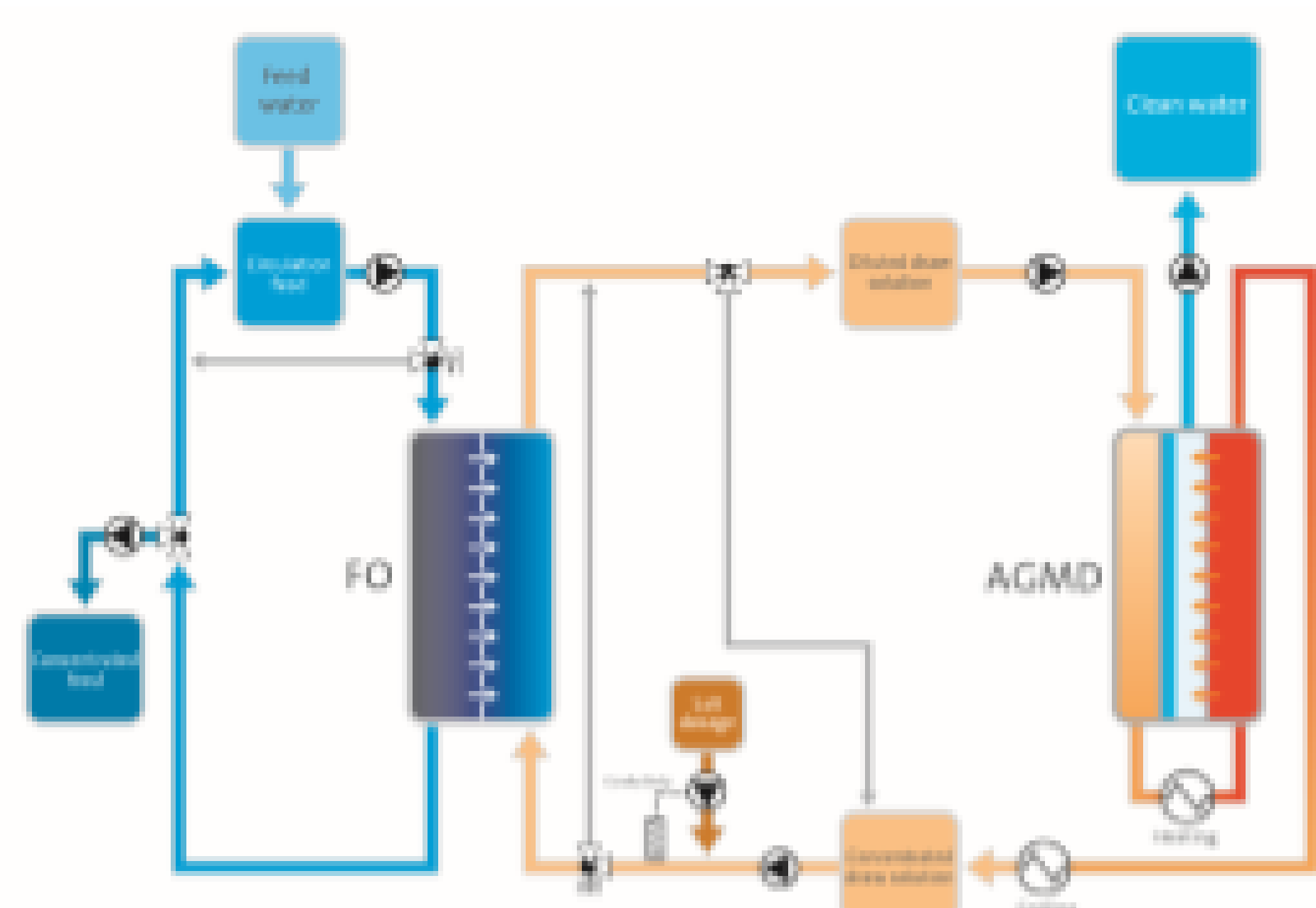


Principle of FO



FO with draw solution recovery

The high osmotic solution is called the draw solution. During this process the draw solution is diluted and should be separated in clean water and a concentrated draw solution. In this project Reverse Osmosis and Membrane Distillation are applied.



Forward Osmosis with Membrane Distillation flow scheme

Applicability:

Examples for the application of FO are:

- Concentration of products in the food and beverage industry
- Concentration of difficult wastewater (Zero Liquid Discharge)
- Reuse of wastewater and recovery of raw materials
- Concentration of digestate or manure
- Osmotic-MBR
- FO in combination with cooling towers



FO-MD pilot unit

Project scope:

Four different types of industrial feed streams are tested for concentration using FO on pilot scale:

- The concentration of Vitamin C for DSM.
- The concentration of whey for FrieslandCampina.
- The concentration of food industry wastewater, for the production of reusable water and biogas for Marfo.
- The concentration of the produced water released during oil extraction for Shell in co-operation with Gaz de France.

Status:

The pilot tests confirm the low sensitivity for fouling of the FO membranes. Tests are done with different concentration factors and different concentrations for the draw solution using either RO or MD as a draw recovery method. The tests will be finished in February 2016.