SC6: FUNCTIONALIZED POLYMERIC HF MEMBRANES FOR AQUEOUS APPLICATIONS

PILOT LINE 10

Production of HFs with additional in-line coating and/or crosslinking.

PL OWNER

- EMI Twente is upgrading their spinning line with an Electron beam for in-line modification of hollow fiber membranes.

PARTNER

- Together with EMI Twente, they are developing and showcasing new functionalized polymeric HF membranes for aqueous applications

THE CONTEXT

Hollow fiber (HF) membranes are produced using a continuous dry-wet spinning process. Specific operating conditions, use of additives etc. give the membranes their separation performance, i.e., flux and selectivity. Within the nanofiltration area, typically thin film composite membranes are used to separate molecules <1000 Da. To enhance the performance of any type of membrane, often a surface modification on the nanoscale is applied. The purpose of such a modification is to obtain e.g., better chemical stability, higher rejection or reduced fouling. Typically, these modifications are done off-line in a batch-wise post-treatment. Although several studies have shown the feasibility of this modification, its off-line nature renders the process to be time-consuming, cost-ineffective and prone to errors. There is a need to apply these modifications in-situ during the initial fabrication of the membranes.

THE CHALLENGE

PL#10 will integrate in-line nanoscale surface modification by means of electro-beam eliminating the need of an off-line surface modification. During INNOMEM the focus will lie on the modification of a new type of dense Nanofiltration (NF) membrane. NXFiltration produces NF membranes based on nanometer thin polyelectrolyte multilayers (PEMs) self-assembled via the electrostatic interactions of polycations and polyanions. This coating technology enables the preparation of NF membranes with highly tunable selectivity, both in charge and in molecular weight cut-off. This can be achieved by selecting different polyelectrolytes. However, the stability of some of these PEMs towards cleaning agents (chlorine, surfactants and acid/alkaline) severely limits the choice of polyelectrolytes. Crosslinking these PEMs, by using E-beam, can improve the stability by creating a covalently crosslinked PEM (in addition to the electrostatic interactions). An addition benefit of the cross-linking is that the crosslinking density can potentially enhance the selectivity of the selective layer. A higher degree of covalent cross-links reduces the hydration of the nanometer thin layer, reducing passage of small solutes

KEY DRIVERS OF THE SERVICE: THE VALUE PROPOSITION

The key features that differentiate the membranes being developed in SC6 are as below:

Simple Process	Higher Selectivity	Higher Stability
•no need for pre-treatment chemicals (coagulants, anti-scalants, floculants)	•more selective membrane using the same simple DNF process	•thus can be used for a wide range of applications