Membrane fouling

Nanofiltration tests on organic acid solution using V-SE

Project: CS-01-02
Project leader: Ton Franken
E-mail: franken@mact.nl
Partners: MACT, Purac, NL GUTS
Budget: 50 K€
Duration: Successfully completed

Separation task:

In one of the production processes a process stream containing an organic acid and some contaminants (typically polymeric impurities) is obtained. This stream needs to be treated in such a way that the polymeric impurities are removed. A suitable process is nanofiltration. Due to the nature of the contaminants cross-flow conditions have to be used to avoid fouling and to maintain an acceptable flux.

Approach:

One of the characteristics of the organic acid solution is that it has a high concentration of several components and its viscosity is rather high. As such it is proposed to perform tests with a system that uses increased mechanical support. The system used in the test is V-SEP, in which the mechanical support is supplied by vibration.

In the membrane system, a stack of discs is moved at high speed in a torsional oscillation creating a shear rate of around 150,000 s-1 which is more than 10 times higher than the maximum shear in cross-flow operation. As no cross-flow is needed the total energy consumption for a V-SEP system is only about 10 to 15% of the energy costs for cross-flow operation, whereas filtration rates of up to five times higher than in cross-flow filtration can be obtained.

Equipment:

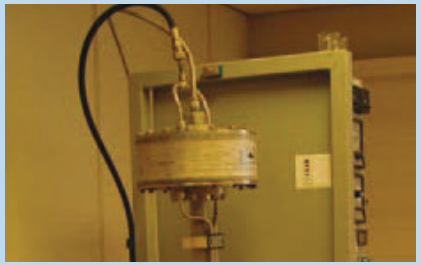
The tests were carried out using a vibrating membrane system from New Logic equipped with a membrane stack (1.55 m^2) with nanofiltration membranes with a MWCO of 250 Dalton.

Results:

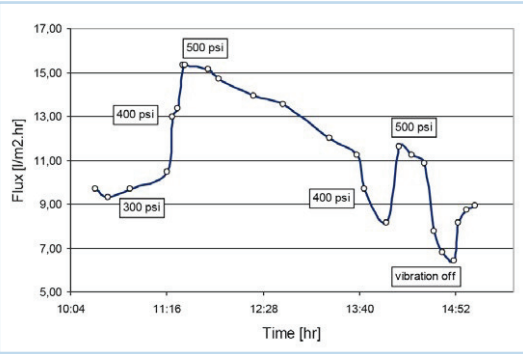
The following graph shows some of the results that were obtained with V-SEP. In this graph effects of time, concentration, pressure and vibration are presented.

Some observations:

- Vibratory enhanced filtration is good method in avoiding flux decline in a NF process.
- Pressure increase leads to near proportional flux increase if vibration is used to minimize fouling.
- During a concentration run, V-SEP can avoid a strong flux decrease despite a concentration factor of nearly 3.
- During filtration an irreversible deposition of feed components occurs on the membrane that can be easily removed by using a commercial cleaning agent.



Membrane module on torsion spring



Flux as a function of time