

# Membrane compaction, internal fouling, and membrane preconditioning as major factors affecting performance of solvent resistant nanofiltration membranes in methanol solutions

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## ABSTRACT

The viability of using solvent-resistant nanofiltration (SRNF) membranes for concentration of a methanol solution containing a mixture of methyl lactate (ML), glycoaldehyde dimethyl acetal (GLAD), and methylvinylglycolate (MVG) was evaluated in this study. The highest retention was achieved with the GE AG membrane at 60 bars, compared to NF 270, Desal DK, and BW 30 membranes, where the retention was 20–30% lower at the same pressure. All membranes except NF 270 showed a high compaction effect at pressures above 40 bars, which explained the low flux and high retention at high pressures. Preconditioning the membranes with pure ethanol or methanol resulted in no differences in flux compared to the virgin membrane, which was in agreement with the “clustering effect” of the hydrophilic groups, which predicts same hydrophilicity but larger (and fewer) pores on the membrane surface. On the contrary, when the membranes were preconditioned with 50/50 alcohol mixtures of methanol or ethanol and water, a general decrease of flux and retention increase was observed, which was ascribed to the previously reported “pore wetting” effect exerted by water in alcohol mixtures. Increasing pH of the feed solution from 4 to 7 also caused decreases of flux and retention, which was explained by the increased internal fouling due to pore swelling. The results from this study suggest that the balance between compaction of the membrane due to high pressure and the pore size enlargement resulting from swelling and reorganization of the polymer chains of the membrane when subjected to organic solvents determines the size exclusion efficiency and susceptibility of the membrane to internal fouling, which in turn determine the performance of the membrane in terms of retention and flux.

## KEYWORDS

Solvent resistant nanofiltration membranes; Membrane compaction; Internal fouling; Solution concentration

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