EVALUATION OF THE OPTIMAL MEMBRANE THICKNESS FOR DIRECT CONTACT MEMBRANE DISTILLATION DESALINATION VIA MODELLING AND EXPERIMENTS

L. Eykens[1,2*], I. Hitsov[1,3], K. De Sitter[1], C. Dotremont[1], L. Pinoy[4], I. Nopens[3], B. Van der Bruggen[2]

[1]VITO - Flemish Institute for Technological Research, Boeretang 200, 2400 Mol, Belgium
* (Email: lies.eykens@vito.be)
[2]Department of Chemical Engineering, Process Engineering for Sustainable Systems Section, KU Leuven, W. de Croylaan 46, 3001 Leuven, Belgium
[3]BIOMATH, Department of Mathematical Modelling, Statistics and Bioinformatics, Faculty of Bioscience Engineering, Ghent University, Coupure Links 653, 9000 Ghent, Belgium
[4]Department of Chemical Engineering, Cluster Sustainable Chemical Process Technology, KU Leuven, Gebroeders Desmetstraat 1, Ghent B-9000, Belgium

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Membrane distillation is an emerging separation technology, mainly aimed at desalination. The mass and heat transfer through the membrane depend on membrane structure and process conditions. In this contribution, the effect of membrane thickness on the membrane performance is evaluated both from a modelling and experimental point of view. Both heat and mass transfer through the membrane are greatly enhanced by reducing the membrane thickness. Therefore, it is in general accepted that low membrane thickness enables high fluxes, but also results in high energy losses through the membrane. Although it has been suggested before in literature [1], in this contribution, for the first time we prove using modelling and experiments that for clean water the energy efficiency is independent of the membrane thickness, while the flux is largely enhanced at lower thicknesses. This observation was made for both commercial and in-house made membranes. Further modeling results suggest that at higher salinities an optimal membrane thickness exists at which a maximum flux is obtained. This optimal membrane thickness is not a constant, but a function of specific module and operational conditions. Experimental results at high salinities show very low and even negative fluxes for the thinnest membranes, while the thicker membranes still show acceptable fluxes. Therefore, for higher salinities, the membrane thickness should be tailored for the specific module and operational conditions, since it is one of the most important parameters for optimization of the membrane in the membrane distillation process.

[1] Robert Field, Ho Y. Wu, Jun J. Wu, Multiscale Modeling of Membrane Distillation: Some Theoretical Considerations, *Ind. Eng. Chem. Res*, **52**, 8822−8828