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# Towards optimization of spacer geometrical characteristics for spiral wound membrane modules

C.P. Koutsou, A.J. Karabelas*

*Chemical Process Engineering Research Institute (CPERI) Centre for Research and Technology – Hellas (CERTH), 6th km Charilaou-Thermi Road, PO Box 6036, Thermi-Thessaloniki, 57001, Greece*
*Tel. +30 2310 498181; email: karabaj@cperi.certh.gr*

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**ABSTRACT**

Key parameters in the design of spiral wound elements are the geometrical characteristics of net-type spacers at the feed-flow channels, which greatly influence the transport phenomena therein and the overall operation of these modules. Recent results from a comprehensive theoretical and experimental study, on the fl ow characteristics and mass transfer in narrow channels with spacers, summarized in this paper, provide basic information that enables optimization of spacer characteristics. The new results include correlations of pressure drop and of average mass transfer rates to the wall as well as distributions of local shear stress and mass transfer, as a function of Reynolds and Schmidt number and of spacer geometry. An assessment of spacers, based on the above results, indicate trends, regarding geometric parameter values, leading to improved membrane element performance. Numerical results are also presented of an example, involving a single element in a RO seawater desalination plant, which demonstrate the applicability of the proposed new expressions for optimizing spacer and system performance. Finally, it is argued that an "optimum" spacer geometry depends on the kind of membrane operation (RO, NF, UF) employed to treat feed water of specific characteristics, which implies that most likely there exists no single spacer geometry with universally optimum performance.

*Keywords*: Spiral wound membrane elements; Spacers; Pressure drop; Shear stresses; Mass transfer coefficients; Optimization of performance

* Corresponding author.