# Study of the performance in Membrane Distillation of PVDF membranes prepared with green solvents and specific coatings

M. C. Carnevale[1*], F. Russo[1], A. Corozzi[2], M. Raimondo[2], R. Conti[3], M. Aquino[4], S. Santoro[4], E. Curcio[4], A. Figoli[1], A. Criscuoli[1*]

[1] *Institute on Membrane Technology (CNR-ITM), Via P. Bucci 17/C 87036 Rende (CS), Italy*
[2] *Institute of Science and Technology for Ceramics (ISSMC), Via Granarolo, 64 - 48018 Faenza (RA), Italy*
[3] *GVS SpA, via Roma 50, 40069 Zola Predosa (BO), Italy*
[4] *Dept. of Environmental Engineering (DIAm), University of Calabria, Via P. Bucci 45, 87036 Rende (CS), Italy*
**Corresponding Author's E-mail: mc.carnevale@itm.cnr.it; a.criscuoli@itm.cnr.it*

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**Introduction**

Membrane Distillation (MD) is a process that can be successfully used for the treatment of industrial wastewater, but the membranes employed must have specific requirements in order to avoid problems of interaction between the feed species and the membrane surface, and consequently wetting phenomena. This aspect becomes particularly important when the membranes used are prepared with solvents defined "green" to replace the traditional toxic solvents. Based on the above considerations, the work presents a study on the performance of membrane distillation, in terms of distillate flux, when flat PVDF membranes, prepared via phase inversion with a specific green solvent (γ-Valerolactone-GVL) and using a particular coating (to reduce wetting issues), are employed. A comparison with the performance of PVDF commercial membranes (both coated and uncoated) is also included.

**Experimental/methodology**

Contact angle measurements on PVDF lab made/commercial uncoated/coated membranes with pore size ranging from 0.2 to 0.8 μm were carried out and a comparison in terms of distillate fluxes was made. In particular, the experimental tests were conducted in Direct Contact Membrane Distillation (DCMD) configuration using deionised water as feed at the following operative conditions: membrane area of 40 $cm^2$, feed/distillate inlet pressure of 1 atm, feed flow rate ($Q_{feed}$) of 66 L/h, feed temperature ($T_{feed}$) around 60°C, distillate flow rate ($Q_{dist}$) of 42 L/h and distillate temperature ($T_{dist}$) of 20 °C.

**Results and discussion**

The results have shown a significant enhancement of the hydrophobicity for coated membranes together with an improvement of the repellency in case of tests with a specific wastewater produced in a membrane manufacturing plant. The data of permeate flux for 0.2 μm coated membranes have highlighted a significant reduction of flux with respect to uncoated ones, probably due to partial occlusion of the pores and a lower porosity.

Subsequently, to obtain higher permeate fluxes, further DCMD tests, at the same operating conditions, were conducted on coated lab and commercial membranes with bigger pore size (around 0.45 and 0.8 μm). The coated membranes still led to a decrease in flux when compared to the uncoated ones, however, these fluxes were higher than those registered for the 0.2 coated membranes, thus leading to a higher MD productivity.

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