**Superhydrophobicity using plasma nanotechnology for superior membrane distillation and anti-fouling performance**

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**ABSTRACT**

Membrane distillation (MD), as a technique for high salinity feedwater treatment, receives increasing interest since many regions of the world are facing water scarcity and the demands for clean water are rising. To be capable of desalination a membrane needs to be porous, in order to allow water vapour to pass through and also hydrophobic, in order to prevent mass transfer of liquids and resist capillary condensation within the pores. While there are several MD methods, in this work we focus on Direct Contact Membrane Distillation (DCMD). In this method the membrane is in contact with liquids on both sides and due to temperature difference between the two streams, water vapour from the hot feed solution passes through the pores and condenses on the cold solution on the other side [1]. Recently superhydrophobicity became a requirement in membrane fabrication and modification since it has been proven to improve performance in terms of distilled water flux, stability, scaling and fouling resistance in long-term MD operations [2]–[7]. In this work we introduce a novel and environmentally friendly method by means of plasma micro-nanotexturing followed by plasma deposition for transforming commercial membranes, both hydrophobic and hydrophilic, to superhydrophobic [8]–[10]. To this direction, we render superhydrophobic initially hydrophobic Polytetrafluoroethylene (PTFE) as well as initially hydrophilic Cellulose acetate (CA) membranes. All plasma treated membranes give enhanced distilled water flux in MD with very high salt rejection due to superhydrophobicity, increased pore size and porosity. Additionally the bio-fouling resistance of plasma treated membranes was investigated by adding bovine serum albumin (BSA) to the saline solution; plasma treated membranes were able to resist wetting and pore clogging by preventing the adsorption of proteins and give increased permeate flux up to 75 % compared to pristine membrane samples.

**KEYWORDS:** membrane distillation, plasma nanotexturing, superhydrophobic membranes

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