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**Title:**

**Graphene oxide incorporated polysulfone substrate for the fabrication of flat-sheet thin-film composite forward osmosis membranes**

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The preparation and performances of the newly synthesized thin film composite (TFC) forward osmosis (FO) membranes with graphene oxide (GO)-modified support layer are presented in this study. GO nanosheets were incorporated in the polysulfone (PSf) to obtain PSf/GO composite membrane support layer. Polyamide (PA) active layer was subsequently formed on the PSf/GO by interfacial polymerization to obtain the TFC-FO membranes. Results reveal that at an optimal amount of GO addition (0.25 wt%), a PSf/GO composite support layer with favorable structural property measured in terms of thickness, porosity and pore size can be achieved. The optimum incorporation of GO in the PSF support layer not only significantly improved water permeability but also allowed effective PA layer formation, in comparison to that of pure PSf support layer which had much lower water permeability. Thus, a TFC-FO membrane with high water flux (19.77 $Lm^{-2}h^{-1}$ against 6.08 $Lm^{-2}h^{-1}$ for pure PSf) and reverse flux selectivity (5.75 $Lg^{-1}$ against 3.36 $Lg^{-1}$ for pure PSf) was obtained under the active layer facing the feed solution or AL-FS membrane orientation. Besides the improved structural properties (reduced structural parameter, S) of the support layer, enhanced support hydrophilicity also contributed to the improved water permeability of the membrane. Beyond a certain point of GO addition (≥0.5 wt%), the poor dispersion of GO in dope solution and significant structure change resulted in lower water permeation and weaker mechanical properties in support as well as FO flux/selectivity of consequent TFC membrane. Overall, this study suggests that GO modification of membrane supports could be a promising technique to improve the performances of TFC-FO membranes.