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Abstract

Polyvinylidene fluoride (PVDF) is a popular membrane material, but it has the drawback of relatively high fouling potential. In this study, we prepared carboxylated nanodiamonds (CNDs) by thermal oxidation, and then incorporated CNDs into PVDF membranes during phase inversion. Transmission electron microscopy (TEM) showed that the CNDs had minimized aggregation and better dispersity compared with the raw nanodiamonds. The prepared membranes were characterized by Fourier-transform infrared spectroscopy (FTIR), scanning electron microscope (SEM), atomic force microscopy (AFM) and water contact angle analysis. The bulk porosities and pore sizes of the membranes were evaluated by the gravimetric method and the filtration method, respectively; surface pores were evaluated based SEM images. Compared with the pristine PVDF membrane, CNDs blended membranes had larger porosities and surface pore sizes, higher water permeabilities and hydrophilicities, smoother surfaces, and improved antifouling and cleaning performance due to the incorporation of hydrophilic carboxyl groups. In particular, the irreversible fouling ratio to the total fouling ratio (R_{ir}/R_t) dropped from 85% for the pure PVDF membrane to 21% for the CNDs blended membrane. Our study demonstrates that CNDs are excellent pore-forming fillers in developing