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Using of TFC Polysulfone Electrospun Nanofiber Mats in Oil-Water Separation

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Abstract : Membrane technology is the most promising process for oil-water separation operation if the hydrophilicity, fouling and reusability properties could be improved. In this study, novel effective and reusable membrane for oil-water separation process is introduced based on modification of polysulfone (PSF) electrospun nanofiber mats. The modification process was achieved by incorporation of NaOH nanoparticles inside the PSF nanofibers, and formation of a thin layer from a polyamide polymer on the surface of the electrospun mat. Typically, solutions composed of PSF and NaOH (twelve solutions were prepared based on different PSF concentrations; 15, 18 and 20 wt%, and various NaOH content; 1.5, 1.7 and 2.5 wt%) have been electrospun, then the dried nanofiber mats were treated by m-phenylenediamine and 1,3,5-benzenetricarbonyl chloride to form polyamide thin layer on the surface of the mats. The results indicated that incorporation of NaOH and the formed polyamide could decrease the water contact angle from ~ 130˚ to 13˚ for the nanofiber mats obtained from 20 wt% PSF solutions containing 1.7 wt% sodium hydroxide powders. Interestingly, the membrane having the lowest contact angle could separate oil-water mixture for three successive cycles and 100% removal of the oil with relatively high water flux; 5.5 m3/m2.day. Overall, simplicity of the manufacturing technique, and effectiveness and reusability of the produced nanofiber mats open new avenue for the introduced as promising membranes for the oil-water separation process.

Keywords : electrospinning, oil-water separation, hydrophilic membrane, nanofibers
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