Ultrafiltration of oil/water emulsions using PVDF/PC blend membranes

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ABSTRACT

Membranes with varying degrees of hydrophilicity made from blends of poly(vinylidene fluoride) (PVDF) and polycarbonate (PC) were prepared to recover water from emulsified oily wastewater. The effects of different amounts of PC content on the structure, hydrophilicity, and functionality of these PVDF/PC membranes were analyzed using contact angle measurements, scanning electron microscope and energy dispersion X-ray analysis, liquid–liquid displacement, and a fouling test with an oil/water emulsion. The slightly hydrophilic character of the PC decreases the hydrophobicity of the blend membranes compared to a pure PVDF membrane. Increasing the amount of PC in the casting solution causes little change in average pore size but a substantial change in the membrane’s porosity and surface structure, with these changes reflected in the efficiency of the membranes with respect to recovering water from the emulsified oily wastewater. The best performance, meaning less membrane fouling and better permeate quality, was obtained using a blend membrane containing 20% PC, which achieved an initial permeate flux of 28.59 L/m²·h with a limiting permeate flux of 22.11 L/m²·h, a COD of 88 ppm in the permeate solution, and 97.8% oil retention.

Keywords: Poly(vinylidene fluoride); Polycarbonate; Blend membranes; Oily wastewater emulsion; Ultrafiltration