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Abstract

A gradient composite membrane has been put forward in this paper, which is cost-efficient and remarkable to solve the problem of inherent tradeoff between flux and selectivity. The hierarchical composite membrane exhibited an ideal morphology, which was comprised of oxidized multi-wall carbon nanotubes (OMWCNTs) functional layer built via electrospraying, ultrathin electrospun polyacrylonitrile (PAN) midlayer and microfibrous polypropylene (PP) nonwoven support. Experimental results showed that when the additive amount of OMWCNTs was 1wt%, the composite membranes presented an excellent flux (up to 3891.85 L m^{-2} h^{-1} at a low pressure of 0.1 MPa) and a superior indigo rejection ratio (98.73%). Compared with PAN/PP composite membrane, its rejection ratio increased 3.11 times, while the water flux only reduced 17.30%. It was owing that the excellent hydrophilicity of OMWCNTs network and ultrathin electrospun PAN midlayer endowed the composite membrane with a high flux. And the high rejection efficiency of OMWCNTs-PAN/PP composite membranes was achieved on the account of the combination of gradient structures (i.e., OMWCNTs network and ultrathin PAN nanofibrous membrane) and multilevel filtration mechanisms. Therefore, the OMWCNTs-PAN/PP composite membranes have opened up an innovative alternative for the fabrication of high flux and rejection composite membranes in wastewater treatment.

Keywords:
Ultrathin electrospun nanofibrous membrane; Electrospraying; Multi-wall carbon nanotubes; High flux; Dye removal

1. Introduction

With the development of textiles and paper industries, harmful organic molecules derived from sewage disposal such as dyes, metal ions, *etc.*, have become a serious hazard to environment and human health[1, 2]. A variety of techniques, including chemical oxidation[3], biodegradation[4], adsorption[5], filtration[6], *etc.*, have been used to separate contaminations from wastewater. Related to these means, filtration

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