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ENHANCING HYDROPHILICITY OF POLYSULFONE MEMBRANE SURFACE BY UV IRRADIATION OF DIFFERENT WAVELENGTHS AND BY PEG GRAFTING

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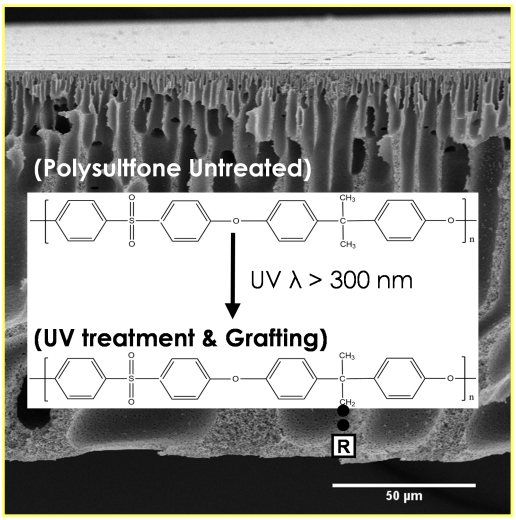
Graphical abstract



Abstract

Polysulfone polymer (PSF) membrane has disadvantages due to its hydrophobicity, which may cause fouling and reduce separation performance. Therefore, this study aimed to enhance the hydrophilicity of PSF membranes by using irradiation at different ultraviolet (UV) wavelengths, followed by Poly(ethylene glycol) (PEG) grafting on the PSF surfaces. The hydrophilicity of the treated membrane surfaces was examined by measuring water contact angle (WCA), surface energy (SE), surface morphology, functional groups, salt rejection, and water flux in a filtration instrument. The results show that with long UV treatment for up to 72 h, the 312 nm wavelength gave lesser WCA than treatment at 254 nm. The treated PSF membrane irradiated at 312 nm for 72 h, followed by PEG grafting, was effectively improved and retained increased hydrophilicity for up to thirty days.

Keywords: UV treatment, PEG-grafting, Surface modification, hydrophilicity, polar component

1.0 INTRODUCTION

Membrane technology is pervasive in the industry. Polysulfone (PSF) has been widely used as a polymer in the commercial production of microfiltration and ultrafiltration membranes, due to several advantages, such as good mechanical, chemical, and thermal properties, and easy film-forming [1, 2]. However, PSF membranes tend to have severe fouling during filtration due to natural hydrophobicity, low surface energy, and non-ionic character [3]. The membrane surface properties play a key role in the interactions with atoms or molecules or other active particles. Many polymers that have been used in membranes are hydrophobic with a low surface energy, such as poly(ethylene terephthalate)(24.2 mN/m), poly(propylene)(29.5 mN/m), and poly(vinylidene fluoride)(42-47 mN/m) [4,5]. If the membrane surface is hydrophilic with a high surface energy, this reduces fouling due to electrostatic repulsion of other molecules from the membrane surface [6]. Several methods have been used in many studies to improve membrane surface energy, such as coating with a hydrophilic polymer for increased hydrophilicity of