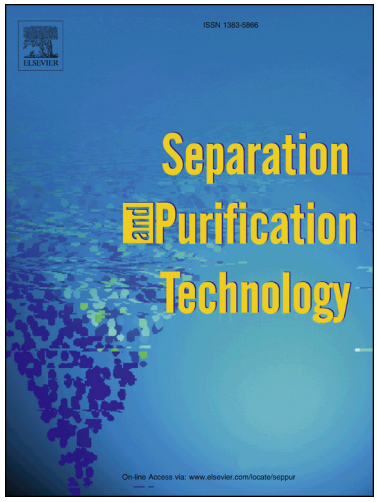

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Habib Etemadi, Reza Yegani, Mahdi Seyfollahi

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The effect of amino functionalized and polyethylene glycol grafted nanodiamond on anti-biofouling properties of cellulose acetate membrane in membrane bioreactor systems

Habib Etemadi[a, b], Reza Yegani[a, b,*], Mahdi Seyfollahi[a, b]

[a] *Faculty of Chemical Engineering, Sahand University of Technology, Tabriz, Iran*
[b] *Membrane Technology Research Center, Sahand University of Technology, Tabriz, Iran*

[*] *Corresponding author: Reza Yegani; E-mail address: ryegani@sut.ac.ir*

Abstract

In this work, cellulose acetate (CA) nanocomposite membranes were prepared by embedding amino functionalized nanodiamond (ND-NH_2) as well as polyethylene glycol grafted ND (ND-PEG); 0 to 0.75 wt.%, in order to improve the membrane surface hydrophilicity and subsequently reduce membrane biofouling in the membrane bioreactor (MBR) system. Scanning electron microscopy (SEM) and contact angle measurements were used to determine the surface properties of the membranes. To compare the prepared nanocomposite membranes with pure CA membrane, critical flux, fouling behavior, and anti-fouling properties against extracellular polymeric substances (EPS) were studied. The Fourier transform infrared (FT-IR) spectra analysis showed that the NH_2 functional groups and PEG molecule formed on the surface of ND. Maximum improvement in tensile strength and hydrophilicity properties of CA membrane was observed at 0.5 wt.% loading of ND-PEG. Also, higher critical flux and anti-fouling properties was obtained by CA/ND-PEG (0.5 wt.%) nanocomposite membrane due to the change in surface characteristics. Analysis of extractable EPS showed that the concentrations of proteins and carbohydrates in the EPS and soluble microbial products (SMP) for CA/ND-NH_2 (0.5 wt.%) and CA/ND-PEG (0.5 wt.%) membrane are less than that of other membranes. Meanwhile, COD