Fabrication of Electro Spun Nylon6.12/Chitosan @PES Nanofibrous UF Membrane Towards Dyes Rejection From Synthetic Wastewater

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Abstract

Nanofibrous ultrafilter of nylon6.12/chitosan@Poly ether sulfone (N6.12/CS@PES) membrane were fabricated by chitosan casted PES membrane and coated with nylon6.12 thin layer using electrospinning technique for dye rejection. The membranes were characterized by scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FT-IR), and X-ray diffraction (XRD). Both of cationic and anionic dye rejection capability of the membrane was investigated for basic blue dye41 and alizarin red dye, respectively, as dyes were investigated with respect to solution parameters (pH, Zeta potential, pressure, dye concentration and different electrolyte) through filtration system. In addition, the effect of parameters and their possible interactions on dye rejection have been studied. An enhanced hydrophilicity and antifouling property was observed for the composite membrane as compared to pristine PES ultrafiltration membranes. The results show that the rejection of dyes increase with the decreases of operating pressure. At optimum condition of PH=7, and pressure=10 bar and concentration=220 mg/L, the rejection ratio improves from 75.3 to 99.5% and 71 to 82% for basic blue dye41 and alizarin red dye, respectively. Dye rejection are not changed after 7 cycles and not change separation efficiency of dyes. The mechanical and electrical properties were investigated for PES and N6.12 / CS@PES composite membrane. The results showed that the N6.12 / CS@PES composite membrane exhibited the highest mechanical properties and the highest dielectric constant especially at low frequencies with low dielectric loss. This study demonstrated that the developed nanofibrous composite membrane were successfully characterized and proved to be a good rejection for dyes from aqueous solutions.

Full-text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the manuscript can be downloaded and accessed as a PDF.

Figures

Figure 1

Process flow diagram of the synthesis of N6.12/CS@PES composite membrane.

Figure 2

SEM of nylon layer formed over hydrophobic PES membrane (N6.12/PES).

Figure 3

SEM of nylon layer formed over hydrophobic PES membrane which blended with hydrophilic chitosan (N6.12/CS@ PES).

Figure 4

FT-IR spectra of PES, N6.12, CS and N6.12/CS@ PES composite membrane.

Figure 5

XRD spectra of PES and N6.12/CS@ PES composite membrane.

Figure 6

Zeta potential of PES, N6.12, CS and N6.12/CS@ PES composite membrane.

Figure 7

Rejection (%) of different electrolytes using (a) PES membrane (b) N6.12/CS@ PES composite membrane.

Figure 8

Rejection (%) of different dyes using (a) PES membrane (b) N6.12/CS@ PES composite membrane.

Figure 9

Effect of pH on the rejection of Basic blue dye 41(R1) and Alizarin red (R2) in (a) PES membrane and (b) N6.12/CS@ PES composite membrane.

Figure 10

Effect of pressure on the rejection of Basic blue dye 41(R1) and Alizarin red (R2) in (a) PES membrane and (b) N6.12/CS@ PES composite membrane.

Figure 11

Regeneration cycles of the rejection of Basic blue dye 41(R1) and Alizarin red (R2) in composite membrane.

Figure 12

The variation of (a) tensile storage modulus and (b) the damping parameter with temperature for the PES and N6.12/CS@PES composite membranes.

Figure 13

The variation of (a) dielectric constant and (b) dielectric loss with frequencies for the PES and N6.12/CS@PES composite membranes.

Figure 14

The variation of (a) real electrical modulus and (b) imaginary electrical modulus with frequencies for the PES and N6.12/CS@PES composite membranes.