PENGARUH KONSENTRASI KITOSAN TERHADAP KARAKTERISTIK DAN KINERJA MEMBRAN KOMPOSIT PES/MWCNT

SKRIPSI

Diajukan untuk memenuhi salah satu syarat memperoleh gelar
Sarjana Sains Program Studi Kimia

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LEMBAR HAK CIPTA

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HALAMAN PENGESAHAN

PENGARUH KITOSAN TERHADAP KARAKTERISTIK DAN KINERJA *MIXED MATRIX MEMBRANE* PES/MWCNT

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ABSTRAK

Teknologi pemurnian air menggunakan membran ultrafiltrasi merupakan salah satu solusi untuk mengatasi permasalahan air bersih. Penelitian ini bertujuan untuk mengetahui pengaruh penambahan kitosan terhadap karakteristik dan kinerja membran komposit PES/MWCNT. Membran PES/MWCNT disintesis melalui metode inversi fasa dengan komposisi optimum PES (15 g) dan MWCNT (1 mg) dalam pelarut dimetilasetamida (DMAc). Campuran larutan MWCNT dan CS (konsentrasi 0.1%, 0.25%, dan 0.5%) ditambahkan pada membran PES melalui metode *in-situ solution mixing*. Membran dikarakterisasi dengan spektroskopi *Fourier Transform Infrared* (FTIR), *X-ray Diffraction* (XRD), hidrofilisitas, dan porositas. Kinerja membran ditentukan melalui uji permeabilitas, rejeksi, serta *molecular weight cut off* (MWCO) menggunakan model crossflow. Hasil penelitian menunjukkan bahwa interaksi antara PES, MWCNT, dan CS berlangsung melalui metode *in-situ solution mixing* diindikasikan dengan adanya pergeseran pada serapan khas spektrum FTIR S=O dari 1107 cm^{-1} menjadi 1113 cm^{-1} C=C dari 1479 cm^{-1} menjadi 1491 cm^{-1}, C=O dari 1574 cm^{-1} menjadi 1580 cm^{-1}, C-O dari 1237 cm^{-1} menjadi 1243 cm^{-1}, O=C=O dari 2362 cm^{-1} menjadi 2364 cm^{-1}, dan serapan N-H dari 3415 cm^{-1} menjadi 3428 cm^{-1}. Difraktogram sinar-X menunjukkan bahwa penambahan CS mengakibatkan peningkatan intensitas dan pergeseran puncak pada 2θ 18,04º, 52,50º, dan 9,93º, serta meningkatnya ukuran kristal dari 1,037 mm (P) menjadi 1,677mm (PCC-3) dan kristalinitas membran dari 56,32% (P) menjadi 78,71% (PCC-3). Porositas dan hidrofilisitas membran komposit meningkat seiring dengan penambahan konsentrasi CS dari 61,77% (P) menjadi 83,71% (PCC-3), dan dari 71,72° (P) menjadi 60,37° (PCC-3) secara berturut-turut. Permeabilitas membran meningkat dari 9,25 $L/m^2.h$ (P) ke 30,72 $L/m^2.h$ (PCC-2). Permselektivitas (rejeksi) membrane terhadap variasi konsentrasi Bovin Serum Albumin (BSA) 100-400 ppm meningkat dari 8,12%, 16,97%, 30,11%, dan 52,47% (P) menjadi 58,55%, 62.42%, 68.18%, dan 82.76% (PCC-3) secara berturut-turut. *Molecular weight cut off* (MWCO) membran mencapai <6,00 kDa. penambahan CS meningkatkan kinerja membran komposit PES/MWCNT dalam proses filtrasi.

Kata kunci: Membran komposit, PES/MWCNT/CS, karakterisasi, uji kinerja, *crossflow*

ABSTRACT

Water purification technology using ultrafiltration membranes is one solution to overcome the problem of clean water. This study aims to determine the effect of chitosan addition on characterization and performance of PES/MWCNT composite membranes. PES/MWCNT membranes were synthesized via phase inversion method with optimum composition of PES (15 g) and MWCNT (1 mg) in dimethylacetamide solvent (DMAc). A mixture of MWCNT and CS solutions (concentrations of 0.1%, 0.25%, and 0.5%) is added to the PES membrane through the in-situ solution mixing method. Membranes are characterized by Fourier Transform Infrared (FTIR), X-ray Diffraction (XRD), hydrophilicity, and porosity spectroscopy. Membrane performance is determined through permeability, injection, and molecular weight cut off (MWCO) tests using a crossflow model. The results showed that the interaction between PES, MWCNT, and CS took place through the in-situ solution mixing method indicated by a shift in the typical absorption of the FTIR spectrum S=O from 1107 cm^{-1} to 1113 cm^{-1}, C=C from 1479 cm^{-1} to 1491 cm^{-1}, C=O from 1574 cm^{-1} to 1580 cm^{-1}, C-O from 1237 cm^{-1} to 1243 cm^{-1}, O=C=O from 2362 cm^{-1} to 2364 cm^{-1}, and N-H uptake from 3415 cm^{-1} to 3428 cm^{-1}. X-ray diffractograms showed that the addition of CS resulted in increased intensity and peak shifts at 2θ 18.04o, 52.50o, and 9.93o, as well as increased crystal size from 1.037 mm (P) to 1.677mm (PCC-3) and membrane crystallinity from 56.32% (P) to 78.71% (PCC-3). The porosity and hydrophilicity of the composite membrane increased with the increase in CS concentration from 61.77% (P) to 83.71% (PCC-3), and from 71.72° (P) to 60.37° (PCC-3) respectively. Membrane permeability increased from 9.25 L/m2.h (P) to 30,72 L/m2.h (PCC-2). Permselectivity (injection) of membranes against variations in Bovin Serum Albumin (BSA) concentrations of 100-400 ppm increased from 8.12%, 16.97%, 30.11%, and 52.47% (P) to 58.55%, 62.42%, 68.18%, and 82.76% (PCC-3) respectively. Molecular weight cut off (MWCO) membrane reaches <6.00 kDa. the addition of CS improves the performance of PES/MWCNT composite membranes in filtration processes.

Keywords: *Composite membrane, PES/MWCNT/PES, characterization, performance test, cross-flow*

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DAFTAR GAMBAR

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