PERMEASI ASETON, *n*–BUTANOL, DAN ETANOL (ABE) MENGGUNAKAN MEMBRAN PADUAN POLI(VINIL ALKOHOL)-BIOPOLIMER YANG TERIKAT SILANG

INTISARI

Telah dilakukan penelitian mengenai permeasi aseton, n-butanol dan etanol (ABE) menggunakan membran paduan poli(vinil alkohol)-biopolimer yang terikat silang. Poli(vinil alkohol) atau PVA digunakan sebagai membran dasar, sedangkan biopolimer yang digunakan adalah pektin dan natrium alginat (NaAlg). Gluteraldehida (GA) dan asam malat (AM) ditambahkan sebagai agen pengikat silang. Penelitian ini bertujuan untuk mencari komposisi optimum pada pembuatan membran paduan PVA-biopolimer dengan penambahan agen pengikat silang GA atau AM. Membran optimum dipilih berdasarkan membran dengan nilai fluks tertinggi serta mempunyai sifat fisikokimia terbaik. Membran dengan komposisi optimum akan diaplikasikan untuk permeasi etanol hasil fermentasi.

Penelitian ini mempunyai tiga tahapan, meliputi (1) optimasi membran dengan mempelajari pengaruh konsentrasi PVA, penambahan agen pengikat silang, penambahan biopolimer, ketebalan membran dan konsentrasi sampel ABE; (2) mempelajari sifat fisikokimia membran yang mempunyai komposisi optimum, meliputi analisa secara spektrofotometri inframerah (*Fourier transform infrared spectroscopy*/FTIR), mikroskop electron (*Scanning Electron Microscope*/SEM), analisis simultan termogravimetri dan perbedaan panas/TG-DTA), dan sifat mekanik meliputi kekuatan tarik (*tensile strength*/TS) dan derajat penggembungan (*swelling degree*/SD); (3) aplikasi membran optimum untuk permeasi etanol hasil fermentasi. Optimasi membran dipelajari berdasarkan kecepatan permeasi (nilai fluks) dari masing–masing sampel (ABE) saat melewati membran. Membran dengan nilai fluks tertinggi dipilih sebagai membran optimum.

Hasil penelitian menghasilkan beberapa kesimpulan: (1) Penambahan agen pengikat silang mengakibatkan nilai fluks menurun tetapi stabilitas membran meningkat. Nilai fluks tertinggi dihasilkan dari membran yang terikat silang dengan jumlah ikatan silang (n) sebesar 120 (GA) dan 90 (AM); (2) Penambahan biopolimer mengakibatkan nilai fluks meningkat tetapi stabilitas membran menurun. Nilai fluks tertinggi dihasilkan dari membran paduan PVA-pektin-GA dengan komposisi optimum pada perbandingan mol PVA : pektin = (1:2), sedangkan membran paduan PVA-NaAlg-AM mempunyai komposisi optimum pada perbandingan mol PVA : NaAlg = (1:½); (3) Membran paduan PVA-pektin-GA dan PVA-NaAlg-AM merupakan membran yang bersifat homogen dan tidak berpori, dengan ketebalan optimum berkisar antara 0,9-1,2 mm, serta dapat diaplikasikan untuk permeasi etanol hasil fermentasi.

Kata kunci: poli(vinil alkohol), biopolimer, pengikat silang

PERMEATION OF ACETONE, *n*–BUTANOL, AND ETHANOL (ABE) USING CROSSLINKED BLENDED POLY(VINYL ALCOHOL)–BIOPOLYMER MEMBRANE

ABSTRACT

A study on the permeation of acetone, *n*-butanol and ethanol (ABE) using blended membrane of crosslinked poly(vinyl alcohol)-biopolymers has been performed in where poly(vinyl alcohol) or usually called PVA was used as a membrane base, pectin and natrium alginate (NaAlg) were used as biopolymers, and glutaraldehyde (GA) or malic acid (MA) were added as crosslinking agents. The study was aimed to determine an optimum composition of PVA-biopolymer blended membranes with additional GA or MA as crosslinking agents. An optimum membrane was selected based on its high flux value and its better physicochemical characteristics. A membrane with an optimum composition would be applied on ethanol permeation resulted from fermentation.

This study was divided into three stages; i.e., (1) ptimization of membrane which performed by studying the effect of PVA concentration, crosslinking agent addition, biopolymeric addition, membrane thickness and ABE samples concentration; (2) studying physicochemical characteristics of membranes which had optimum composition including analysis using infrared spectrophotometry (Fourier transform infrared spectroscopy/FTIR), electron microscope (Scanning Electron Microscope/SEM), simultaneous thermogravimetric-differential thermal analyses /TG-DTA) and mechanical characteristics including tensile strength/TS and swelling degree/SD) ; (3) optimum membrane application to permeate ethanol resulted from fermentation process. Membrane optimization was studied based on permeation rate (flux value) of each sample (ABE) when crossing the membrane. A membrane with higher flux was selected as the optimum membrane.

The study found some results; i.e., (1) The addition of crosslinking agents led to decreased of flux value but increased the stabilization of membranes. The highest value of flux was resulted from crosslinked membrane that have degree of polymerization (n) are 120 (GA) and 90 (MA); (2) The addition of biopolymers led to increase of flux value but decreased the stabilization of membrane. The highest value of flux was resulted from blended membranes of PVA-pectin-GA when the composition was optimum and the mole ratio of PVA : pectin was 1:2. It was also resulted from blended membranes of PVA-NaAlg-MA with an optimum composition and the mole ratio of PVA : NaAlg was 1:½; (3). The blended membranes of PVA-pectin-GA and PVA-NaAlg-MA were homogenous and non-porous with optimum thickness ranging from 0.9 to 1.2 mm, and could be applied to permeate ethanol resulted from fermentation process.

Keywords: poly(vinyl alcohol), biopolymer, crosslinking agent