ADSORPSI DAN DESORPSI BIRU METILEN PADA MEMBRAN MAKROPORI KITOSAN-KARBOKSIMETIL SELULOSA

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INTISARI

Telah dilakukan adsorpsi dan desorpsi biru metilen pada membran makropori kitosan-karboksimetil selulosa tertaut silang glutaraldehida dan SiO_2 sebagai porogen. Membran makropori diperoleh dengan mencampurkan larutan CMC 0,1% (b/v) dan larutan kitosan 1% (b/v) yang telah diatur pada pH 5. Setelah silika dan glutaraldehida ditambahkan, larutan diuapkan pada suhu 70 °C. Membran makropori dikarakterisasi menggunakan FTIR dan SEM. Pada kajian adsorpsi dipelajari pengaruh komposisi membran, waktu kontak, pH, jumlah porogen, kinetika adsorpsi-desorpsi, pola isoterm adsorpsi, kapasitas adsorpsi, dan energi adsorpsi.

Pelepasan porogen SiO_2 dari membran untuk menghasilkan membran makropori ditunjukkan oleh hilangnya puncak tajam pada daerah serapan 1095 cm^{-1} yang merupakan vibrasi ulur asimetri Si-O dari Si-O-Si. Citra SEM membran makropori menunjukkan permukaan kasar dan berpori berbeda dengan permukaan halus pada membran tanpa porogen. Kondisi optimum untuk adsorpsi biru metilen diperoleh pada membran makropori dengan komposisi kitosan:CMC sebesar 30:70, adsorpsi menit ke-30, pH 8, dan jumlah porogen 50%. Adsorpsi biru metilen mengikuti kinetika reaksi orde dua semu dengan pola isoterm Langmuir. Kapasitas adsorpsi maksimum sebesar 158,7 mg g^{-1} dan energi adsorpsi sebesar 23,0 kJ mol^{-1}. Desorpsi maksimum biru metilen menggunakan NaCl 1 M mengikuti kinetika reaksi orde dua semu.

Kata kunci: membran makropori, biru metilen, adsorpsi, desorpsi, kinetika reaksi

ADSORPTION AND DESORPTION OF METHYLENE BLUE ON CHITOSAN-CARBOXYMETHYL CELLULOSE MACROPOROUS MEMBRANE

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ABSTRACT

A study on the adsorption and desorption of methylene blue on chitosan-carboxymethyl cellulose macroporous membrane crosslinked by glutaraldehyde and SiO_2 as porogen has been conducted. The macroporous membrane had been obtained by mixing a solution of CMC 0,1% (w/v) and chitosan 1% (w/v) which has been set to pH 5. After silica and glutaraldehyde were added, the solution was evaporated at 70 °C. The macroporous membranes were characterized using FTIR and SEM. In the adsorption study, the effect of membrane composition, contact time, pH, the amount of porogen, adsorption-desorption kinetics, adsorption isotherms pattern, adsorption capacity, and adsorption energy were examined.

The release of SiO_2 porogen from the membrane to produce macroporous membrane was indicated by disappearance of a sharp peak absorption area at 1095 cm^{-1} which is asymmetric stretching vibration of Si-O from Si-O-Si. SEM image of macroporous membrane showed a rough and porous surface in contrast to smooth surface of non porogen membrane. The optimum conditions for adsorption of methylene blue was obtained on the macroporous membrane with chitosan:CMC composition of 30:70, 30 min adsorption, at pH 8, and the amount of porogen 50%. The adsorption of methylene blue followed the pseudo second order reaction kinetics with the Langmuir isotherm pattern. The adsorption capacity was 158.7 mg g^{-1} and the adsorption energy was 23.0 kJ mol^{-1}. The maximum desorption of methylene blue using NaCl 1 M followed pseudo second order reaction kinetics.

Key words: macroporous membrane, methylene blue, adsorption, desorption, reaction kinetics