ZEOLIT ALAM TERMODIFIKASI SETILTRIMETILAMMONIUM BROMIDA (CTAB) SEBAGAI ADSORBEN SENYAWA ORGANIK NONPOLAR BENZENA DAN BENZALDEHIDA

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INTISARI

Modifikasi zeolit alam Klaten dengan surfaktan setiltrimetilamonium bromida (CTAB) sebagai adsorben senyawa organik nonpolar benzena dan benzaldehida telah berhasil dilakukan. Kemampuan adsorpsi zeolit alam termodifikasi CTAB (SMZ-CTAB) untuk adsorpsi benzena dan benzaldehida diuji menggunakan sistem *batch*. Penelitian diawali dengan pengayakan dan pencucian zeolit alam dengan akuades, kemudian zeolit alam (ZA) diaktivasi dengan larutan HCl 3 M pada temperatur 72 ^{o}C selama 30 menit menghasilkan zeolit alam aktivasi (ZAA). ZAA dimodifikasi dengan surfaktan CTAB pada konsentrasi sama dengan kapasitas tukar kation (KTK) untuk memperoleh *Surfactant Modified Zeolite-Cetyltrimethylammonium Bromide* (SMZ-CTAB). ZA, ZAA, dan SMZ-CTAB dikarakterisasi dengan spektrofotometer FTIR dan difraktometer sinar-X. Adsorpsi benzena dan benzaldehida dipelajari pengaruh waktu kontak,variasi adsorben, variasi konsentrasi adsorbat, model kinetika adsorpsi, dan model isoterm adsorpsi. Konsentrasi benzena dan benzaldehida yang tidak teradsorpsi dianalisis dengan spektrofotometer UV-Vis.

Hasil penelitian menunjukkan bahwa komponen utama zeolit alam Klaten terdiri dari mordenit dan klinoptilolit. Urutan nilai KTK adalah SMZ-CTAB (0,769 meq g^{-1}) < ZAA (1,028 meq g^{-1}) < ZA (1,056 meq g^{-1}). Adsorpsi benzena dan benzaldehida mengikuti model isoterm adsorpsi Freundlich. Kapasitas adsorpsi SMZ-CTAB terhadap adsorbat benzena 2,50 mmol g^{-1} dan kapasitas adsorpsi SMZ-CTAB terhadap adsorbat benzaldehida 5,52 mmol g^{-1}. Kemampuan adsorpsi benzena oleh adsorben SMZ-CTAB > ZAA > ZA sedangkan kemampuan adsorpsi benzaldehida oleh adsorben SMZ-CTAB > ZA > ZAA. Kinetika adsorpsi untuk benzena dan benzaldehida mengikuti model kinetika orde kedua semu Ho dengan laju adsorpsi 2,33 g $mmol^{-1}$ $menit^{-1}$ untuk adsorpsi benzena dan laju adsorpsi 1,72 g $mmol^{-1}$ $menit^{-1}$ untuk adsorpsi benzaldehida.

Kata kunci: adsorpsi, benzena, benzaldehida, CTAB, zeolit

CETYLTRIMETHYLAMMONIUM BROMIDE-MODIFIED NATURAL ZEOLITE AS ADSORBENT FOR NONPOLAR ORGANIC COMPOUND BENZENE AND BENZALDEHYDE

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ABSTRACT

Modification of natural zeolite from Klaten with cetyltrimethylammonium bromide (CTAB) as adsorbent for benzene and benzaldehyde has been conducted. The ability of surfactant modified natural zeolite (SMZ-CTAB) to remove benzene and benzaldehyde compounds from aqueous solutions was investigated by using a batch system. The study was begun by washing natural zeolite with aquadest, then natural zeolite activated by heating process in 3 M HCl at 72 ^{o}C for 30 minutes to produce activated zeolite. Activated zeolite was modified with CTAB surfactant equivalent to cation exchange capacity (CEC) to form Surfactant Modified Zeolite-Cetyltrimethylammonium Bromide (SMZ-CTAB). Natural zeolite, activated zeolite, and SMZ-CTAB were characterized with FTIR spectrophotometer and XRD. In the adsorption of benzene and benzaldehyde, its contact time, variation of adsorbents, variation concentration of the adsorbates, adsorption kinetic models, and adsorption isotherm models were studied. The concentrations of benzene and benzaldehyde after adsorption were determined with UV-Vis spectrophotometer.

The result showed that major component of Klaten natural zeolite was mordenite and clinoptilolite. The result from CEC's test showed that the value of SMZ-CTAB (0.769 meq g^{-1}) < activated zeolite (1.028 meq g^{-1}) < natural zeolite (1.056 meq g^{-1}). Adsorption of benzene and benzaldehyde followed Freundlich isotherm adsorption model. Adsorption capacities of SMZ-CTAB for benzene adsorption 2.50 mmol g^{-1} is lower than that for benzaldehyde (5.52 mmol g^{-1}). The adsorption ability for benzene using SMZ-CTAB > activated zeolite > natural zeolite but the adsorption ability for benzaldehyde using SMZ-CTAB > natural zeolite > activated zeolite. Adsorption kinetics both benzene and benzaldehyde followed pseudo-second order Ho model, with the adsorption rates for benzene was 2.33 g $mmol^{-1}$ $menit^{-1}$ and the adsorption rates for benzaldehyde was 1.72 g $mmol^{-1}$ $menit^{-1}$.

Keywords: adsorption, benzene, benzaldehyde, CTAB, zeolite