

MODIFIKASI ZEOLIT ALAM DENGAN SETILTRIMETILAMONIUM BROMIDA SEBAGAI ADSORBEN MULTIFUNGSI UNTUK KATIONKALSIUM, ANION FOSFAT DAN SENYAWA NONPOLAR NITROBENZENA

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INTISARI

Modifikasi zeolit alam (ZA) dengan surfaktan setiltrimetilamonium bromida (CTAB) sebagai adsorben multifungsi untuk kalsium, fosfat dan nitrobenzena telah berhasil dilakukan. Zeolit alam dicuci dengan akuades, kemudian dipanaskan dalam larutan HCl 3 M pada suhu 72 °C selama 30 menit. Zeolit alam teraktivasi (ZAA) dimodifikasi dengan penambahan surfaktan CTAB pada konsentrasi dua kali Kapasitas Tukar Kation (KTK). Karakterisasi SMZ-CTAB dilakukan dengan spektrofotometri FTIR dan metode difraksi sinar-X (XRD). SMZ-CTAB digunakan untuk adsorpsi kalsium, fosfat dan nitrobenzena dalam air. Penentuan konsentrasi kation kalsium yang tidak teradsorpsi dianalisis dengan spektrofotometer AAS, anion fosfat dianalisis dengan spektrofotometer UV-Visibel dan nitrobenzena dianalisis dengan spektrofotometer UV.

Hasil penelitian menunjukkan bahwa aktivasi ZA menurunkan nilai KTK. Nilai KTK SMZ-CTAB ($0,860 \text{ meq g}^{-1}$) < ZAA ($0,952 \text{ meq g}^{-1}$) < ZA ($1,324 \text{ meq g}^{-1}$). Kemampuan adsorpsi SMZ-CTAB terhadap fosfat > nitrobenzena > kalsium. Adsorpsi SMZ-CTAB terhadap anion fosfat mengikuti isotermsorpsi Langmuir dengan kapasitas adsorpsi masing-masing sebesar $4,78 \times 10^{-5} \text{ mol g}^{-1}$. Adsorpsi SMZ-CTAB terhadap kalsium dan nitrobenzena mengikuti isoterms Freundlich dengan nilai K_f masing-masing sebesar $2,62 \text{ mol g}^{-1}$ dan $2,23 \times 10^{-2} \text{ mol g}^{-1}$. Dibandingkan dengan ZA dan ZAA, SMZ-CTAB menunjukkan kapasitas adsorpsi lebih tinggi untuk fosfat dan nitrobenzena, tetapi menunjukkan kapasitas adsorpsi yang lebih rendah untuk kation kalsium.

Kata kunci: zeolit, modifikasi, kalsium, fosfat, nitrobenzena

**MODIFICATION OF NATURAL ZEOLITE WITH
CETYLTRIMETHYLAMMONIUM BROMIDE AS MULTIFUNCTIONAL
ADSORBENT FOR CALCIUM CATION, PHOSPHATE ANION AND
NITROBENZENE NONPOLAR COMPOUND**

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ABSTRACT

Natural zeolite (ZA) modification with cetyltrimethylammonium bromide (CTAB) surfactant as multifunctional adsorbent for calcium, phosphate and nitrobenzene has been researched. The natural zeolite was washed with water, and then was heated by 3 M HCl at 72°C for 30 minutes. The activated natural zeolite (ZAA) was modified by adding CTAB surfactant at the twice concentration of cation exchange capacity (CEC). The characterization of SMZ-CTAB was performed by FTIR spectrophotometer and X-ray diffraction method. The SMZ-CTAB was used for adsorption of calcium, phosphate and nitrobenzene in water. Concentration of unadsorbed calcium cation was analyzed by AAS spectrophotometer, anion phosphate was analyzed by UV-Visible spectrophotometer and nitrobenzene was analyzed by UV spectrophotometer.

The result showed that ZA activation decreased CEC value, SMZ-CTAB (0.860 meq g^{-1}) < ZAA (0.952 meq g^{-1}) < ZA (1.324 meq g^{-1}). The adsorption capacity of SMZ-CTAB towards phosphate, nitrobenzene and calcium was in the order of phosphate > nitrobenzene > calcium. Adsorption of SMZ-CTAB towards phosphate followed Langmuir isotherm adsorption with adsorption capacity of $4.78 \times 10^{-5} \text{ mol g}^{-1}$. Adsorption of SMZ-CTAB towards phosphate and nitrobenzene followed Freundlich isotherm adsorption with K_f value of 2.62 mol g^{-1} and $2.23 \times 10^{-2} \text{ mol g}^{-1}$ respectively. Compared to ZA and ZAA, SMZ-CTAB showed higher adsorption capacity for phosphate and nitrobenzene, but showed lower adsorption capacity for calcium cation.

Keywords: zeolite, modified, calcium, phosphate, nitrobenzene