SINTESIS ZEOLIT DARI ABU TERBANG YANG DIMODIFIKASI DENGAN CETILTRIMETILAMONIUM KLORIDA UNTUK ADSORPSI ANTIBIOTIK KLINDAMISIN

SKRIPSI

Diajukan untuk Memenuhi Sebagian Syarat Memperoleh Gelar Sarjana Sains di Bidang Kimia

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Sebuah skripsi yang diajukan untuk memenuhi salah satu syarat untuk memperoleh gelar Sarjana Sains Kimia pada Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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PERNYATAAN

Dengan ini saya menyatakan bahwa skripsi dengan judul "**Sintesis Zeolit dari Abu Terbang yang dimodifikasi dengan Cetiltrimetilamonium Klorida untuk Adsorpsi Antibiotik Klindamisin"** beserta seluruh isinya adalah benar-benar karya saya sendiri. Saya tidak melakukan penjiplakan atau pengutipan dengan cara-cara yang tidak sesuai dengan etika ilmu yang berlaku dalam masyarakat keilmuan. Atas pernyataan ini, saya siap menerima risiko apabila kemudian hari ditemukan adanya pelanggaran etika keilmuan atau ada klaim dari pihak lain terhadap keaslian karya saya.

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Yang membuat pernyataan

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ABSTRAK

Eksresi antibiotik oleh makhluk hidup dan pembungan limbah antibiotik dapat menyebabkan akumulasi antibiotik di lingkungan. Akibatnya, terjadi pencemaran lingkungan serta penyebaran *antibiotic resistance gene* yang telah menyebabkan kematian hingga 4,95 juta jiwa. Adsorpsi dinilai sebagai metode yang ekonomis, mudah diaplikasikan, dan efektif untuk penanganan limbah antibiotik. Suatu adsorben potensial yang dapat digunakan adalah zeolit, alumina-silika terhidrasi yang memiliki struktur berpori. Zeolit dapat disintesis dari abu terbang batu bara karena mengandung mineral kuarsa (silika) dan mullite (alumina). Efektivitas adsorpsi oleh zeolit dapat ditingkatkan melalui modifikasi permukannya. Tujuan dari penelitian ini adalah untuk menganalisis pengaruh penambahan cetiltrimetilamonium klorida (CTAC) terhadap zeolit yang telah disintesis dari abu terbang batu bara serta kemampuan adsorpsinya terhadap antibiotik klindamisin. Metode sintesis yang digunakan adalah hidrotermal. Karakterisasi zeolit sebelum dan setelah modifikasi dilakukan dengan *X-ray Diffraction* (XRD) dan *Fourier Transform Infrared Spectroscopy* (FTIR). Hasil karakterisasi menunjukkan bahwa zeolit yang disintesis merupakan tipe gismondine dan NaX. Modifikasi tidak mempengaruhi fasa mineral zeolit tetapi mempengaruhi kemampuan adsorpsinya. Kapasitas adsorpsi maksimum klindamisin oleh zeolit adalah 18,02 mg/g sedangkan untuk zeolit setelah modifikasi mencapai 24,44 mg/g. Kedua jenis zeolit menunjukkan kesesuaian dengan model isoterm adsorpsi Temkin dan Redlich Peterson. Interaksi elektrostatik terjadi antara Al^- zeolit dengan NH_2^+ klindamisin. Selain itu, pada zeolit modifikasi dapat terjadi interaksi antara N^+ dari CTAC dengan O^- dari klindamisin. Zeolit modifikasi juga dapat mengadsorpsi senyawa nonionik melalui interaksi hidrofilik atau hidrofobik. Oleh karena itu, zeolit modifikasi dinilai sebagai adsorben potensial bagi spesi anionik, kationik, serta nonionik untuk menghilangkan cemaran antibiotik di lingkungan.

Kata Kunci: Abu Terbang, Adsorpsi Klindamisin, CTAC, Hidrotermal, Zeolit.

ABSTRACT

Excretion of antibiotics by living organisms and industrial waste disposal of antibiotics can lead to accumulation of antibiotics in the environment. As a result, there has been environmental pollution and the growth of antibiotic resistance genes which have caused the death up to 4.95 million people. Adsorption is considered as an economical, easy to apply, and effective method for treating antibiotic waste. A potential adsorbent that can be used is zeolite, a hydrated alumina-silica which has a porous structure. Zeolite can be synthesized from coal fly ash which contains mineral quartz (silica) and mullite (alumina). The effectiveness of adsorption by zeolite can be increased by modifying its surface. The purpose of this study was to analyze the effect of adding cetyltrimethylammonium chloride (CTAC) to zeolite that has been synthesized from coal fly ash and its adsorption capacity to the antibiotic clindamycin. The synthesis method used is hydrothermal. Characterization of zeolite before and after modification was carried out by X-ray diffraction (XRD) and Fourier Transform infrared spectroscopy (FTIR). The characterization results showed that the synthesized zeolite was gismondine and NaX types. The modification does not affect the zeolite mineral phase but affects its adsorption ability. The maximum adsorption capacity of klindamisin by zeolite was 18,02 mg/g, while for zeolite after modification it reached 24,44 mg/g. Both types of zeolite showed a good agreement with Temkin and Redlich Peterson adsorption isotherm models. Electrostatic interaction occurs between Al^- from zeolite and NH_2^+ from clindamycin. In addition, modified zeolite also exhibited interaction between N^+ from CTAC and O^- from clindamycin. Modified zeolite can also adsorp nonionic compounds through hydrophilic or hydrophobic interactions. Therefore, modified zeolite claimed as potential adsorbent for anionic, cationic, and nonionic species to remove antibiotic contamination in the environment.

Keywords: *Clindamycin Adsorption, CTAC, Fly Ash, Hydrothermal, Zeolite*

DAFTAR ISI

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DAFTAR GAMBAR

DAFTAR LAMPIRAN

DAFTAR ISTILAH DAN SINGKATAN

CTAC	:*Cethyltrimethylammonium Chloride*/Cetiltrimetilamonium Klorida
CMC	:*Critical micelle concentration*, konsentrasi ketika surfaktan dapat membentuk misel
FA	:*Fly Ash*/Abu Terbang
Fasa kristalin	:Padatan kristal dengan susunan 3 dimensi yang teratur
Z2	:Zeolit yang disintesis dari 2M NaOH
Z3	:Zeolit yang disintesis dari 3M NaOH
Z4	:Zeolit yang disintesis dari 4M NaOH
Z4C3	:Zeolit modifikasi oleh 0,3M CTAC
Z4C4	:Zeolit modifikasi oleh 0,4M CTAC
Z4C5	:Zeolit modifikasi oleh 0,5M CTAC

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