SINTESIS ZEOLIT MAGNETIK DARI ABU TERBANG MENGGUNAKAN NANOPARTIKEL MAGNETIT (Fe_3O_4) DAN APLIKASINYA UNTUK ADSORPSI ANTIBIOTIK KLINDAMISIN

SKRIPSI

diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar
Sarjana Sains pada Program Studi Kimia

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KELOMPOK BIDANG KAJIAN MATERIAL

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Sebuah skripsi yang diajukan untuk memenuhi sebagian syarat memperoleh gelar Sarjana Sains pada Program Studi Kimia

LEMBAR PENGESAHAN

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ABSTRAK

Limbah antibiotik merupakan *emerging contaminant* yang dapat menimbulkan efek racun berbahaya. Zeolit merupakan salah satu adsorben yang dapat digunakan pada penjerapan antibiotik dari larutan, Zeolit dapat disintesis dari limbah abu terbang menggunakan metode hidrotermal dengan teflon autoklaf. Untuk memudahkan regenerasinya, zeolit dapat dimodifikasi menjadi zeolit magnetik. Pada penelitian ini, zeolit abu terbang dimodifikasi menggunakan nanopartikel magnetit (Fe_3O_4), dengan memvariasikan rasio FA:Fe_3O_4. Zeolit hasil sintesis digunakan sebagai adsorben antibiotik klindamisin dengan pengujian adsorpsi menggunakan metode batch. Berdasarkan hasil karakterisasi XRD, kondisi terbaik sintesis tercapai pada sampel tanpa perlakuan *alkaline fusion*, dengan lama waktu pengadukan 4 jam, dan lama waktu proses hidrotermal 24 jam. Zeolit yang diperoleh termasuk dalam zeolit X dan gismondin, sedangkan zeolit magnetik memiliki kemiripan dengan tipe zeolit X, gismondin, dan tiptopit. Analisis FTIR menunjukkan adanya kerangka aluminosilikat pada zeolit. Sifat magnet zeolit dikonfirmasi menggunakan batang magnet neodymium. Zeolit magnetik dengan variasi rasio FA:Fe_3O_4 10:3 menunjukkan sifat adsorpsi paling baik yaitu sebesar 25%. Nilai pH optimum pada adsorpsi antibiotik klindamisin pada zeolit non magnetik adalah 6,5 dengan nilai %adsorpsi sebesar 73,1%, sedangkan zeolit magnetik berada pada pH 12,8 dengan nilai %adsorpsi sebesar 48,78%. Hasil ini disebabkan oleh terjadinya ikatan elektrostatik dari spesi aktif zeolit dan antibiotik klindamisin. Berdasarkan hasil pemodelan adsorpsi isotermal, kedua sampel zeolit non magnetik dan zeolit magnetik mengikuti isoterm Sips, dengan masing-masing nilai R^2 sebesar 0,99566 dan 0,99191. Hasil analisis data adsorpsi menghasilkan nilai kapasitas adsorpsi dari zeolit non magnetik sebesar 9,81 mg/g, sedangkan untuk zeolit magnetik sebesar 5,24 mg/g.

Kata Kunci : abu terbang, adsorpsi, antibiotik clindamycin, hidrotermal, zeolit magnetik

ABSTRACT

Antibiotic waste is emerging contaminants (EC) which can cause dangerous toxic effects. Zeolite is one of the adsorbents that can be used in adsorption of antibiotics from solution. Zeolite can be synthesized from fly ash waste using hydrothermal method with autoclave Teflon. To facilitate regeneration, zeolite can be modified into magnetic zeolite. In this research, fly ash zeolite was modified using magnetite (Fe_3O_4) nanoparticles, by varying the FA:Fe_3O_4 ratio. The synthesized zeolite was used as adsorbent for antibiotic clindamycin with adsorption experiment using the batch method. XRD characterization shows the best conditions for synthesis were achieved in samples without alkaline fusion treatment, with 4 hours stirring time, and 24 hours hydrothermal process time. Zeolite obtained is included in zeolite X and gismondine, while magnetic zeolite has similarities with zeolite X, gismondine, and tiptopite. FTIR analysis shows the presence of aluminosilica framework in zeolite. The magnetic properties of zeolites were confirmed using neodymium bar magnets. Magnetic zeolite with variations of FA:Fe_3O_4 ratio of 10:3 shows the best adsorption properties, namely 25%. The optimum pH for adsorption of antibiotic clindamycin on non-magnetic zeolite was 6.5 with %adsorption value was 73.1%, while magnetic zeolite at pH 12.8 with %adsorption value was 48.78%. This result was caused by electrostatic bonding of the active sites of zeolite and antibiotic clindamycin. Based on the isothermal adsorption modeling results, both non-magnetic and magnetic zeolite samples followed Sips isotherm, with R^2 values was 0.99566 and 0.99191, respectively. The results of the adsorption data analysis yielded an adsorption capacity value was 9.81 mg/g for non-magnetic zeolite, while for magnetic zeolite was 5.24 mg/g.

***Keywords**: adsorption, antibiotic clindamycin, fly ash, hydrothermal, magnetic zeolite*

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