SINTESIS ZEOLIT BERBASIS ABU TERBANG TERMODIFIKASI KITOSAN DAN APLIKASINYA PADA ADSORPSI PEWARNA METIL JINGGA

SKRIPSI

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Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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LEMBAR PENGESAHAN

SINTESIS ZEOLIT BERBASIS ABU TERBANG TERMODIFIKASI KITOSAN DAN PENGARUHNYA TERHADAP KEMAMPUAN ADSORPSI PEWARNA METIL JINGGA

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ABSTRAK

Pewarna sintetis merupakan salah satu kontaminan yang terkandung dalam air limbah industri. Metil jingga merupakan salah satu kelompok pewarna sintetis yang banyak digunakan pada berbagai industri serta dapat menyebabkan berbagai masalah kesehatan pada manusia. Metode adsorpsi dianggap sebagai metode yang memiliki kelebihan dalam pengolahan air limbah karena operasinya sederhana, ekonomis, dan tidak menghasilkan produk samping. Zeolit merupakan salah satu material adsorben yang efektif dan dapat disintesis dari limbah abu terbang batu bara. Penelitian ini bertujuan mengetahui pengaruh modifikasi zeolit menggunakan kitosan untuk mengadsorpsi pewarna metil jingga. Metode sintesis zeolit dilakukan secara hidrotermal menggunakan autoklaf. Karakterisasi zeolit dilakukan menggunakan difraksi sinar-x (XRD) dan FTIR sedangkan uji adsorpsi dilakukan menggunakan spektrofotometer UV-Vis. Hasil karakterisasi XRD menunjukkan bahwa zeolit sintetis merupakan tipe Na-P1 dan hidroksi-sodalit. Adsorpsi metil jingga mencapai nilai tertinggi pada pH 3 dengan persentase adsorpsi zeolit mencapai 99% sedangkan komposit zeolit/kitosan menunjukkan persentase adsorpsi sebesar 98%. Kapasitas adsorpsi dari zeolit sebesar 14,26 mg/g sedangkan komposit zeolit/kitosan memiliki nilai kapasitas adsorpsi sebesar 13,42 mg/g. Modifikasi zeolit dengan kitosan diketahui tidak dapat meningkatkan kemampuan adsorpsi zeolit. Zeolit menunjukkan kesesuaian mekanisme adsorpsi dengan model isoterm Redlich-Peterson yang mengindikasikan proses adsorpsi yang terjadi secara monolayer sedangkan komposit zeolit/kitosan menunjukkan kesesuaian mekanisme adsorpsi dengan model isoterm Sips yang mengindikasikan proses adsorpsi yang terjadi pada permukaan heterogen. Interaksi antara adsorben dan adsorbat diduga melibatkan gaya elektrostatik dan ikatan hidrogen.

Kata Kunci: Abu terbang, adsorpsi, hidrotermal, kitosan, metil jingga, zeolit

ABSTRACT

Synthetic dyes are one of contaminants contained in industrial wastewater. Methyl orange is one of a group of synthetic dyes that are widely used in various industries and can cause various health problems. Adsorption is considered as a method that has advantages in wastewater treatment because its simple operation, economical, and does not produce by-products. Zeolite is one of the effective adsorbent materials that can be synthesised from coal fly ash waste. This study aims to determine the effect of zeolite modification using chitosan to adsorb methyl orange dye. Zeolite synthesis method was conducted hydrothermally using an autoclave. Characterisation of zeolite was done using X-Ray Diffraction (XRD) and FTIR while adsorption test was done using UV-Vis spectrophotometer. The XRD characterisation results showed that the synthetic zeolites were Na-P1 and hydroxy-sodalite. Methyl orange adsorption reached the highest value at pH 3 with the zeolite adsorption percentage reaching 99% while the zeolite/chitosan composite showed an adsorption percentage of 98%. The adsorption capacity of zeolite was 14.26 mg/g while the zeolite/chitosan composite had an adsorption capacity value of 13.42 mg/g. Modification of zeolite with chitosan was found not to improve the adsorption ability of zeolite. Zeolite showed the suitability of adsorption mechanism with Redlich-Peterson isotherm model which indicates the adsorption process occurs in monolayer while zeolite/chitosan composite showed the suitability of adsorption mechanism with Sips isotherm model which indicates the adsorption process occurs on heterogeneous surface. The interaction between adsorbent and adsorbate is thought to involve electrostatic forces and hydrogen bonding.

Keywords: Adsorption, Chitosan, Fly Ash, Hydrothermal, Methyl Orange, Zeolite.

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