

INTISARI

PENANGANAN LIMBAH ZAT WARNA BIRU METILEN MENGUNAKAN ADSORBEN ZEOLIT ALAM TERMAGNETISASI Fe_3O_4

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Preparasi dan karakterisasi adsorben zeolit alam termagnetisasi Fe_3O_4 telah dilakukan dan digunakan untuk penanganan limbah zat warna biru metilen. Adsorben zeolit alam/ Fe_3O_4 dipreparasi melalui dua metode yaitu kopresipitasi (metode padat-cair) dan pencampuran serbuk Fe_3O_4 dan serbuk zeolit alam (metode padat-padat). Pada masing-masing metode dilakukan variasi massa zeolit alam untuk memperoleh adsorben zeolit alam/ Fe_3O_4 dengan fraksi Fe_3O_4 25,0% (b/b), 33,3% (b/b) dan 50,0% (b/b). Karakterisasi struktur adsorben zeolit alam/ Fe_3O_4 dilakukan menggunakan XRD (*X-Ray diffraction*), spektrofotometer FTIR (*Fourier Transform Infra Red*), SEM-EDX (*Scanning elctron Microscope-Energy Dispersive X-ray*) dan SAA (*Surface Area Analyzer*). Uji kemampuan adsorpsi dan kemampuan perolehan kembali (*recoverability*) adsorben pada proses adsorpsi biru metilen dilakukan untuk mengetahui pengaruh perbedaan metode preparasi dan fraksi Fe_3O_4 yang terembankan pada adsorben zeolit alam/ Fe_3O_4 . Konsentrasi zat warna biru metilen dalam larutan yang tidak teradsorpsi diukur menggunakan spektrofotometer UV-Vis dan kemampuan perolehan kembali adsorben ditentukan berdasarkan nilai turbiditas.

Hasil penelitian menunjukkan bahwa adsorben zeolit alam/ Fe_3O_4 hasil preparasi dengan metode padat-cair memberikan kemampuan adsorpsi dan kemampuan perolehan kembali yang lebih tinggi dari adsorben zeolit alam/ Fe_3O_4 hasil preparasi dengan metode padat-padat. Kenaikan fraksi Fe_3O_4 pada adsorben zeolit alam/ Fe_3O_4 menyebabkan penurunan kemampuan adsorpsi terhadap zat warna biru metilen, tetapi meningkatkan kemampuan perolehan kembali adsorben zeolit alam/ Fe_3O_4 . Adsorpsi zat warna biru metilen pada adsorben zeolit alam/ Fe_3O_4 (metode padat-cair dengan fraksi Fe_3O_4 33,3% b/b) optimum pada massa adsorben 25 mg, pH 9, waktu kontak 60 menit dan konsentrasi awal biru metilen 10 ppm. Kinetika adsorpsi mengikuti kinetika orde ke dua semu dengan konstanta laju reaksi 0,024 mg/g.menit dan isoterm adsorpsi mengikuti model isoterm Langmuir dengan kapasitas adsorpsi 32,258 mg/g.

Kata kunci: Adsorpsi, zeolit alam, Fe_3O_4 , biru metilen

ABSTRACT

WASTE TREATMENT OF METHYLENE BLUE DYE USING NATURAL ZEOLITE MAGNETIZED Fe_3O_4

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Preparation, characterization and application of magnetized natural zeolite with Fe_3O_4 has been conducted for removal of methylene blue dye from aqueous solution. Natural zeolite/ Fe_3O_4 was prepared through two methods, i.e by co-precipitation (solid-liquid method) and by mixing the powder of Fe_3O_4 with the natural zeolite powder (solid-solid method). In each method the mass of natural zeolite was varied to obtain natural zeolite/ Fe_3O_4 with different fraction of Fe_3O_4 i.e 25.0% (w/w), 33.3% (w/w) and 50.0% (w/w). Structural characterization of natural zeolite/ Fe_3O_4 was performed by using X-Ray diffraction (XRD), Fourier Transform Infra Red (FTIR), Scanning Elctron Microscope-Energy Dispersive X-ray (SEM-EDX) dan Surface Area Analyzer (SAA). The adsorption capacity and recoverability test of the adsorbents in the methylene blue dye adsorption process were carried out to determine the effect of the different preparation methods and fractions of Fe_3O_4 on natural zeolite/ Fe_3O_4 adsorbent. The concentration of methylene blue in solution was determined by UV-Vis spectrophotometer and recoverability of the adsorbent was determined based on the value of turbidity.

The results showed that natural zeolite/ Fe_3O_4 was prepared by solid-liquid method revealed good adsorbent character with higher adsorption capacity and recoverability than natural zeolite/ Fe_3O_4 that prepared by solid-solid method. The increase of Fe_3O_4 fraction on the natural zeolite/ Fe_3O_4 caused a decrease in the adsorption capacity of methylene blue dye, but increased the recoverability of natural zeolite/ Fe_3O_4 adsorbents. The adsorption of methylene blue dyes on the natural zeolite/ Fe_3O_4 (solid-liquid method with Fe_3O_4 fraction 33.3% w/w) was optimum at adsorbent weight 25 mg, pH 9 and reached equilibrium after 60 min with initial concentration of methylene blue dye 10 ppm. The adsorption kinetics followed pseudo second order with reaction rate constant of 0.024 mg/g.min and the adsorption isotherm agreed with the Langmuir isotherm with adsorption capacity as much as 32.258 mg/g.

Keywords: Adsorption, natural zeolite, Fe_3O_4 , methylene blue