

**ADSORPSI ZAT WARNA METIL ORANYE DALAM AIR
MENGGUNAKAN ZEOLIT/MAGNETIT TERMODIFIKASI
SETILTRIMETILAMONIUM BROMIDA**

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INTISARI

Adsorpsi zat warna metil oranye dalam air menggunakan zeolit/magnetit termodifikasi setiltrimetilamonium bromida telah berhasil dilakukan. Penelitian ini bertujuan untuk melakukan sintesis komposit CTAB-ZAA/Mag sebagai adsorben zat warna MO dalam air serta mengkaji proses adsorpsinya. Dalam penelitian ini, zeolit alam (ZA) diaktivasi dengan HCl 3 M kemudian dimodifikasi dengan magnetit menggunakan metode kopresipitasi pada pH 11 dan temperatur 85 °C untuk menghasilkan ZAA/Mag. Komposit ZAA/Mag kemudian dimodifikasi dengan CTAB pada konsentrasi 2 KTK untuk menghasilkan CTAB-ZAA/Mag. Material yang telah disintesis kemudian dikarakterisasi dengan FTIR, XRD, SEM-EDX, dan dilakukan penentuan nilai kapasitas tukar kation (KTK).

Hasil penelitian menunjukkan bahwa CTAB-ZAA/Mag telah berhasil disintesis dan terbukti dapat digunakan sebagai adsorben zat warna MO. Kondisi optimum adsorpsi MO oleh adsorben CTAB-ZAA/Mag tercapai dengan menggunakan berat adsorben 10 g pada pH 2 dan waktu kontak 30 menit. Proses adsorpsi mengikuti kinetika adsorpsi orde dua semu Ho dan McKay dengan nilai konstanta laju adsorpsi 6,38 g mmol⁻¹ menit⁻¹ dan mengikuti isoterm adsorpsi Langmuir dengan nilai kapasitas adsorpsi 0,153 mmol g⁻¹. Urutan kemampuan adsorpsi MO berdasarkan variasi adsorben adalah CTAB-ZAA/Mag > ZAA/Mag > ZAA > ZA. Penambahan magnet eksternal pada adsorben CTAB-ZAA/Mag setelah proses adsorpsi terbukti dapat mempercepat laju pemisahan adsorben dari adsorbatnya.

Kata kunci: adsorpsi, CTAB, magnetit, metil oranye, zeolit alam

***ADSORPTION OF METHYL ORANGE DYE IN WATER BY USING
CETHYLTRIMETHYLAMMONIUM BROMIDE MODIFIED
ZEOLITE/MAGNETITE***

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ABSTRACT

Adsorption of methyl orange dye in water by using cethyltrimethylammonium bromide modified zeolite/magnetite has been carried out. This research aims to synthesize CTAB-ZAA/Mag composite as an adsorbent for MO dye in water and to study its adsorption process. In this research, natural zeolite (ZA) was activated with HCl 3 M and then modified with magnetite using coprecipitation method at pH 11 and temperature of 85 °C to produce ZAA/Mag. The ZAA/Mag composite was then modified by CTAB with concentration of 2 CEC to produce CTAB-ZAA/Mag. The synthesized materials were characterized by FTIR, XRD, SEM-EDX, and the value of the cation exchange capacity (CEC) was determined.

The results showed that CTAB-ZAA/Mag had been successfully synthesized and proven to be used as an adsorbent for MO dyes. The optimum conditions for MO adsorption by the CTAB-ZAA/Mag adsorbent were achieved by using 10 g of adsorbent weight at pH 2 and a contact time of 30 minutes. The adsorption followed the pseudo second order adsorption kinetics of Ho and McKay with an adsorption rate constant value of $6.38 \text{ g mmol}^{-1} \text{ min}^{-1}$ and followed the Langmuir adsorption isotherm with an adsorption capacity value of $0.153 \text{ mmol g}^{-1}$. The order of MO adsorption performance based on adsorbent variations is CTAB-ZAA/Mag > ZAA/Mag > ZAA > ZA. The use of an external magnet on the CTAB-ZAA/Mag adsorbent after the adsorption process is proven to accelerate the rate of separation of the adsorbent from the adsorbate.

Keywords: adsorption, CTAB, magnetite, methyl orange, natural zeolite