

## **SINTESIS MAGNETIT TERMODIFIKASI ASAM OLEAT SERTA APLIKASINYA SEBAGAI ADSORBEN ZAT WARNA MALASIT HIJAU DAN METIL JINGGA**

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### **INTISARI**

Telah dilakukan sintesis magnetit dan magnetit termodifikasi asam oleat (MTAO). Penelitian ini bertujuan untuk mengkaji pengaruh penambahan asam oleat terhadap karakteristik partikel magnetit serta aplikasinya sebagai adsorben zat warna malasit hijau dan metil jingga.

Sintesis magnetit dan MTAO dilakukan menggunakan metode kopresipitasi dimana 50 mL  $\text{NH}_4\text{OH}$  25% ditambahkan ke dalam campuran 0,046 mol  $\text{Fe}^{3+}$  dan 0,023 mol  $\text{Fe}^{2+}$  dalam 150 mL akuabides hingga tercapai pH 11, kemudian ditambahkan asam oleat sebesar 3, 6, 9, 12, dan 15 mL. Karakterisasi material hasil sintesis dilakukan menggunakan instrumen FTIR, XRD, SEM-EDX, dan VSM. Uji pendahuluan adsorpsi dilakukan untuk mengetahui kemampuan adsorben dalam mengadsorpsi zat warna malasit hijau dan metil jingga. Zat warna yang teradsorpsi paling optimum pada uji pendahuluan adsorpsi kemudian dikaji pengaruh pH, kinetika adsorpsi-desorpsi, dan isoterm adsorpsinya. Konsentrasi zat warna diukur menggunakan spektrofotometer UV-Vis.

Hasil penelitian menunjukkan bahwa sintesis magnetit dan MTAO telah berhasil dilakukan. Penambahan asam oleat mempengaruhi ukuran dan karakteristik magnetit. Hasil uji pendahuluan adsorpsi 20 mL zat warna 10 mg  $\text{L}^{-1}$  menggunakan 25 mg adsorben menunjukkan bahwa metil jingga teradsorpsi jauh lebih sedikit dibandingkan malasit hijau. Uji pendahuluan adsorpsi tertinggi metil jingga pada MTAO-6 sebesar 9,23% sedangkan malasit hijau pada MTAO-15 sebesar 76,63%. Adsorpsi optimum malasit hijau oleh MTAO-15 terjadi pada pH 7, mengikuti model kinetika adsorpsi orde kedua semu ( $H_0$ ) dan mengikuti model isoterm adsorpsi Langmuir dengan nilai kapasitas adsorpsi dan energi adsorpsi masing-masing sebesar 38,820 mg  $\text{g}^{-1}$  dan 30,479 kJ  $\text{mol}^{-1}$  yang menunjukkan proses adsorpsi terjadi secara kemisorpsi. Kajian desorpsi malasit hijau dari MTAO-15 oleh larutan NaCl 1 M memberikan persen desorpsi yang lebih tinggi yaitu sebesar 87,48% dibandingkan larutan NaCl 0,1 M sebesar 72,66%.

Kata kunci: magnetit, asam oleat, zat warna, adsorpsi, desorpsi

## **SYNTHESIS OF MAGNETITE MODIFIED WITH OLEIC ACID AND ITS APPLICATION AS ADSORBENT OF MALACHITE GREEN AND METHYL ORANGE DYES**

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### **ABSTRACT**

Modification of magnetite with oleic acid has been successfully synthesized. This research aims to study the effect of oleic acid on the surface layer of magnetite and its application for malachite green and methyl orange adsorption.

Modification of magnetite with oleic acid was synthesized by coprecipitation method. This experiment was firstly conducted by synthesizing magnetite using 0.046 moles of  $\text{Fe}^{3+}$  and 0.023 moles of  $\text{Fe}^{2+}$  in 150 mL distilled water, followed by adding 50 mL of  $\text{NH}_4\text{OH}$  25% until  $\text{pH}=11$ . Oleic acid was added to the magnetite with the variation of volume from 3, 6, 9, 12, and 15 mL. The material characterizations were carried out by FTIR, XRD, SEM-EDX, and VSM. The preliminary adsorption test was studied to find out the appropriate adsorbent and the optimum adsorption efficiency for malachite green and methyl orange dyes. The effect of pH, adsorption-desorption kinetic, and adsorption isotherm was studied on dye that has optimum adsorption in the preliminary test. Dyes concentration was measured using a UV-Vis spectrophotometer.

The result shows that magnetite and magnetite modified with oleic acid were successfully synthesized. Characterization result shows that the greater the volume of oleic acid affects the size and characteristic of magnetite. The preliminary adsorption test using 20 mL of  $10 \text{ mg L}^{-1}$  dyes and 25 mg of adsorbent shows that methyl orange was less adsorbed than malachite green. Magnetite modified with oleic acid 6 mL (MTAO-6) adsorbent has the highest adsorption of 9.23% for methyl orange meanwhile magnetite modified with oleic acid 15 mL (MTAO-15) adsorbent has the highest adsorption of 76.63% for malachite green. Adsorption of malachite green by MTAO-15 optimally occurred at pH 7 and follows the pseudo-second-order adsorption kinetics model and follows the Langmuir adsorption isotherm model with adsorption capacity and energy adsorption of  $38.820 \text{ mg g}^{-1}$  and  $30.479 \text{ kJ mol}^{-1}$  that shows the adsorption process is chemisorption. Malachite green desorption from MTAO-15 by 1 M NaCl gives higher desorption efficiency of 87.48% than 0.1 M NaCl of 72.66%.

Keywords: magnetite, oleic acid, dyes, adsorption, desorption