SINTESIS MAGNETIT (Fe_3O_4) DAN MAGNETIT TERLAPIS ASAM FULVAT (AF-Fe_3O_4) UNTUK ADSORPSI p-KLOROFENOL

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INTISARI

Isolasi, sintesis dan karakterisasi asam fulvat (AF) serta magnetit terlapis asam fulvat (AF-Fe_3O_4) telah berhasil dilakukan dan diaplikasikan untuk adsorpsi p-klorofenol dalam larutan. Penelitian diawali dengan ekstraksi AF, dilanjutkan dengan sintesis Fe_3O_4 dan magnetit terlapis asam fulvat (AF-Fe_3O_4) pada pH 11 secara ko-presipitasi menggunakan NH_4OH sebagai agen pengendap, dengan variasi penambahan AF dengan perbandingan massa AF dan Fe_3O_4 yaitu 1:20, 2:20, 4:20 dan 6:20. Ekstraksi asam fulvat diawali dengan melarutkan tanah gambut Rawa Pening ke dalam larutan NaOH 0,1 M di bawah atmosfer nitrogen, kemudian supernatan diasamkan menggunakan HCl 6 M hingga pH = 1 dan disentrifugasi kembali dan terakhir diuapkan pada suhu 60 °C. Material dikarakterisasi menggunakan metode spektroskopi *Fourier transform infrared* (FTIR), *X-ray diffraction* (XRD) dan *Scanning electron microscopy* (SEM).

Hasil penelitian menunjukkan pelapisan magnetit dengan asam fulvat (AF-Fe_3O_4) berhasil dilakukan. Karakterisasi dengan XRD menunjukkan bahwa AF terlapis Fe_3O_4 tidak mengubah struktur kristal Fe_3O_4 namun menghasilkan intensitas puncak dan jarak antar lapis lebih kecil daripada Fe_3O_4, ukuran *d-spacing* Fe_3O_4 dan AF-Fe_3O_4 secara berturut-turut adalah 14,41; 11,46; 11,79; 12,60 dan 11,41 nm. Kajian adsorpsi p-klorofenol dengan Fe_3O_4 optimum pada pH 5 sedangkan pada AF-Fe_3O_4 optimum pada pH 7. Model kinetika adsorpsi p-klorofenol pada Fe_3O_4 dan AF-Fe_3O_4 dapat dijelaskan dengan persamaan model kinetika adsorpsi pseudo orde dua. Kesetimbangan adsorpsi mengikuti isoterm Langmuir dengan kapasitas (q_{max}) sebesar $4{,}61 \times 10^{-4}$ mol g^{-1} pada Fe_3O_4 dan $6{,}69 \times 10^{-4}$ mol g^{-1} pada AF-Fe_3O_4. Hasil ini menunjukkan magnetit terlapis asam fulvat dapat digunakan sebagai adsorben yang efisien untuk adsorpsi p-klorofenol.

Kata kunci: Asam fulvat, magnetit, p-klorofenol, adsorpsi.

SYNTHESIS OF MAGNETITE (Fe_3O_4) AND MAGNETITE COATED BY FULVIC ACID (FA-Fe_3O_4) FOR ADSORPTION of p-CHLOROPHENOL

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ABSTRACT

Isolation, synthesis and characterization of fulvic acid (FA) as well as magnetite (FA-Fe_3O_4) coated with fulvic acid have been successfully carried out and applied for the adsorption of p-chlorophenol in solution. The study began with FA extraction, followed by the synthesis of Fe_3O_4 and magnetite coated with fulvic acid (FA-Fe_3O_4) at pH 11 by the coprecipitation using NH_4OH as a precipitating agent. The addition of FA was varied with a mass ratio of FA and Fe_3O_4 namely 1:20, 2:20, 4:20 and 6:20. Fulvic acid extraction was initiated by dissolving peat soil from the Rawa Pening area into 0.1 M NaOH solution under nitrogen atmosphere, then precipitated by acidifying it using 0.1 M HCl solution until pH = 1. The material was characterized using the Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD) and scanning electron microscopy (SEM).

The results showed that coating of magnetite with fulvic acid (FA-Fe_3O_4) was successfully carried out. Characterization using XRD showed that FA coated Fe_3O_4 did not change the crystalline structure of Fe_3O_4 but produced peak intensity and size or distance between layers smaller than Fe_3O_4. d-spacing size of Fe_3O_4 and FA-Fe_3O_4 were 14.41; 11.46; 11.79; 12,60 and 11.41 nm respectively. The study of p-chlorophenol adsorption with Fe_3O_4 was optimum at pH 5 whereas FA-Fe_3O_4 was optimum at pH 7. Adsorption kinetics model of p-chlorophenol on Fe_3O_4 and FA-Fe_3O_4 can be described with pseudo-second-order kinetics model equation. The adsorption equilibrium followed the Langmuir isotherm with a capacity (qmax) of 4.61×10^{-4} mol g^{-1} at Fe_3O_4 and 6.69×10^{-4} mol g^{-1} at FA-Fe_3O_4. These results indicated that FA coated magnetite can be used as an efficient adsorbent for the adsorption of p-chlorophenol.

Keywords: *fulvic acid, magnetite, p-chlorophenol, adsorption*