

**ADSORPSI ION Cr(VI) MENGGUNAKAN ADSORBEN AMPAS KOPI
TERMODIFIKASI SETILTRIMETILAMONIUM BROMIDA (CTAB)
DAN Fe₃O₄**

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INTISARI

Adsorpsi ion Cr(VI) menggunakan adsorben ampas kopi termodifikasi setiltrimetilamonium bromida (CTAB) dan Fe₃O₄ telah dilakukan. Adsorben disintesis dari ampas kopi yang dikeringkan. Ampas kopi dimodifikasi Fe₃O₄ melalui metode kopresipitasi dengan pencampuran (FeCl₂·4H₂O) dan (FeCl₃·6H₂O), kemudian ditambahkan larutan NH₄OH hingga pH 11. AK/Fe₃O₄ dimodifikasi dengan variasi konsentrasi CTAB menghasilkan AK/Fe₃O₄-CTAB. Karakterisasi adsorben AK/Fe₃O₄-CTAB dilakukan dengan instrumen FTIR, XRD, dan SEM. Kemampuan adsorpsi AK/Fe₃O₄-CTAB diuji melalui adsorpsi ion Cr(VI) dengan mempelajari pengaruh konsentrasi CTAB dalam adsorben AK/Fe₃O₄-CTAB, pH larutan ion Cr(VI), waktu adsorpsi, dan konsentrasi awal ion Cr(VI) terhadap efektivitas adsorpsi ion Cr(VI). Konsentrasi ion Cr(VI) yang teradsorpsi ditentukan dengan instrumen UV-Vis.

Hasil penelitian menunjukkan bahwa adsorben AK/Fe₃O₄-CTAB telah berhasil disintesis yang terdeteksi melalui spektra FTIR, XRD, dan SEM. Adsorben AK/Fe₃O₄-CTAB dengan konsentrasi CTAB 0,5 mmol memiliki aktivitas adsorpsi paling besar. Adsorpsi Cr(VI) oleh adsorben AK/Fe₃O₄-CTAB berlangsung efektif pada pH 3, waktu kontak 60 menit, dan konsentrasi awal Cr(VI) sebesar 5 mg L⁻¹. Adsorpsi Cr(VI) oleh adsorben AK/Fe₃O₄-CTAB mengikuti orde dua semu dengan nilai R² 0,9996 dan konstanta laju adsorpsi sebesar 3,303×10⁻¹ g mg⁻¹ menit⁻¹. Adsorpsi berjalan mengikuti model isoterm Freundlich dengan nilai R² 0,9961 dan konstanta Freundlich sebesar 1,757 L mg⁻¹.

Kata kunci: adsorpsi, ampas kopi, Cr(VI), CTAB, Fe₃O₄

***ADSORPTION OF CR(VI) IONS USING CETYLTRIMETHYLAMMONIUM
BROMIDE (CTAB) AND Fe₃O₄ COFFEE GROUND ADSORBENT***

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ABSTRACT

Adsorption of Cr(VI) ions using cetyltrimethylammonium bromide (CTAB) and Fe₃O₄ coffee ground adsorbent has been conducted. The adsorbent was synthesized from dried coffee grounds. The coffee grounds were modified with Fe₃O₄ through a coprecipitation method by mixing (FeCl₂·4H₂O) and (FeCl₃·6H₂O), followed by the addition of an NH₄OH solution until the pH reached 11. The AK/Fe₃O₄ was then modified with varying concentrations of CTAB, resulting in AK/Fe₃O₄-CTAB. The AK/Fe₃O₄-CTAB adsorbent was characterized using FTIR, XRD, and SEM instruments. The adsorption capacity of AK/Fe₃O₄-CTAB was tested for Cr(VI) ion adsorption by studying the effects of CTAB concentration in the AK/Fe₃O₄-CTAB adsorbent, the pH of the Cr(VI) ion solution, adsorption time, and initial Cr(VI) ion concentration on the effectiveness of Cr(VI) ion adsorption. The concentration of adsorbed Cr(VI) ions was determined using a UV-Vis instrument.

The results of the study show that the AK/Fe₃O₄-CTAB adsorbent was successfully synthesized, as detected through FTIR, XRD, and SEM spectra. The AK/Fe₃O₄-CTAB adsorbent with 0.5 mmol CTAB concentration exhibited the highest adsorption activity. The adsorption of Cr(VI) by AK/Fe₃O₄-CTAB was most effective at pH 3, with a contact time of 60 minutes, and an initial Cr(VI) concentration of 5 mg L⁻¹. The adsorption of Cr(VI) by AK/Fe₃O₄-CTAB followed pseudo-second-order kinetics with an R² value of 0.9996 and an adsorption rate constant of 3.303×10⁻¹ g mg⁻¹ min⁻¹. The adsorption follows the Freundlich isotherm model with an R² value of 0.9961 and a Freundlich constant of 1.757 L mg⁻¹.

Keywords: adsorption, coffee grounds, Cr(VI), CTAB, Fe₃O₄