

SINTESIS KOMPOSIT MAGNETIT/KARBON AKTIF/KITOSAN DAN APLIKASINYA UNTUK ADSORBEN Cu(II)

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INTISARI

Telah dilakukan sintesis komposit magnetit/karbon aktif/kitosan sebagai adsorben Cu(II). Karbon aktif disintesis dari limbah ampas tebu dengan metode karbonisasi dan diaktivasi dengan larutan H₃PO₄. Kitosan diisolasi dari limbah cangkang udang dengan tahapan demineralisasi, deproteinasi, dan deasetilasi. Sintesis adsorbendilakukan dengan metode kopresipitasi dengan FeCl₃·6H₂O dan FeSO₄·7H₂O sebagai sumber Fe. Komposit hasil sintesis dikarakterisasi dengan *Fourier Transform Infrared Spectroscopy* (FTIR), *X-Ray Diffraction* (XRD) dan *Scanning Electron Microscope-Energy Dispersive Spectrometer* (SEM-EDX). Adsorpsi ion Cu(II) dilakukan dengan variasi pH, waktu kontak, dan konsentrasi awal Cu(II). Desorpsi ion Cu(II) dilakukan dengan NaCl variasi konsentrasi sebagai larutan pendesorpsi.

Hasil karakterisasi komposit dengan FTIR menunjukkan serapan khas vibrasi ulur Fe-O magnetit pada 617 cm⁻¹, vibrasi tekuk N-H dari NH₂ kitosan pada 1620cm⁻¹, dan vibrasi ulur O-H karbon aktif pada 3448 cm⁻¹. Hasil karakterisasi komposit dengan XRD menunjukkan 2 puncak difraksi yang menyerupai difraksi puncak magnetit pada 2θ=35,66°(d₃₁₁) dan 2θ=62,70°(d₄₄₀). Uji morfologi dengan SEM menunjukkan terbentuknya agregat kitosan, karbon aktif, dan magnetit. Studi adsorpsi Cu(II) menunjukkan pH optimum adsorpsi pada pH 6, waktu optimum adsorpsi pada menit ke-90, serta persen adsorpsi terbesar 91,67%. Kinetika adsorpsi mengikuti kinetika orde kedua semu dengan konstanta laju reaksi sebesar 0,038 g.mg⁻¹.menit⁻¹. Isoterm adsorpsi mengikuti model isoterm Langmuir dengan kapasitas adsorpsi maksimum 26,316 mg.g⁻¹. Adsorben dapat digunakan kembali hingga 3 kali siklus dengan NaCl sebagai larutan pendesorpsi.

Kata Kunci: adsorpsi, komposit magnetit/karbon aktif/kitosan, Cu(II), desorpsi.

***SYNTHESIS OF MAGNETITE ACTIVATED CARBON/CHITOSAN COMPOSITE AND
THE APPLICATION FOR Cu(II) ADSORBENT***

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ABSTRACT

Synthesis of magnetite/activated carbon/chitosan composite as Cu(II) adsorbent has been done. Activated carbon was synthesized from sugarcane bagasse by carbonation and H_3PO_4 activation. Chitosan was isolated from shrimp shell waste by demineralization, deproteination, and deacetylation. Adsorbent was synthesized by coprecipitation method with $FeCl_3 \cdot 6H_2O$ and $FeSO_4 \cdot 7H_2O$ as magnetite sources. Adsorbent was characterized by *Fourier Transform Infrared Spectroscopy (FTIR)*, *X-Ray Diffraction (XRD)* and *Scanning Electron Microscope-Energy Dispersive Spectrometer (SEM-EDX)*. Adsorption of Cu(II) ions was performed by variation of pH, contact time, and initial concentration of Cu(II) ions. Desorption of Cu(II) ions was performed by NaCl variation of type as desorption solution.

Characterization of composite by FTIR has shown typical stretching vibration of Fe-O magnetite on 617 cm^{-1} , bonding vibration of NH_2 chitosan on 1620 cm^{-1} , and stretching vibration of O-activated carbon on 1620 cm^{-1} . Characterization of composite by XRD has shown 2 diffraction peak which resemble the peak of magnetite, those are at $2\theta=35.66^\circ(d_{311})$ and $2\theta=62.70^\circ(d_{440})$. Morphology characterization by SEM has shown that the aggregate of chitosan, activated carbon, and magnetite has formed. Adsorption study showed the optimum pH at pH 6, optimum contact time at 90 minutes, and maximum adsorption percentage was 91.67%. Adsorption kinetic followed pseudo second order with the value of reaction rate constant was $0.038\text{ g.mg}^{-1}.\text{minutes}^{-1}$. Isotherm adsorption followed Langmuir isotherm and the adsorption capacity was 26.316 mg/g. Adsorbent could be used for three cycles adsorption with NaCl as desorption solution.

Keywords: adsorption, magnetite activated carbon/chitosan composite, Cu(II), desorption.