

ADSORPSI-DESORPSI Cu(II) DENGAN SILIKA TERMODIFIKASI KITOSAN TERLAPIS PADA BAHAN MAGNETIK PASIR BESI

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INTISARI

Telah dilakukan penelitian untuk mengkaji adsorpsi-desorpsi ion Cu(II) dengan silika termodifikasi kitosan terlapis pada bahan magnetik pasir besi (BM@SiO₂/K). Adsorben BM@SiO₂/K disintesis melalui metode sol-gel dengan penghubung GPTMS. Adsorben dikarakterisasi dengan spektrofotometri *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 ion Cu(II). Desorpsi ion Cu(II) dilakukan dengan variasi jenis dan konsentrasi larutan pendesorpsi. Konsentrasi ion Cu(II) dalam larutan sebelum dan setelah adsorpsi-desorpsi dianalisis dengan *Atomic Absorbance Spectrometer* (AAS).

Hasil karakterisasi menunjukkan bahwa bahan magnetik berhasil dilapisi oleh SiO₂ dan kitosan melalui penghubung GPTMS. BM@SiO₂/K memiliki ukuran kristal magnetit 36,8 nm, tekstur kasar, bentuk tidak teratur dengan ukuran partikel berkisar 1–100 μm , dan persentase N sebesar 7,35%. Adsorpsi ion Cu(II) dengan BM@SiO₂/K optimum pada pH 4 dan waktu kontak 120 menit. Kinetika adsorpsi ion Cu(II) mengikuti model orde kedua semu dengan konstanta laju adsorpsi (k) sebesar 0,369 $\text{mg g}^{-1} \text{menit}^{-1}$. Adsorpsi ion Cu(II) mengikuti model isotherm Freundlich dengan konstanta Freundlich (K_F) 0,49 L g^{-1} , intensitas adsorpsi (n) 1,35 dan kapasitas adsorpsi 14,1 \pm 0,56 mg g^{-1} . Uji desorpsi menunjukkan bahwa 20 mL larutan Na₂EDTA 0,3 M mampu mendesorpsi Cu(II) sebesar 57,6% dari 0,283 mg Cu(II) dalam 20,1 mg BM@SiO₂/K.

Kata kunci: tembaga, kitosan, silika, pasir besi

ADSORPTION-DESORPTION OF Cu(II) WITH CHITOSAN MODIFIED SILICA COATED ON IRON SAND MAGNETIC MATERIAL

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ABSTRACT

A research to investigate the adsorption-desorption properties of Cu(II) ions on chitosan modified silica coated on iron sand magnetic (BM@SiO₂/K) has been done. Adsorbent was synthesized by sol gel method with GPTMS as grafting agent. 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 variation of type and concentration of desorption solution. The concentration of Cu(II) ions in solution before and after adsorption-desorption were analyzed by *Atomic Absorbance Spectrometer* (AAS).

The characterization results show that the magnetic material was successfully coated by SiO₂ and chitosan with GPTMS as grafting agent, has magnetic size of 36.8 nm, irregular shape with particle size from 1 to 100 μ m and N percentage of 7.35%. Adsorption of Cu(II) ions with BM@SiO₂/K optimum at pH 4 and contact time of 120 minutes. Adsorption kinetics of Cu(II) ions follows second order pseudo model with an adsorption rate constant (k) of 0.369 mg g⁻¹ min⁻¹. Isotherm adsorption of Cu(II) ions follows Freundlich isotherm model with Freundlich constant (K_F) 0.49 L g⁻¹, adsorption intensity (n) 1.35 and the adsorption capacity of 14,1 \pm 0,56 mg g⁻¹. The desorption test showed that 20 mL Na₂EDTA solution 0.3 M was capable to desorb Cu(II) of 57.6% from 20,1 mg BM@SiO₂/K containing Cu(II) of 0.283 mg.

Keywords: copper, chitosan, silica, iron sand