SINTESIS NANOPARTIKEL Fe_3O_4/SiO_2 TERMODIFIKASI KITOSAN SEBAGAI ADSORBEN ION $[AuCl_4]^-$

Vinanda Hayuning Sukma
14/365676/PA/16133

INTISARI

Pungut ulang logam mulia seperti Au merupakan topik penelitian yang menarik. Sintesis nanopartikel Fe_3O_4/SiO_2 termodifikasi kitosan sebagai adsorben ion $[AuCl_4]^-$ telah dilakukan. Nanopartikel Fe_3O_4 disintesis melalui metode sono-kopresipitasi dan dilapisi dengan SiO_2 melalui metode sol-gel. Partikel Fe_3O_4/SiO_2 kemudian dimodifikasi dengan kitosan dengan agen penghubung aminopropil trimetoksi silan (APTMS). APTMS direaksikan dengan agen taut silang glutaraldehid sebelum direaksikan dengan kitosan. Produk dikarakterisasi menggunakan spektrofotometer *Fourier Transform Infrared* (FT-IR), *X-Ray Diffractometer* (XRD), *Scanning Electron Microscope-Energy Dispersive X-ray* (SEM-EDX) dan *Transmission Electron Microscope* (TEM). Adsorpsi ion $[AuCl_4]^-$dilakukan pada berbagai pH, berat adsorben, waktu kontak dan konsentrasi awal ion $[AuCl_4]^-$ dalam sistem *batch*. Konsentrasi ion $[AuCl_4]^-$ sebelum dan sesudah adsorpsi dianalisis menggunakan *Atomic Absorbance Spectrophotometer* (AAS).

Hasil penelitian menunjukkan bahwa adsorben Fe_3O_4/SiO_2 berhasil dimodifikasi dengan kitosan. Data FT-IR menunjukkan puncak yang teramati sebagai yang bersesuaian dengan kitosan yang terikat dengan Fe_3O_4/SiO_2 melalui APTMS dan gluataraldehid. XRD menunjukkan puncak difraksi dari Fe_3O_4 dan kitosan. Adsorben Fe_3O_4/SiO_2/Kitosan berukuran 14 nm dengan kandungan unsur C dan N sebesar 12,7 dan 8,14%. Kondisi optimum adsorpsi ion $[AuCl_4]^-$ tercapai pada pH 3, berat adsorben 10 mg dan konsentrasi $[AuCl_4]^-$ 60 mg L^{-1}, dan waktu kontak 540 menit. Adsorpsi mengikuti isoterm Langmuir dan kinetika orde dua semu dengan kapasitas adsorpsi maksimum 91,8 mg g^{-1} dan energi adsorpsi 36,6 kJ mol^{-1}.

Kata kunci: adsorpsi, ion $[AuCl_4]^-$, kitosan, magnetik, nanopartikel.

SYNTHESIS OF Fe_3O_4/SiO_2 NANOPARTICLES MODIFIED WITH CHITOSAN AS $[AuCl_4]^-$ ION ADSORBENT

Vinanda Hayuning Sukma
14/365676/PA/16133

ABSTRACT

Recovery of precious metals like Au is an exciting topic of research. The synthesis of Fe_3O_4/SiO_2 nanoparticles modified with chitosan for recovery $[AuCl_4]^-$ ion has been performed. The Fe_3O_4 nanoparticles were synthesized by sono-coprecipitation method and coated with SiO_2 by sol-gel method. They were modified with chitosan using aminopropyl trimethoxy silane (APTMS) and glutaraldehyde as a crosslinking agent before reaction with with chitosan. The product was characterized with Fourier Transform Infrared (FT-IR) spectrophotometer, X-Ray Diffractometer (XRD), Scanning Electron Microscope-Energy Dispersive X-ray (SEM-EDX) and Transmission Electron Microscope (TEM). Adsorption of $[AuCl_4]^-$ ion was performed after optimization of media pH, adsorbent weight, contact time and initial concentration of adsorbates, which was performed in a batch system. The concentration of $[AuCl_4]^-$ ions in solution before and after adsorption was analyzed with Atomic Absorbance Spectrophotometer (AAS).

The results showed that Fe_3O_4/SiO_2 nanoparticles modified with chitosan and APTMS coupling agent were successfully synthesized. The FT-IR spectra showed typical peaks for corresponding chitosan, Fe_3O_4/SiO_2, APTMS, and glutaraldehid. The XRD data showed a specific peak of Fe_3O_4 and chitosan. The adsorbent has an average diameter of 14 nm with elemental C and N content of 12.7 and 8.14 %, respectively. The optimum conditions for adsorption were reached at pH 3, the adsorbent weight of 10 mg, initial $[AuCl_4]^-$ concentration of 60 mg L^{-1}, and contact time of 540 min. The $[AuCl_4]^-$ adsorption followed pseudo-second order and Langmuir isotherm model with capacity of 91.8 mg g^{-1} and energy of 36.7 kJ mol^{-1}.

Keywords: adsorption, chitosan, magnetic, nanoparticles, $[AuCl_4]^-$ ions.