SINTESIS NANOPARTIKEL Fe_3O_4/SiO_2 TERMODIFIKASI ASAM GLUTAMAT SEBAGAI ADSORBEN ION Ag^+

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INTISARI

Sintesis nanopartikel Fe_3O_4/SiO_2 termodifikasi asam glutamat (AG) sebagai adsorben ion Ag^+ telah dilakukan. Tujuan penelitian adalah untuk mengetahui kemampuan nanopartikel Fe_3O_4/SiO_2/AG dalam mengadsorpsi ion Ag^+. Nanopartikel Fe_3O_4 disintesis melalui metode sono-kopresipitasi sebelum dilapisi dengan SiO_2. Pelapisan SiO_2 berfungsi menghindari aglomerasi nanopartikel Fe_3O_4 dan menurunkan solubilitas dalam media asam. Partikel Fe_3O_4/SiO_2 kemudian dimodifikasi dengan AG menggunakan agen penghubung aminopropil trimetoksi silan (APTMS). APTMS direaksikan dengan agen taut silang glutaraldehid sebelum direaksikan dengan AG. Nanopartikel Fe_3O_4/SiO_2/AG hasil sintesis dikarakterisasi menggunakan FT-IR, XRD, SEM-EDX dan TEM.

Hasil penelitian menunjukkan bahwa SiO_2 melapisi partikel Fe_3O_4 dan berhasil dimodifikasi dengan AG sehingga dihasilkan Fe_3O_4/SiO_2/AG berukuran 12 nm. Data FT-IR, XRD, dan SEM-EDX mendukung keberhasilan sintesis. Kondisi optimum adsorpsi ion Ag^+ tercapai pada pH 3, massa adsorben 10 mg, konsentrasi awal Ag^+ 40 mg L^{-1} dan waktu kontak 240 menit. Adsorpsi mengikuti isoterm Langmuir dan kinetika orde dua semu dengan kapasitas adsorpsi maksimum 97,59 mg g^{-1} dan energi adsorpsi sebesar 31,37 kJ mol^{-1}. Material selektif terhadap ion Ag^+.

Kata kunci: nanopartikel, magnetik, asam glutamat, adsorpsi, ion Ag^+.

SYNTHESIS OF Fe_3O_4/SiO_2 NANOPARTICLES MODIFIED WITH GLUTAMATE ACID AS Ag^+ ION ADSORBENT

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ABSTRACT

The synthesis of Fe_3O_4/SiO_2 nanoparticles modified with glutamic acid (AG) for adsorption of Ag^+ ions has been performed to test the ability of the Fe_3O_4/SiO_2/AG nanoparticles to adsorb Ag^+ metal ions. The Fe_3O_4 nanoparticles were synthesized by sono-coprecipitation method and were coated with SiO_2. The SiO_2 coating functions to avoid agglomeration of Fe_3O_4 particles and dissolution in acidic solutions. Later, the Fe_3O_4/SiO_2 particles were modified with AG using aminopropyl trimethoxy silane (APTMS) as a linking agent. APTMS was reacted with glutaraldehyde as a crosslinking agent before being reacted with AG. The product was characterized by using FT-IR, XRD, SEM-EDX, and TEM.

The result showed that SiO_2 coated Fe_3O_4 particles and was successfully modified with AG produced Fe_3O_4/SiO_2/AG on a 12 nm scale. The FT-IR, XRD, SEM-EDX, and TEM data suggested that the synthesis was successful. The optimum conditions for adsorption were reached at pH 3, the adsorbent mass of 10 mg, initial Ag^+ concentration of 40 mg L^{-1}, and contact time of 240 min. The Ag^+ adsorption followed pseudo-second order and Langmuir isoterm model capacity of 97.59 mg g^{-1} and energy of 31.37 kJ mol^{-1}. The material is selective toward Ag^+ ion.

Keywords: nanoparticles, magnetite, glutamic acid, adsorption, Ag^+ ions