

**MODIFIKASI SILIKA TERLAPIS PADA BAHAN MAGNETIK
PASIR BESI DENGAN KITOSAN MELALUI PENGHUBUNG
3-GLISIDOKSIPROPIL TRIMETOKSISILAN
UNTUK ADSORPSI $[\text{AuCl}_4]^-$**

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INTISARI

Modifikasi silika terlapis pada bahan magnetik pasir besi dengan kitosan melalui penghubung 3-glisisidoksiopropil trimetoksisilan (GPTMS) untuk studi adsorpsi $[\text{AuCl}_4]^-$ telah dilakukan. Bahan magnetik (BM) dipisahkan dari pasir besi menggunakan magnet eksternal kemudian dicuci dengan akuades dan larutan HF 10 %. Material BM-silika-kitosan-GPTMS (BMSiKG) disintesis melalui proses sol gel dengan menambahkan campuran BM dan natrium silikat ke dalam larutan kitosan-GPTMS. Pada penelitian ini perbandingan jumlah mol kitosan terhadap GPTMS divariasi 0:1; 1:0; 1:0,5; 1:1; dan 1:2. Produk dikarakterisasi dengan spektrofotometer *Fourier Transform Infrared*, *X-Ray Diffractometer*, *Scanning Electron Microscopy* dan *Energy Dispersive X-Ray*, analisis Termogravimetri, serta *Vibration Sample Magnetometer*. Selain itu produk diuji kestabilannya terhadap pengaruh pH. Adsorpsi $[\text{AuCl}_4]^-$ pada produk dilakukan dalam sistem *batch* dengan variasi pH, waktu, dan konsentrasi. Adsorben dipisahkan dari larutan menggunakan medan magnet luar dan kadar $[\text{AuCl}_4]^-$ yang tidak teradsorpsi dianalisis dengan *Atomic Absorption Spectroscopy*. Hasil karakterisasi menunjukkan bahwa material BMSiKG berhasil disintesis. Penggunaan GPTMS pada BM-silika-kitosan meningkatkan kestabilan material pada kondisi asam (pH 1-3). Hasil adsorpsi BM-silika-kitosan (BMSiK) dan BMSiKG terhadap $[\text{AuCl}_4]^-$ mengikuti model kinetika pseudo orde-2 semu dan isoterm adsorpsi Langmuir dengan nilai tetapan laju adsorpsi dan kapasitas adsorpsi berturut-turut untuk BMSiK sebesar $4,1 \times 10^{-3} \text{ g mg}^{-1} \text{ menit}^{-1}$ dan $149,25 \text{ mg g}^{-1}$, sedangkan untuk BMSiKG adalah $1,99 \times 10^{-3} \text{ g mg}^{-1} \text{ menit}^{-1}$ dan $94,34 \text{ mg g}^{-1}$. Meskipun terjadi penurunan kapasitas adsorpsi, penggunaan GPTMS meningkatkan kestabilan produk pada kondisi asam.

Kata kunci: silika, kitosan, pasir besi, GPTMS, adsorpsi

MODIFICATION OF SILICA COATED ON IRON SAND MAGNETIC MATERIAL WITH CHITOSAN USING GRAFTING AGENT OF 3-GLYCIDOOXYPROPYL TRIMETHOXY SILANE FOR ADSORPTION OF $[\text{AuCl}_4]^-$

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ABSTRACT

Modification of silica coated on magnetic material iron sand with chitosan using a grafting agent of 3-Glycidooxypropyl trimethoxysilane (GPTMS) for adsorption of $[\text{AuCl}_4]^-$ has been carried out. Magnetic materials (BM) from iron sand was separated using an external magnet and washed with aquades and HF 10 %. BM-silica-chitosan-GPTMS (BMSiKG) material was synthesized via sol gel process by mixing BM and sodium silicate with chitosan-GPTMS solution. In this research mol ratios chitosan to GPTMS were varied 0:1; 1:0; 1:0,5; 1:1; and 1:2. Product was characterized by Fourier Transform Infrared spectrophotometer, X-Ray Diffractometer, Scanning Electron Microscopy and Energy Dispersive X-Ray, Thermogravimetry Analysis, and Vibration Sample Magnetometer. Additionally, the effect of pH on the stability of the product has also been studied. The adsorption of $[\text{AuCl}_4]^-$ on the product was done in a batch system with variation of pH, time, and concentration. Adsorbent was separated using external magnet and concentration of $[\text{AuCl}_4]^-$ not adsorbed was analyzed using Atomic Absorption Spectroscopy. Characterization result indicated that BMSiKG was successfully synthesized. The addition of GPTMS on BM-silica-chitosan improved the stability of the material under acidic condition (pH 1–3). The result of BM-silica-chitosan (BMSiK) and BMSiKG adsorption to Au(III) according to pseudo second-order kinetic model and Langmuir isotherm with the value of adsorption rate constant and adsorption capacity for BMSiK are 4.10×10^{-3} and 149.25 mg g^{-1} , for BMSiKG are $1.99 \times 10^{-3} \text{ g mg}^{-1} \text{ min}^{-1}$ and 94.34 mg g^{-1} respectively. Even though decreasing the adsorption capacity, however the use of GPTMS as grafting agent improves the stability of the product under acidic condition.

Keyword: silica, chitosan, iron sand, GPTMS, adsorption.