

SINTESIS HIBRIDA SILIKA-BIGUANIDA TERLAPIS PADA BAHAN MAGNETIK PASIR BESI SEBAGAI ADSORBEN Au(III) DALAM CAMPURAN ION LOGAM Au(III)/Cu(II)/Ni(II)

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INTISARI

Pelapisan silika termodifikasi biguanida (BG) pada bahan magnetik (BM) pasir besi telah dilakukan menggunakan larutan natrium silikat sebagai sumber silika dan 1-(*o*-tolil)biguanidina (TBG) sebagai sumber gugus biguanida. Untuk mengikatkan TBG pada silika digunakan senyawa penghubung 3-kloropropiltrimetoksisilan (CPTS). Karakteristik adsorpsi bahan magnetik terlapis (BM/SiO₂-BG) terhadap Au(III) yang meliputi pengaruh pH, kapasitas adsorpsi, kinetika dan selektivitas terhadap campuran Cu(II)/Ni(II) telah dievaluasi.

Bahan magnetik dipisahkan dari pasir besi menggunakan magnet eksternal dan diaktivasi dengan larutan HF 10% selama 15 menit. Pelapisan dilakukan melalui proses sol-gel dengan mencampur BM, larutan natrium silikat, CPTS dan TBG. Larutan HCl 1 M ditambahkan ke dalam campuran tersebut hingga terbentuk gel. Karakterisasi bahan dilakukan dengan spektrometer *X-Ray Fluorescence* (XRF), spektrofotometer *Fourier Transform Infrared* (FTIR), difraktometer sinar-X (XRD), *Vibrating Sample Magnetometer* (VSM), uji kestabilan pada berbagai pH dan penentuan pH_{PZC}. Adsorpsi terhadap Au(III) dilakukan pada variasi pH, konsentrasi awal dan waktu kontak serta keberadaan ion logam lain (Cu(II) dan Ni(II)).

Hasil penelitian menunjukkan bahwa BM/SiO₂-BG berhasil diperoleh melalui proses sol-gel dengan CPTS sebagai agen penghubung. Adsorpsi Au(III) pada BM/SiO₂-BG mengikuti model isotherm Langmuir dengan kapasitas adsorpsi sebesar 9,44 mg/g. Kinetika adsorpsi Au(III) mengikuti reaksi pseudo orde ke-2. Uji selektivitas membuktikan bahwa BM/SiO₂-BG memiliki selektivitas yang tinggi terhadap Au(III) dalam campuran dengan Cu(II) dan Ni(II) dengan koefisien selektivitas (α) 4,53 untuk Au(III)/Cu(II) dan 6,05 untuk Au(III)/Ni(II).

Kata Kunci: bahan magnetik pasir besi, silika, biguanida, adsorpsi Au(III)

**SYNTHESIS OF BIGUANIDE-SILICA HYBRID ON IRON SAND
MAGNETIC MATERIAL AS Au(III) ADSORBENT IN METAL IONS
MIXTURE OF Au(III)/Cu(II)/Ni(II)**

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ABSTRACT

Biguanide (BG) modified silica has been coated on iron sand magnetic material (MM) using sodium silicate solution as silica source and 1-(*o*-tolyl)biguanidine as biguanide source. 3-chloropropyltrimethoxysilane (CPTS) was used as cross-linking group of TBG and silica. The Au(III) adsorption characteristics of coated MM (MM/SiO₂-BG) including the pH effect, adsorption capacity, kinetics and selectivity towards mixture of Cu(II)/Ni(II) were evaluated.

Magnetic material was separated from iron sand by applying external magnetic field and was activated using 10% HF solution for 15 min. Magnetic material was coated through the sol-gel process by mixing it, sodium silicate, CPTS and TBG. The mixture was adjusted to form gel using HCl solution. Magnetic material was characterized by X-Ray Fluorescence (XRF), X-ray Diffraction (XRD), Fourier Transform Infrared Spectrophotometer (FTIR), Vibrating Sample Magnetometer (VSM), stability test at various pHs and determination of pH_{PZC}. Adsorption of Au(III) was investigated at various pHs, initial concentrations, contact times and the presence of other metal ions (Cu(II) and Ni(II)).

The results showed that MM/SiO₂-BG was successfully obtained through the sol-gel process using CPTS as the cross-linking group. The Au(III) adsorption of BM/SiO₂-BG followed the Langmuir isotherm models with adsorption capacity of 9.44 mg/g. The Au(III) adsorption kinetics of it followed pseudo-second order reaction. The selectivity test proved that MM/SiO₂-BG gave a high selectivity towards Au(III) in a mixture of Au(III)/Cu(II)/Ni(II) with selectivity coefficient (α) of 4.53 for Au(III)/Cu(II) and that of 6.05 for Au(III)/Ni(II).

Keywords: iron sand magnetic material, silica, biguanide, Au(III) adsorption