

**ADSORPSI-DESORPSI Cr(VI) DENGAN ADSORBEN SILIKA
TERMODIFIKASI KITOSAN TERLAPIS PADA BAHAN MAGNETIK
PASIR BESI**

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INTISARI

Telah dilakukan kajian adsorpsi-desorpsi Cr(VI) pada limbah penyamakan kulit dengan adsorben silika termodifikasi kitosan terlapis pada bahan magnetik pasir besi (BM@SiO₂/K). Adsorben disintesis dengan bahan magnetik pasir besi yang dilapisi hibrida silika-kitosan melalui metode sol gel menggunakan prekursor larutan natrium silikat dan kitosan serta penghubung glisidoksi propil trimetoksisilan. Produk dikarakterisasi dengan spektrofotometer FT-IR, XRD dan SEM-EDX. Produk digunakan untuk adsorpsi Cr(VI) pada variasi pH, waktu kontak, konsentrasi; desorpsi Cr(VI) dan penggunaan kembali adsorben. Kadar Cr(VI) pada larutan standar dianalisis dengan AAS dan Cr(VI) pada limbah penyamakan kulit dianalisis menggunakan UV-Vis dengan pengompleks 1,5-difenil karbazida. Hasil karakterisasi adsorben menunjukkan bahwa adsorben berhasil disintesis. Pada spektra FT-IR ditunjukkan adanya puncak 3425, 1558 dan 570 cm⁻¹ yang berturut-turut merupakan vibrasi ulur -OH, N-H dan Fe-O-Si. Pada difraktogram material, terdapat puncak spesifik dari Fe₃O₄ dan kitosan. Material hasil sintesis memiliki permukaan kasar dan mengandung unsur C, N, O, Si, Fe. Adsorpsi maksimum Cr(VI) pada BM@SiO₂/K terjadi pada pH 3, waktu 90 menit dan konsentrasi Cr(VI) 200 ppm. Adsorpsi mengikuti model kinetika pseudo orde-2 dan isoterm Freundlich dengan konstanta laju adsorpsi sebesar 0,145 mg⁻¹ g min⁻¹, kapasitas adsorpsi sebesar 30,06 mg g⁻¹, K_F = 60,18 L mol⁻¹ dan energi adsorpsi = 10,22 kJ mol⁻¹. Desorpsi maksimum menggunakan NaOH 0,01 M dengan persen desorpsi sebesar 95,8 %. Adsorben dapat digunakan kembali dengan pengurangan kapasitas adsorpsi sebesar sepertiga kapasitas adsorpsi awal. Cr(VI) pada limbah penyamakan kulit mampu teradsorpsi sebesar 0,289 mg g⁻¹ dan persen desorpsi sebesar 42,1 %.

Kata kunci: adsorpsi-desorpsi Cr(VI), pasir besi, silika, kitosan, GPTMS

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

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ABSTRACT

Adsorption-desorption of Cr(VI) in leather tanning waste with adsorbent of chitosan modified silica coated on iron sand magnetic material has been studied. BM@SiO₂/K was synthesized by coating iron sand magnetic material with silica-chitosan hybrid via sol gel process using sodium silicate solution as precursor and chitosan, and glycidoxypopyl trimethoxysilane as the coupling agent. Product was characterized with FT-IR spectrophotometer, XRD and SEM-EDX. Product used to adsorb Cr(VI) in various pHs, contact times, concentration. Desorption of Cr(VI) and reusability of adsorbent were examined as well. The concentration of standard solution was analyzed using AAS and Cr(VI) in leather tanning waste was analyzed using UV-Vis with 1,5-diphenyl carbazide complex agent. Characterization result indicated that adsorbent was successfully synthesized. In the FT-IR spectra, there are 3425, 1558 and 570 cm⁻¹ peaks which are vibration of -OH, N-H and Fe-O-Si. In the material diffractogram, there is a specific peak of Fe₃O₄ and chitosan. The synthesized material has a rough surface and contains elements C, N, O, Si, Fe. The maximum adsorption of Cr (VI) on BM@SiO₂/K occurred at pH 3, for 90 minutes and the Cr (VI) concentration of 200 ppm. Adsorption follows the pseudo-second order kinetics and Freundlich isotherms with adsorption rate constant of 0.145 mg⁻¹ g min⁻¹, adsorption capacity of 30.06 mg g⁻¹, K_F = 60.18 L mol⁻¹ and adsorption energy = 10.22 kJ mol⁻¹. Maximum desorption using NaOH 0,01 M with percentage desorption equals to 95.8 %. Adsorbents can be reused and the adsorption capacity by one-third of the initial adsorption capacity. Cr (VI) in the tannery waste was able to adsorbed 0.289 mg g⁻¹ and the desorption percentage was 42.1 %.

Keyword: adsorption-desorption of Cr(VI), iron sand, silica, chitosan, GPTMS