

## **IMOBILISASI DITIZON PADA SILIKA GEL DARI ABU DASAR BATUBARA DAN APLIKASINYA SEBAGAI ADSORBEN Ag(I)**

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### **INTISARI**

Penelitian mengenai imobilisasi ditizon pada silika gel dari abu dasar batubara dan aplikasinya sebagai adsorben Ag(I) telah dilakukan. Tujuan penelitian ini adalah untuk mempelajari pembuatan silika gel dan silika gel terimobilisasi ditizon serta membandingkan kemampuan adsorpsi antara kedua adsorben tersebut, menentukan kondisi optimum adsorpsi, serta mempelajari kinetika dan isoterm adsorpsi ion logam Ag(I).

Penelitian ini diawali dengan aktivasi abu dasar menggunakan HCl dan sintesis silika gel dari abu dasar batubara teraktivasi menggunakan metode sol-gel. Silika gel kemudian diimobilisasi dengan ditizon dalam medium air/basa. Karakterisasi adsorben dilakukan dengan Mikroskop Pemindai Elektron (SEM), Spektroskopi Inframerah (FTIR), Fluoresensi Sinar-X (XRF), dan Difraksi Sinar-X (XRD). Pengaruh pH, massa adsorben, waktu kontak, dan konsentrasi awal larutan ion logam Ag(I) terhadap kapasitas adsorpsi dipelajari. Konsentrasi ion logam Ag(I) dalam larutan diukur menggunakan Spektroskopi Serapan Atom (AAS).

Analisis menggunakan FT-IR, XRF, dan XRD mengkonfirmasi keberhasilan aktivasi abu dasar batubara, konversi abu dasar menjadi silika gel, dan imobilisasi ditizon pada silika gel. Silika gel hasil sintesis memiliki kandungan silikon (Si) sebesar 89,85% dengan situs aktif berupa gugus silanol dan siloksan serta struktur amorf. Imobilisasi ditizon menambah gugus aktif -SH dan -NH pada silika gel. Kondisi optimal untuk adsorpsi 10 mL larutan ion logam Ag(I) pada silika gel dan silika gel terimobilisasi ditizon adalah pH 7, massa adsorben 0,010 g (SG) dan 0,005 g (SGD), waktu kontak 45 menit, dan konsentrasi awal larutan Ag(I) 80 ppm. Adsorpsi ion logam Ag(I) pada SG dan SGD mengikuti model kinetika orde kedua semu dengan konstanta laju berturut-turut 0,0472 dan 0,2468 g mg<sup>-1</sup> min<sup>-1</sup>, dan model isoterm Langmuir dengan kapasitas adsorpsi ( $q_m$ ) berturut-turut 37,59 dan 62,11 mg g<sup>-1</sup>. Imobilisasi ditizon pada silika gel terbukti meningkatkan kapasitas adsorpsi adsorben secara signifikan.

Kata kunci: abu dasar batubara, adsorpsi, ditizon, ion logam Ag(I), silika gel.

## **IMMOBILIZATION OF DITHIZONE ON SILICA GEL FROM COAL BOTTOM ASH AND ITS APPLICATION AS ADSORBENT OF Ag(I)**

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### **ABSTRACT**

Research on the immobilization of dithizone on silica gel from coal bottom ash and its application as adsorbent of Ag(I) has been carried out. The aim of this research is to study the synthesis of silica gel and dithizone-immobilized silica gel from bottom ash, to compare the adsorption capabilities between the two adsorbents, to determine the optimum conditions for Ag(I) adsorption, and to study the kinetics and isotherms of adsorption of Ag(I) metal ions.

This research has started with the activation of bottom ash using HCl and the synthesis of silica gel from activated coal bottom ash was using the sol-gel method. The silica gel was then immobilized with dithizone in a water/alkaline medium. Adsorbent characterization was carried out using Scanning Electron Microscopy (SEM), Infrared Spectroscopy (FTIR), X-Ray Fluorescence (XRF), and X-Ray Diffraction (XRD). The effect of pH, adsorbent mass, contact time, and initial concentration of Ag(I) metal ion on the adsorption capacity were also studied. The concentration of Ag(I) metal ions in the solution was measured using Atomic Absorption Spectroscopy (AAS).

Analysis using FT-IR, XRF, and XRD confirmed the successful activation, conversion of coal bottom ash into silica gel, and immobilization of dithizone on silica gel. The synthesized silica gel has a silicon (Si) content of 89.85% with active sites in the form of silanol and siloxane groups and an amorphous structure. Dithizone immobilization adds -SH and -NH active groups into the surface of silica gel. The optimal conditions for adsorption of 10 mL of Ag(I) metal ion solution on silica gel and dithizone immobilized silica gel are pH 7, adsorbent mass 0.010 g (SG) and 0.005 g (SGD), contact time 45 min, and initial concentration of Ag(I) solution 80 ppm. Adsorption of Ag(I) metal ions on SG and SGD follows a pseudo second order kinetic model with rate constants of 0.0472 and 0.2468 g mg<sup>-1</sup> min<sup>-1</sup> respectively, and best described by a Langmuir isotherm model with adsorption capacity ( $q_m$ ) at 37.59 and 62.11 mg g<sup>-1</sup>. Immobilization of dithizone on silica gel has been proven to be able to increase the adsorption capacity of the adsorbent significantly.

Key words: adsorption, Ag(I) metal ion, coal bottom ash, dithizone, silica gel.