

MODIFIKASI ABU LAYANG BATUBARA DENGAN DITIZON UNTUK ADSORPSI LOGAM Ni(II) DAN Co(II)

DINI NOVI ROHMAH

18/433818/PPA/05633

INTISARI

Penelitian adsorpsi ion Ni(II) dan Co(II) pada abu layang terimobilisasi ditizon sebagai adsorben telah dilakukan. Penelitian ini dilakukan dengan mengaktivasi abu layang batubara menggunakan HCl 5M. Abu layang batubara teraktivasi kemudian diimobilisasi dengan ditizon. Karakterisasi abu layang batubara teraktivasi dan abu layang batubara terimobilisasi ditizon dilakukan dengan menggunakan Spektroskopi Inframerah (FT-IR) dan analisis Difraksi Sinar X (XRD). Parameter adsorpsi logam yang diteliti dalam penelitian ini meliputi pengaruh pH adsorben, massa adsorben, waktu kontak, dan konsentrasi awal ion logam Ni(II) dan Co(II). Desorpsi dilakukan untuk memahami mekanisme adsorpsi dengan menggunakan H₂O, KNO₃, HONH₂HCl dan Na₂EDTA. Konsentrasi setiap ion logam yang tersisa dalam larutan setelah adsorpsi dan desorpsi ditentukan dengan menggunakan Spektrofotometri Serapan Atom (AAS).

Hasil penelitian menunjukkan kondisi optimum adsorpsi ion Ni(II) dan Co(II) 10 mg L⁻¹ pada abu layang batubara terimobilisasi ditizon masing – masing terjadi pada pH 4 dan pH 5 dengan massa adsorben masing-masing 0,02 g dan waktu kontak optimum masing-masing 60 menit. Kinetika adsorpsi ion Ni(II) dan Co(II) pada abu layang teraktivasi dan terimobilisasi ditizon mengikuti persamaan kinetika orde kedua semu dengan nilai konstanta laju (k) untuk Ni(II) yaitu 0,050 dan 0,015 g mg⁻¹ menit⁻¹, sedangkan untuk ion logam Co(II) yaitu 0,029 dan 0,121 g mg⁻¹ menit⁻¹. Model isoterm adsorpsi ion logam Ni(II) dan Co(II) mengikuti model isoterm Langmuir dengan kapasitas adsorpsi ion logam Ni(II) pada abu layang teraktivasi dan abu layang terimobilisasi ditizon berturut-turut yaitu 1,10 x 10⁻⁶ mol g⁻¹ dan 1,14x10⁻⁶ mol g⁻¹. Kapasitas adsorpsi untuk ion logam Co(II) terhadap abu layang teraktivasi dan abu layang terimobilisasi ditizon berturut-turut 2,11 x 10⁻⁶ mol g⁻¹ dan 3,86 mol g⁻¹. Berdasarkan data desorpsi, mekanisme adsorpsi ion logam Ni(II) dan Co(II) dengan abu layang teraktivasi adalah mekanisme pertukaran ion. Adsorpsi ion logam Ni(II) dengan abu layang batubara terimobilisasi ditizon terjadi melalui ikatan hidrogen, dan adsorpsi ion logam Co(II) dengan abu layang batubara terimobilisasi ditizon terjadi melalui pembentukan kompleks.

Kata kunci: abu layang batubara, adsorpsi, Ni(II), Co(II), ditizon

MODIFICATION OF COAL FLY ASH WITH DITHIZONE FOR ADSORPTION OF Ni(II) AND Co(II) METAL IONS

DINI NOVI ROHMAH
18/433818/PPA/05633

ABSTRACT

The research of adsorption of Ni(II) and Co(II) metal ion onto adsorbent of dithizone-immobilized coal fly ash (IFA) has been investigated in batch experiments. The research was conducted by activating the coal fly ash by reflux method at 110 °C with 4M HCl for 4 hours before being used for immobilization. Then, activated coal fly ash (AFA) was used to dithizone-immobilized. The AFA and IFA adsorbents were characterized by Fourier Transform Infra-Red (FT-IR) and X-Ray Diffraction (XRD) spectroscopies. Several parameters influencing the adsorption of Ni(II) and Co(II) metal ions on both adsorbents including effect of pH, adsorbent dosage, contact time and initial concentration on the efficiency of the adsorption of Ni(II) ion were investigated. The adsorbent of AFA or IFA that has been used to adsorb Ni(II) ion from the mixture solution was subjected to desorption experiments by immersing and stirring it by H₂O, KNO₃, HONH₂.HCl and Na₂EDTA. The concentration of each metal ion in the solution after adsorption and desorption was determined using Atomic Adsorption Spectrophotometry (AAS).

The result showed that the optimum conditions of adsorption of Ni(II) dan Co(II) ions 10 mg L⁻¹ in immobilized fly ash occurred at pH 4 and pH 5 with adsorbent masses of 0,02 g and the optimum contact time adsorption of Ni(II) and Co(II) is 60 minutes. The kinetic adsorption of Ni (II) and Co (II) metal ions on activated and immobilized dithizone fly ash followed the pseudo second-order, whereas Ni (II) ion with rate constant values (k) 0.050 and 0.015 g mg⁻¹ minute⁻¹, and Co(II) ion with rate constant values (k) 0.029 and 0.121 g mg⁻¹ minute⁻¹. The Ni(II) and Co(II) metal ion adsorption follows the Langmuir for isotherm model, with the adsorption capacity of Ni(II) metal ions on activated fly ash and immobilized fly ash in dithizone respectively, namely 1.10 x 10⁻⁶ mol g⁻¹ and 1.14x10⁻⁶ mol g⁻¹. Meanwhile, the adsorption capacity for metal ion Co(II) against activated fly ash and immobilized fly ash by dithizone were 2.11 x 10⁻⁶ mol g⁻¹ and 3.86 x 10⁻⁶ mol g⁻¹, respectively. Based on desorption data, the adsorption mechanism of Ni(II) and Co(II) metal ions with activated fly ash is an ion exchange mechanism. Adsorption of Ni (II) metal ions with dithizone immobilized coal fly ash occurs through hydrogen bonding, and adsorption of Co (II) metal ions with dithizone immobilized fly ash occurs through complex formation.

Key words: coal fly ash, adsorption, Ni(II), Co(II), dithizone