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ADSORPSI ION Pb(II) MENGGUNAKAN ZEOLIT ALAM TERMAGNETISASI Fe3O4
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Universitas Gadjah Mada, 2019 | Diunduh dari http://etd.repository.ugm.ac.id/

INTISARI

ADSORPSI ION Pb(II) MENGGUNAKAN ZEOLIT ALAM TERMAGNETISASI Fe_3O_4

Teguh Pambudi
16/403653/PPA/05170

Adsorpsi ion Pb(II) menggunakan zeolit alam/Fe_3O_4 sebagai adsorben telah dipelajari secara sistematis. Pembuatan adsorben dilakukan dengan dua teknik yang berbeda, yaitu teknik padat-cair dan teknik padat-padat. Teknik padat-cair dilakukan dengan menginteraksikan ion Fe(II) dan ion Fe(III) dengan serbuk zeolit alam dalam larutan NH_4OH, sedangkan teknik padat-padat dilakukan dengan mencampurkan serbuk Fe_3O_4 dengan serbuk zeolit alam. Karakter dari adsorben yang dihasilkan dibandingkan. Selain itu, pengaruh fraksi Fe_3O_4 (25,0% b/b, 33,3% b/b, 50,0% b/b) terhadap karakter adsorben (kristalinitas, sifat pori, luas permukaan, morfologi, kemampuan perolehan kembali), kemampuan adsorpsi dan kemampuan perolehan kembali juga dievaluasi. Adsorben dikarakterisasi dengan menggunakan XRD, FTIR, *surface area analyzer* dan turbidimeter. Adsorpsi Pb(II) pada adsorben dilakukan menggunakan teknik batch dengan dosis adsorben, pH dan waktu kontak dioptimalkan. Konsentrasi Pb(II) dalam larutan dianalisis dengan mengggunakan AAS.

Hasil penelitian menunjukkan bahwa zeolit alam/Fe_3O_4 yang dipreparasi menggunakan teknik padat-cair menunjukkan luas permukaan, volume pori dan sebaran Fe_3O_4 yang lebih baik daripada teknik padat-padat. Secara umum ditemukan bahwa peningkatan fraksi Fe_3O_4 meningkatkan kemampuan perolehan kembali adsorben, tetapi menyebabkan efektivitas adsorpsi menurun. Fraksi Fe_3O_4 33,3% b/b dalam adsorben memberikan kemampuan adsorpsi dan kemampuan perolehan kembali terbaik. Adsorpsi Pb(II) berlangsung optimum dengan menggunakan dosis adsorben 1,25 g/L, pH 3, waktu kontak 90 menit dan konsentrasi awal Pb(II) 150 mg/L dengan efektivitas adsorpsi sebesar 95,15%. Kinetika adsorpsi sesuai dengan model pseudo orde kedua dengan laju adsorpsi k= 3,752 g mg^{-1} $menit^{-1}$. Adsorpsi juga dijelaskan dengan baik oleh model isoterm Langmuir dengan kapasitas adsorpsi sebesar 55,249 mg g^{-1}. Energi adsorpsi ditemukan sebesar 31,548 kJ mol^{-1}, menunjukkan bahwa adsorpsi mengikuti fenomena kemisorpsi.

Kata kunci: ion Pb(II), adsorpsi, zeolit alam, Fe_3O_4

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ABSTRACT

ADSORPTION OF Pb(II) ION USING Fe_3O_4-MAGNETIZED NATURAL ZEOLITE

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The adsorption of Pb(II) ion using natural zeolite/Fe_3O_4 as adsorbent has been systematically studied. The preparation of the separable adsorbent was carried by two different techniques, called as solid-liquid technique and solid-solid technique. The former was performed by interacting Fe(II) and Fe(III) with natural zeolite powder in NH_4OH solution, while the later was conducted by mixing Fe_3O_4 powder with natural zeolite powder. The characters of the obtained adsorbents (crystallinity, pore properties, surface area, morphology, recoverability) were compared. In addition, the influence of the Fe_3O_4 fraction (25.0% w/w, 33.3% w/w, 50.0% w/w) on the adsorbent characters, adsorption capacity and recoverability were also evaluated. The adsorbents were characterized by using XRD, FTIR, surface area analyzer and turbidimeter. The adsorption of Pb(II) by the adsorbents was conducted by batch technique where adsorbent dose, pH, contact time and initial concentration of Pb(II) were optimized. The Pb(II) concentration in the solution was analyzed by AAS.

The results showed that natural zeolite/Fe_3O_4 prepared by solid-liquid technique has better surface area, pore volume and distribution of Fe_3O_4 than that of by solid-solid technique. Generally the increasing of Fe_3O_4 fraction raised the recoverability, but led to the adsorption effectivity decreased. The 33.3% w/w fraction of Fe_3O_4 in the adsorbents gave compromisingly good capacity and recoverability. The optimum Pb(II) adsorption was reached by using 1.25 g/L of the adsorbent dosage, pH 3, contact time 90 minutes and initial concentration of Pb(II) 150 mg/L with adsorption efficiency as 95.15%. The adsorption kinetic well fitted to pseudo second order with adsorption rate k= 3.752 g mg^{-1} $minute^{-1}$. The corresponding adsorption was well described by Langmuir isotherm model with adsorption capacity as high 55.249 mg g^{-1}. The adsorption energy is found to be 31.548 kJ mol^{-1} suggesting that the adsorption followed the chemisorption phenomena.

Keywords: Pb(II) ion, adsorption, natural zeolite, Fe_3O_4