

ADSORPSI ION FOSFAT DENGAN KOMPOSIT BENTONIT-MAGNETIT-ALGINAT

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INTISARI

Penelitian tentang komposit bentonit-magnetit-alginat sebagai adsorben ion fosfat telah dilakukan. Sintesis komposit bentonit-magnetit-alginat dilakukan menggunakan metode ko-presipitasi, metode pengikat silang kalsium klorida, serta pengeringan dengan *freeze-drying*. Komposit bentonit-magnetit-alginat hasil sintesis dikarakterisasi menggunakan FTIR, XRD, dan SEM-EDX. Kajian adsorpsi fosfat dilakukan melalui penentuan kondisi optimum untuk parameter pH, massa adsorben, waktu kontak, dan konsentrasi awal ion fosfat.

Hasil penelitian menunjukkan bahwa komposit bentonit-magnetit-alginat telah berhasil disintesis. Komposit bentonit-magnetit-alginat berwujud serbuk kasar dan berwarna hitam. Keberhasilan sintesis dibuktikan dengan karakterisasi menggunakan FTIR, XRD, dan SEM-EDX yang menunjukkan adanya unsur Si, O, H, Fe, C, dan Ca. Komposit bentonit-magnetit-alginat berhasil mengadsorpsi ion fosfat dengan kondisi optimum adsorpsi pada pH 9, massa adsorben 90 mg, waktu kontak 90 menit dan konsentrasi awal ion fosfat 40 mg L⁻¹ dengan kapasitas adsorpsi maksimum 15,071 mg g⁻¹. Nilai kapasitas adsorpsi yang didapatkan tergolong cukup baik dibandingkan penelitian sebelumnya yaitu adsorben bentonit teraktivasi asam dengan kapasitas adsorpsi sebesar 2,97 mg g⁻¹ (Darmadinata dkk., 2019). Studi kinetika adsorpsi mengikuti orde dua-semu dengan konstanta laju adsorpsi 0,0061 g mg⁻¹ min⁻¹. Studi isoterm adsorpsi mengikuti model Isoterm Langmuir dengan kapasitas adsorpsi 16,0514 mg g⁻¹. Berdasarkan data yang diperoleh komposit bentonit-magnetit mampu mengadsorpsi ion fosfat dengan proses adsorpsi dikontrol oleh mekanisme adsorpsi kimia dan proses adsorpsi terjadi secara monolayer.

Kata kunci: adsorpsi, alginat, bentonit, fosfat, magnetit.

ADSORPTION OF PHOSPHATE IONS WITH BENTONITE-MAGNETITE-ALGINATE COMPOSITE

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ABSTRACT

Research on bentonite-magnetite-alginate composites as phosphate ion adsorbents has been carried out. Synthesizing the bentonite-magnetite-alginate composite with the co-precipitation method and the calcium chloride binding method, as well as drying with freeze-drying. The synthesized results were characterized using FTIR, XRD, and SEM-EDX. Phosphate adsorption studies were carried out by maintaining optimum conditions for pH parameters, adsorbent mass, contact time, and initial concentration of phosphate ions.

The research results show that the bentonite-magnetite-alginate composite has been successfully synthesized. The bentonite-magnetite-alginate composite is in the form of a coarse powder and is black in color. The success of the synthesis was proven by characterization using FTIR, XRD, and SEM-EDX which shows the presence of the elements Si, O, H, Fe, C, and Ca. The bentonite-magnetite-alginate composite successfully adsorbed phosphate ions with optimum adsorption conditions at pH 9, adsorbent mass of 90 mg, contact time of 90 minutes and initial concentration of phosphate ions of 40 mg L⁻¹ and maximum adsorption capacity of 15.071 mg g⁻¹. The adsorption capacity value obtained is quite good compared to previous research, namely acid-activated bentonite adsorbent with an adsorption capacity of 2.97 mg g⁻¹ (Darmadinata dkk., 2019). The adsorption kinetics study followed a pseudo-second order with an adsorption rate constant of 0.0061 g mg⁻¹ min⁻¹. The adsorption isotherm study followed the Langmuir Isotherm model with an adsorption capacity of 16.0514 mg g⁻¹. Based on the data obtained bentonite-magnetite-alginate composite is able to adsorb phosphate ions with the adsorption process being controlled by a chemical adsorption mechanism and the adsorption process occurs in a monolayer.

Keywords : adsorption, alginate, bentonite, phosphate, magnetite.