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Adsorption of Zn(II), Pb(II), Cr(III) and Mn(II) from water by Jordanian bentonite

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ABSTRACT

Jordanian bentonite from Al-Azraq has been purified using centrifugation technique. Both raw and purified bentonite were characterized by FTIR, XRD, XRF and SEM. Adsorption of Zn(II), Pb(II), Cr(III) and Mn(II) on purified bentonite was studied using batch technique as a function of bentonite dosage, contact time, pH and temperature. The variation of distribution coefficient with bentonite weight was also studied. The isothermal behaviors of the metal ions uptake onto the surface of purified bentonite were investigated. The metal ions uptake properties on the bentonite fit Langmuir better than Freundlich and Dubinin–Radushkevich adsorption isotherms. Purified bentonite showed high-metal ion uptake capacity toward Pb(II) and moderate ion uptake toward Cr(III), while Zn(II) and Mn(II) had relatively low adsorption capacity toward bentonite. The order for increasing adsorption capacity was as the following: Pb(II)>Cr(III)>Zn(II)>Mn(II). Thermodynamic functions, ΔG^*, ΔH^* and ΔS^*, were determined for each metal ion; ΔG^* values indicated that the adsorption process of these metal ions on bentonite is favorable while ΔH^* values indicated that this process is endothermic. On the other hand, the process has positive entropy which means that the adsorption process increases the disorder of the system. Column experiment was used effectively for the determination of metal ion loading capacity. Desorption studies were done using column experiments where 0.1 N HNO_3 was used in order to regenerate bentonite.

Keywords: Jordanian bentonite; Adsorption; Heavy metals; Thermodynamic functions; Column

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