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Kinetics and equilibrium of cadmium removal from aqueous solutions by sorption onto synthesized hydroxyapatite

N. Barka[a,*], K. Ouzaouit[b], M. Abdennouri[c], M. El Makhfouk[c], S. Qourzal[d], A. Assabbane[d], Y. Ait-Ichou[d], A. Nounah[e]

[a]*Equipe de Recherche Gestion de l'Eau et Développement Durable (GEDD), Faculté Polydisciplinaire de Khouribga, Université Hassan 1er, Hay Ezzaitouna, BP. 145, Khouribga, Morocco*
Tel. +212 661 66 66 22; Fax: +212 523 49 03 54; email: barkanoureddine@yahoo.fr
[b]*Laboratoire d'électrochimie, Centre de recherche REMINEX, Site de Hajar, BP. 469 Marrakech, Morocco*
[c]*Equipe de Recherche Analyse Contrôle et Environnement (ERACE), Ecole Supérieure de Technologie de Safi, BP. 89, Route Dar Si Aissa, Safi, Morocco*
[d]*Equipe de Matériaux, Photocatalyse et Environnement, Faculté des Sciences d'Agadir, BP. 8106 Hay Dakhla, Agadir, Morocco*
[e]*Laboratoire des Sciences de l'Environnement, Ecole Supérieure de Technologie de Salé, BP. 227 Salé-Médina, Morocco*

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ABSTRACT

Calcium hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$, Hap) was synthesized by a simple and rapid co-precipitation method. The samples were characterized by X-ray diffraction analysis, FT-IR spectral analysis, and transmission electron microscopy coupled energy-dispersive X-ray analysis (transmission electron microscope-energy dispersive X-ray spectrometer). The synthesized Hap was used as an adsorbent for the cadmium ion removal from aqueous solutions in batch mode. The influence of contact time and initial concentration of metal ion was studied and discussed. The equilibrium uptake increases with an increase in the initial cadmium concentration in solution. Adsorption kinetic data were properly fitted with the pseudo-second-order kinetic model. The experimental isotherm data were analyzed using Langmuir, Freundlich, Toth, and Tempkin isotherm equations. The best fit was obtained by the Toth model with high correlation coefficients ($r^2 > 0.99$). The Langmuir model also yielded a good fit to experimental data (r^2 around 0.98–0.99) with a maximum monolayer adsorption capacity of 240.74 mg/g.

Keywords: Cadmium; Adsorption; Hydroxyapatite; Kinetics; Isotherm

*Corresponding author.