

Adsorptive potential of Zn–Al and Mg–Fe layered double hydroxides for the removal of 2–nitrophenol from aqueous solutions

Fabiola B. Dalla Nora; Victor V. C. Lima; Marcos L. S. Oliveira; Ahmad Hosseini-Bandegharai; Thiago A. de Lima Burgo; Luca Meili; Guilherme L. Dotto

Abstract

Two layered double hydroxides (LDH) of the type Zn–Al and Mg–Fe were synthesized, characterized and used as adsorbents to uptake 2–nitrophenol (2–NP) from aqueous solutions. XRD, FTIR, SEM, EDS, AFM and N₂ adsorption/desorption curves were used to characterize the Zn–Al–LDH and Mg–Fe–LDH. The potential of both layered double hydroxides to adsorb 2–NP was investigated by adsorption kinetics, equilibrium, thermodynamics and consecutive adsorption/desorption cycles. The characterization indicated a high crystallinity degree and a well–organized and lamellar structure, confirming the efficiency of the synthesis. Elovich was the better kinetic model to describe the 2–NP adsorption onto Zn–Al–LDH, while Pseudo–second order was the best for Mg–Fe–LDH. For both LDHs, the adsorption equilibrium followed the Freundlich model. The process was endothermic, being the maximum adsorption capacities of 290 and 165 mg g⁻¹ for Zn–Al–LDH and Mg–Fe–LDH, respectively. LDHs can be applied for five adsorption/desorption cycles with excellent adsorption capacities. It can be concluded that Zn–Al–LDH and Mg–Fe–LDH are promising materials to treat waters and wastewaters containing 2–nitrophenol

Keywords

Adsorption; Layered double hydroxides; Zn–Al; Mg–Fe; 2–Nitrophenol