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Kinetic and equilibrium study on uptake of iodide ion by calcined layered double hydroxides

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ABSTRACT

Iodide contamination removed using calcined MgAl-CO_3 layered double hydroxides (denoted as CLDH) was conducted in batch conditions. The equilibrium isotherms of uptake of iodide by CLDH were well fitted by the Langmuir equation, and thermodynamic parameters including ΔG^0, ΔH^0 and ΔS^0 were calculated from Langmuir constants. The negative value of ΔH^0 confirms the exothermic nature of adsorption. The negative values of ΔG^0 at 30, 40, 50 and 60°C indicate the spontaneous nature of adsorption. The negative value of ΔS^0 suggests the decreased randomness at the solid/solution interface for the uptake of iodide on CLDH. The influences of initial iodide ion concentration, dosage of CLDH, temperature of iodide removal have been tested in kinetic, respectively. Three kinetic models were used to fit the experimental data, and it was found that the pseudo-second order kinetics model could be used to describe the uptake process appropriately. The value of E_a was calculated to be 100.3 kJ mol^{-1}, which suggests that the process of uptake iodide ion is controlled by the reaction rate of iodide ion with the CLDH rather than diffusion. The reconstruction of CLDH to I-LDHs due to uptake of iodide ion has been confirmed by X-ray diffraction patterns, FT-IR spectroscopy and TG-MS measurements.

Keywords: Layered double hydroxides; Calcined; Equilibrium; Kinetic; Iodide; Uptake

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