Kinetics and mechanism of sorption of chloride ion from sodium carbonate manufacturing wastewater by Mg–Al oxide

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ABSTRACT

In this article, the removal of chloride ion generated from industrial wastewater was examined by using magnesium–aluminum (Mg–Al) oxide obtained from Mg–Al layered double hydroxide. The influences of conditions for chloride ion uptake, including quantity of Mg–Al oxide, contact time and temperature on anion exchange has been investigated, respectively. The extent of the chloride ion removal increased with an increase in the quantity of Mg–Al oxide, contact time, and temperature. Thermodynamic parameters including Gibbs free energy ($\Delta G^\circ$), standard enthalpy change ($\Delta H^\circ$), and standard entropy change ($\Delta S^\circ$) for the process were calculated using the Langmuir constants. Kinetic analyses were conducted using pseudo-first and second-order models. The regression results showed that the uptake process was more accurately represented by pseudo-second-order model. The calculated value of $E_a$ was found to be 77.428 kJ/mol, which indicate that the process of uptake of chloride ion is controlled by the rate of reaction of chloride ion with the Mg–Al oxide rather than diffusion. Results suggested that the uptake process was feasible and endothermic.

Keywords: Layered double hydroxide; Chloride; Anion exchange; Thermodynamic; Isotherm