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Application of zinc-aluminium layered double hydroxides for adsorptive removal of phosphate and sulfate: Equilibrium, kinetic and thermodynamic

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1 **APPLICATION OF ZINC-ALUMINIUM LAYERED DOUBLE HYDROXIDES FOR**
2 **ADSORPTIVE REMOVAL OF PHOSPHATE AND SULFATE: EQUILIBRIUM,**
3 **KINETIC AND THERMODYNAMIC**

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10 **Abstract**

11 In this study, a series of layered double hydroxide (Z_xA_y LDH) material was synthesized with
12 different molar ratios and calcination temperatures to remove phosphate and sulfate ions from
13 synthetic solution. Z_xA_y LDH was characterized by XRD, FTIR, BET and SEM analysis. The
14 highest removal was obtained by Z3A200 LDH that is LDH with a Zn-Al molar ratio of 3 and
15 calcined at 200 °C. The leaching of Zn and Al was more under highly acidic pH compared to pH
16 5 and 8. Adsorption isotherms data had a good fit with Langmuir model and maximum
17 adsorption under optimum conditions led to 2.6-2.72 and 1.02-1.31 mmol/g for phosphate and
18 sulfate, respectively. Kinetic studies have been performed by applying reaction based models and
19 diffusion-based models, which indicated the chemisorption interaction for Z3A200 by a
20 controlling step of the macro-pore and micro-pore diffusion for phosphate and sulfate adsorption
21 process onto Z3A200, respectively. Thermodynamic studies showed that adsorption process onto
22 Z3A200 was endothermic and spontaneous. Thus, phosphate and sulfate adsorption by using
23 optimized Zn-Al LDH appears to be a promising adsorbent for their removal.

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