

Synthesis, Characterization of Organic and Inorganic Zn-Al Layered Double Hydroxides and Application for the Uptake of Methyl Orange from Aqueous Solution

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Abstract : Zn-Al layered double hydroxides containing carbonate, nitrate and dodecylsulfate as the interlamellar anions have been prepared through a coprecipitation method. The resulting compounds were characterized using XRD, ICP, FTIR, TGA/DTA, TEM/EDX and pHPZC analysis. The XRD patterns revealed that carbonate and nitrate could be intercalated into the interlayer structure with basal spacing of 22.74 and 26.56 Å respectively. Bilayer intercalation of dodecylsulfate molecules was achieved in Zn-Al LDH with a basal spacing of 37.86 Å. The TEM observation indicated that the materials synthesized via coprecipitation present nanoscale LDH particle. The average particle size of Zn-AlCO₃ is 150 to 200 nm. Irregular circular to hexagonal shaped particles with 30 to 40 nm in diameter was observed in the Zn-AlNO₃ morphology. TEM image of Zn-AlDs display nanostructured sheet like particles with size distribution between 5 to 10 nm. The sorption characteristics and mechanisms of methyl orange dye on organic LDH were investigated and were subsequently compared with that on the inorganic Zn-Al layered double hydroxides. Adsorption experiments for MO were carried out as function of solution pH, contact time and initial dye concentration. The adsorption behavior onto inorganic LDHs was obviously influenced by initial pH. However, the adsorption capacity of organic LDH was influenced indistinctively by initial pH and the removal percentage of MO was practically constant at various value of pH. As the MO concentration increased, the curve of adsorption capacity became L-type onto LDHs. The adsorption behavior for Zn-AlDs was proposed by the dissolution of dye in a hydrophobic interlayer region (i.e., adsolubilization). The results suggested that Zn-AlDs could be applied as a potential adsorbent for MO removal in a wide range of pH.

Keywords : adsorption, dodecylsulfate, kinetics, layered double hydroxides, methyl orange removal

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