

Synthesis, characterization and controlled release properties of zinc–aluminium-beta-naphthoxyacetate nanocomposite

ABSTRACT

An organic–inorganic nanohybrid nanocomposite was synthesized by co-precipitation method using beta-naphthoxyacetate (BNOA) as guest anion and zinc–aluminium layered double hydroxide (Zn–Al-LDH) as the inorganic host. A well-ordered nanohybrid nanocomposite was formed when the concentration of BNOA was 0.08 M and the molar ratio of Zn to Al, $R = 2$. Basal spacing of layered double hydroxide containing nitrate ions expanded from 8.9 to 19.5 Å in resulting of Zn–Al-BNOA nanocomposite was obtained indicates that beta-naphthoxyacetate was successfully intercalated into interlayer spaces of layered double hydroxide. It was also found out the BET surface area increased from 1.13 to 42.79 m² g⁻¹ for Zn–Al-LDH and Zn–Al-BNOA nanocomposite, respectively. The BJH average pore diameter of the synthesized nanocomposite is 199 Å which shows mesoporous-type of material. CHNS analysis shows the Zn–Al-BNOA nanocomposite material contains 36.2 % (w/w) of BNOA calculated based on the percentage of carbon in the sample. Release of BNOA from the lamella of Zn–Al-BNOA was controlled by the zeroth and first order kinetics at the beginning of the deintercalation process up to 200 min and controlled by pseudo-second order kinetics for the whole process. This study suggests that layered double hydroxide can be used as a carrier for organic acid herbicide controlled release formulation of BNOA.

Keyword: Layered double hydroxide; Beta-naphthoxyacetate; Hydrotalcite; Herbicide; Nanocomposite