

Synthesis of dual herbicides-intercalated hydrotalcite-like nanohybrid compound with simultaneous controlled release property

ABSTRACT

A new monophasic nanohybrid containing two herbicides anions, 3,4-dichlorophenoxyacetate (3,4D) and 2-methyldichlorophenoxyacetate (MCPA), was successfully synthesized. The two anions were simultaneously intercalated into the inorganic interlayers of zinc-aluminium-layered double hydroxide (ZAL) for the formation of a nanohybrid, ZAL—MCPA—3,4D (ZAMDX) by anion exchange method. The properties of ZAL intercalated with single guest MCPA and 3,4D, as well as dual-guest nanocomposite were monitored using powder X-ray diffractometer (PXRD), and showed a basal spacing of 19.7, 19.0 and 19.2 Å, respectively. Direct-injection mass spectroscopy (DIMS) and Fourier transform infrared (FTIR) confirmed the dual intercalation of both anions into the interlayer regions of dual-guest nanocomposite. The release of MCPA and 3,4D from ZAMDX fitted a pseudo-second order model and possessed good controlled release properties. This release property exhibits the potential application of layered materials as a delivery system, as well as reservoirs, especially when multiple active agents are used simultaneously in the formation of an organic–inorganic host–guest nanohybrid.

Keyword: Monophasic; Layered double hydroxide; Nanohybrid; Mesoporous