LDH-intercalated D-gluconate: generation of a new food additive-inorganic nanohybrid compound

Abstract

Intercalation of d-gluconate into the interlamellae of zinc–aluminum-layered double hydroxide for the formation of a food additive-inorganic layered nanohybrid was accomplished by both direct (co-precipitation) and indirect (ion-exchange) methods. Powder X-ray diffraction (PXRD) together with CHNS and Fourier transform infrared (FTIR) analyses showed that the hybridization of d-gluconate with pure phase and good crystallinity was successfully accomplished by a direct method within ranges of pH 7.5–10, Zn to Al initial molar ratio of 2–5 and DG concentration of 0.05–0.3 M. The same nanohybrid compound was also prepared using an indirect ion-exchange method by contacting the pre-prepared LDH with 0.1 M DG for 80 min. The basal spacing of the nanohybrid synthesized by the direct method ranged between 9 and 12.0 Å while that synthesized by the indirect ion-exchange method was 14.0 Å. The crystallinity of the latter was higher than the former and it inherited the crystallinity of the precursor. This work shows that a food additive, such as d-gluconate, can be hybridized into an inorganic host for the formation of a new nanohybrid compound, which can be used to regulate the release of acidity in the food industry.

Keyword: Nanostructure; Inorganic compound; Chemical synthesis; X-ray diffraction