

Controlled release formulation of an anti-depression drug based on a L-phenylalanate-zinc layered hydroxide intercalation compound

ABSTRACT

The intercalation of L-phenylalanate (LP) into the interlayer gallery of zinc layered hydroxide (ZLH) has been successfully executed using a simple direct reaction method. The synthesised intercalation compound, zinc layered hydroxide-L-phenylalanate (ZLH-LP), was characterised using PXRD, FTIR, CHNS, ICP-OES, TGA/DTG, FESEM and TEM. The PXRD patterns of the intercalation compound demonstrate an intense and symmetrical peak, indicating a well-ordered crystalline layered structure. The appearance of an intercalation peak at a low angle of 2θ with a basal spacing of 16.3 Å, signifies the successful intercalation of the L-phenylalanate anion into the interlayer gallery of the host. The intercalation is also validated by FTIR spectroscopy and CHNS elemental analysis. Thermogravimetric analysis confirms that the ZLH-LP intercalation compound has higher thermal stability than the pristine L-phenylalanine. The observed percentage of L-phenylalanate accumulated release varies in each release media, with 84.5%, 79.8%, 63.8% and 61.8% release in phosphate buffer saline (PBS) solution at pH 4.8, deionised water, PBS solution at pH 7.4 and NaCl solution, respectively. The release behaviour of LP from its intercalation compounds in deionised water and PBS solution at pH 4.8 follows pseudo second order, whereas in NaCl solution and PBS solution at pH 7.4, it follows the parabolic diffusion model. This study shows that the synthesised ZLH-LP intercalation compound can be used for the formation of a new generation of materials for targeted drug release with controlled release properties.

Keyword: Zinc layered hydroxides; Intercalation compounds; L-phenylalanine; Controlled release formulation