Controlled-release formulation of perindopril erbumine loaded PEG-coated magnetite nanoparticles for biomedical applications

Abstract

Iron oxide nanoparticles (FNPs) were synthesized due to low toxicity and their ability to immobilize biological materials on their surfaces by the coprecipitation of iron salts in ammonia hydroxide followed by coating it with polyethylene glycol (PEG) to minimize the aggregation of iron oxide nanoparticles and enhance the effect of nanoparticles for biological applications. Then, the FNPs–PEG was loaded with perindopril erbumine (PE), an antihypertensive compound to form a new nanocomposite (FPEGPE). Transmission electron microscopy results showed that there are no significant differences between the sizes of FNPs and FPEGPE nanocomposite. The existence of PEG–PE was supported by the FTIR and TGA analyses. The PE loading (10.3 %) and the release profiles from FPEGPE nanocomposite were estimated using ultraviolet–visible spectroscopy which showed that up to 60.8 and 83.1 % of the adsorbed drug was released in 4223 and 1231 min at pH 7.4 and 4.8, respectively. However, the release of PE was completed very fast from a physical mixture (FNPs–PEG–PE) after 5 and 7 min at pH 4.8 and 7.4, respectively, which reveals that the release of PE from the physical mixture is not in the sustained-release manner. Cytotoxicity study showed that free PE presented slightly higher toxicity than the FNPs and FPEGPE nanocomposite. Therefore, the decrease toxicity against mouse normal fibroblast (3T3) cell lines prospective of this nanocomposite together with controlled-release behavior provided evidence of the possible beneficial biological activities of this new nanocomposite for nanopharmaceutical applications for both oral and non-oral routes.

Keyword: Ammonia hydroxide; Biological applications; Biomedical applications; Controlled release; Iron oxide nanoparticle; Physical mixtures; Sustained-release; Visible spectroscopy