Doughnut-shaped bovine serum albumin nanoparticles loaded with doxorubicin for overcoming multidrug-resistant in cancer cells

Abstract

Traditional spherical albumin nanoparticles remain as the dominant shape of nanocarriers described in the literature at present, due to their simple desolvation method of synthesis. However, non-spherical shapes also show great promise as cancer drug delivery vectors. In this study, we report a novel synthetic strategy based on dimethyl sulfoxide (DMSO) addition during desolvation step, to produce doughnut-shaped bovine serum albumin nanoparticles (DBSA-NPs), while maintaining narrow size distributions and homogeneity. The characteristics such as size, polydispersity and doxorubicin loading of prepared DBSA-NPs in comparison with spherical ones were determined. The biodegradation of DBSA-NPs loaded with doxorubicin (Dox-DBSA-NPs) in the presence of trypsin enzyme was spectrophotometrically monitored directly based on doxorubicin release profile. The release profile was analyzed with different kinetic models and it was best fitted with Higuchi kinetics model. The anticancer effect of Dox-DBSA-NPs against lymphoblastic leukemia (MOLT-4) and multidrug resistant uterine sarcoma (MES-SA/DX-5) cell lines were also investigated and the results were comparable with doxorubicin loaded spherical BSA nanoparticles. These results showed the potential of Dox-DBSA-NPs as a novel and high potential nano-carrier for management of non-resistance and also multidrug resistant cancer cells. © 2017 Elsevier B.V.