A pH-sensitive, biobased calcium carbonate aragonite nanocrystal as a novel anticancer delivery system.

ABSTRACT

The synthesised biobased calcium carbonate nanocrystals had demonstrated to be an effective carrier for delivery of anticancer drug doxorubicin (DOX). The use of these nanocrystals displayed high levels of selectivity and specificity in achieving effective cancer cell death without nonspecific toxicity. These results confirmed that DOX was intercalated into calcium carbonate nanocrystals at high loading and encapsulation efficiency (4.8 and 96%, resp.). The $CaCO_3$/DOX nanocrystals are relatively stable at neutral pH (7.4), resulting in slow release, but the nanocrystals progressively dissociated in acidic pH (4.8) regimes, triggering faster release of DOX. The $CaCO_3$/DOX nanocrystals exhibited high uptake by MDA MB231 breast cancer cells and a promising potential delivery of DOX to target cells. In vitro chemosensitivity using MTT, modified neutral red/trypan blue assay, and LDH on MDA MB231 breast cancer cells revealed that $CaCO_3$/DOX nanocrystals are more sensitive and gave a greater reduction in cell growth than free DOX. Our findings suggest that $CaCO_3$ nanocrystals hold tremendous promise in the areas of controlled drug delivery and targeted cancer therapy.

Keyword: Calcium carbonate; Nanocrystals; pH-sensitive; Drug delivery; Doxorubicin; Aragonite