Development of novel flexible sugar ester vesicles as carrier systems for the antioxidant enzyme catalase for wound healing applications

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Abstract

The antioxidant enzyme catalase (CAT) was encapsulated in biocompatible flexible non-ionic sugar esters
(SEs)nano-vesicles forpotentialtopical administration. The effects ofthe SEhydrophilic lipophilic balance
(HLB) value and the carbon chain length of the fatty acid ester of different SEs on the encapsulation
efficiency (EE) were studied. Morphology of the vesicles was not altered upon CAT encapsulation using
freeze fracture electron microscopy. The extrusion measurements indicated that there was an increase
in the vesicle's flexibility index upon the inclusion of phospholipids. The mean diameter of the CAT-EV
(ester vesicle; HSC and HSC–PL) was 222–275 nm using laser diffraction measurements. The catalytic
efficiency (Vmax/Km) of CAT was improved after encapsulation by a factor of 1.7. Both free CAT and CATEV
showed maximum catalytic activity at pH 7.0, and CAT-EV was more stable than free CAT at acidic
pH, which is advantageous for successful topical delivery. Encapsulation of CAT in SE vesicles protected it
against trypsin treatment. Encapsulated CAT retained more than 60% residual activity after 12 successive
decomposition cycles of H2O2. CAT-EV activity was significantly preserved compared to that of free CAT
at 4 ◦C for 180 days. The in vivo study showed a significant effect of the prepared CAT nano-vesicles on
wound healing.

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