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Nanoencapsulation of tetrahydrocurcumin in CTS by rapid expansion of subcritical solutions coupled with ionic gelation

Fabrication of tetrahydrocurcumin (THC) nanoparticles encapsulated in chitosan (CTS) was achieved by a two-step method. THC nanoparticles were produced by rapid expansion of subcritical solutions of THC in a mixture of carbon dioxide and ethanol (1:1, w/w) with pre-expansion temperature and pressure of 80 ℃ and 276 bar, respectively. The aim of this study was to investigate the encapsulation conditions, i.e. CTS concentration, volume of CTS solution, and sodium tripolyphosphate (TPP) concentration, on the size of encapsulated THC nanoparticles and loading capacity of THC. After coating with CTS crosslinked with TPP, the size range of THC nanoparticles increased from 10-120 nm to 15-140 nm, with more than 85% smaller than 100 nm. The obtained encapsulated THC nanoparticles exhibited a spherical shape with average sizes of 45-56 nm and THC loading capacity of 34-47%. Increasing TPP and CTS concentrations and CTS solution volume in encapsulation resulted in larger encapsulated nanoparticles with lower THC loading capacity. The antioxidant activity of encapsulated THC nanoparticles increased with THC loading capacity, and encapsulation of THC in crosslinked CTS prolonged the release and antioxidant activity of THC. Finally, our results indicate that a combination of rapid expansion of subcritical solutions and ionic gelation could be an alternative to produce uniform-sized nanocapsules containing relatively large content of active substances.

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