J Nanostruct 10(2): 327-336, Spring 2020

RESEARCH PAPER

Hydroxypropyl Starch Nanoparticles as Controlled Release Nanocarriers for Piperine

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ARTICLE INFO

Article History:
Received 18 October 2019
Accepted 08 March 2020
Published 01 April 2020

Keywords:
Controlled Release
Hydroxypropyl Starch
Nanoparticles
Piperine

ABSTRACT

Hydroxypropyl starch was synthesized by modified sago starch with hydroxypropylation reaction. Hydroxypropyl starch nanoparticles with mean particle sizes of 110 nm are obtained by controlled precipitation through the drop-wise addition of dissolved hydroxypropyl starch solution into excess absolute ethanol. Piperine was loaded onto hydroxypropyl starch nanoparticles and native starch nanoparticles via the in-situ nanoprecipitation process. Hydroxypropyl starch nanoparticles exhibited higher piperine loading capacity as compared to native starch nanoparticles with the maximum loading capacity of 0.46 and 0.33 $mg.mg^{-1}$, respectively. Piperine was release from hydroxypropyl starch nanoparticles in a slow and sustained manner at pH 1.2 over the period of 24 hours. Whereas piperine was completely released from native starch nanoparticles within 16 hours.

How to cite this article
Salim A, Chin S., Pang S. Hydroxypropyl Starch Nanoparticles as Controlled Release Nanocarriers for Piperine. J Nanostruct, 2020; 10(2):327-336. DOI: 10.22052/JNS.2020.02.012

INTRODUCTION

Piperine is a naturally occurring alkaloid and it is the major bioactive component of pepper, which gives pungency and biting taste to it. Several studies have demonstrated that piperine possesses various beneficial health and therapeutic properties and most recently, piperine also showed chemopreventive and antioxidant activities [1]. Besides, it also has anticarcinogenic, stimulatory, anti-inflammatory, antimicrobial and antiulcer activities [1, 2]. However, the pharmaceutical activities of piperine are limited due to its low water solubility and its toxic effect on the central nervous and reproductive system when being used in high concentrations [1, 3]. These limitations have prompted many researchers to attempt to encapsulate piperine onto various nanoparticles in order to enhance its water solubility, bioavailability, and efficacy. There are several studies in which piperine was loaded onto nanoparticles. For example, piperine and curcumin were loaded onto zein-chitosan nanoparticles and 89% piperine encapsulation efficiency was achieved [2]. Piperine also showed high encapsulation efficiency (90.5%) when being encapsulated onto nanosize liposomes [4].

Studies have shown that starch nanoparticles are promising nanocarriers for various drugs and nutraceutical products due to its advantages, such as improving drug solubility and stability, decreasing drug toxicity and high drug loading capacity. In view of this, some researchers have attempted to load curcumin onto starch nanoparticles via the in-situ nanoprecipitation method. The maximum loading efficiency of 78% was achieved and the curcumin was released in a sustained way within 10 days from the nanoparticles with mean particle sizes of 87

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