Enhanced physicochemical stability and efficacy of angiotensin I-converting enzyme (ACE) - inhibitory biopeptides by chitosan nanoparticles optimized using Box-Behnken design

ABSTRACT

Bromelain-generated biopeptides from stone fsh protein exhibit strong inhibitory efect against ACE and can potentially serve as designer food (DF) with blood pressure lowering efect. Contextually, the DF refer to the biopeptides specifcally produced to act as ACE-inhibitors other than their primary role in nutrition and can be used in the management of hypertension. However, the biopeptides are unstable under gastrointestinal tract (GIT) digestion and need to be stabilized for efective oral administration. In the present study, the stone fsh biopeptides (SBs) were stabilized by their encapsulation in sodium tripolyphosphate (TPP) cross-linked chitosan nanoparticles produced by ionotropic gelation method. The nanoparticles formulation was then optimized via Box-Behnken experimental design to achieve smaller particle size (162.70nm) and high encapsulation efciency (75.36%) under the optimum condition of SBs:Chitosan mass ratio (0.35), homogenization speed (8000rpm) and homogenization time (30min). The SBs-loaded nanoparticles were characterized for morphology by transmission electron microscopy (TEM), physicochemical stability and efcacy. The nanoparticles were then lyophilized and analyzed using Fourier transform infra-red spectroscopy (FTIR) and X-ray difraction (XRD). The results obtained indicated a sustained in vitro release and enhanced physicochemical stability of the SBs-loaded nanoparticles with smaller particle size and high encapsulation efciency following long period of storage. Moreover, the efcacy study revealed improved inhibitory efect of the encapsulated SBs against ACE following simulated GIT digestion.

Keyword: Physicochemical stability; ACE; Biopeptides; Box-Behnken design