**Controlled release of capsanthin using alginate/κ-carrageenan beads**

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**Highlights**

* Biopolymer composite beads were successfully prepared.
* The amount of released capsanthin from alginate/κ-carrageenan composite beads was decreased
* The initial release rate of capsanthin of alginate/κ-carrageenan beads prepared with KCl solution was slow down.

**1. Introduction**

Biopolymers of marine algae origin are ubiquitous in surface waters and attracted to their potentialities. They present an enormous variety of structures, such as alginate, carrageenan, and chitosan. Sodium alginate is a hydrophilic polysaccharide. It consist of a linear copolymer composed two monomeric units β-D-mannuronic acid and α-L-guluronic acid. It conveniently forms into a gel structure in the presence of divalent cations such as Ca2+. κ-carrageenan is a naturally occurring sulfated polysaccharide extracted from red marine algae. It is a linear polyanionic polysaccharides composed of sulfated galactose and 3,6-anhydrogalactose copolymers, linked by alternating α-1,3 and β-1,4 glycosides. It selects K+ to stabilize the junction zones within the characteristically firm.

The aim of this study is to develop a biopolymer composite beads for the oral delivery of hydrophobic physiological functions.

**2. Methods**

2. 1 Preparation of alginate/κ-carrageenan composite beads

Sodium alginate (1g) and κ-carrageenan (1g) was dissolved in DI water (98g) under magnetic stirring at 298K for 12h. Heptane contained capsanthin and Span 85 was added to the sodium alginate/κ-carrageenan solution (20mL), and then it was stirred at 10000 min-1 for 5 min. The mixed solution was extruded dropwise through a syringe (inner diameter= 2 mm) into a CaCl2 solution or KCl solution (1mol/L, 200mL) under magnetic string (450 min-1) at 298 K for 10 min.

2. 2 Release of capsanthin from alginate/κ-carrageenan composite beads

The hydrogel beads (thirty units) loaded into an ethanol solution (100mL) under magnetic string (600 min-1) at 298 K. A sample (1mL) was taken from the ethanol solution at desired time. The concentration of capsanthin was measured a spectrophotometer (472 nm).

**3. Results and discussion**

Fig.1 shows the time course of the concentration of released capsanthin from alginate beads and alginate/κ-carrageenan composite beads. At increasing κ-carrageenan concentration, the amount of released capsanthin from alginate/κ-carrageenan beads was decreased. The improved retention of capsanthin within the alginate/κ-carrageenan composited beads formed at a high concentration of κ-carrageenan.



**Figure 1.** Time course of concentration of capsanthin from alginate beads (■) and

alginate/κ-carrageenan composite beads (●) . (1mol/L CaCl2 sol.)

Fig.2 shows the effect of the different cations on the initial release rate from alginate/κ-carrageenan beads. The release rate of capsanthin of alginate/κ-carrageenan beads prepared with Ca2+ was 1.7-fold greater than that of the beads prepare with K+. Alginate/κ-carrageenan composite beads effectively stabilized by slowing down the release of capsanthin by K+ which cross-linked the κ-carrageenan



**Figure 2.** Effect of the different cations on the initial release rate of capsanthin from alginate beads

(1mol/L CaCl2 sol., 1mol/L KCl sol.)

**4. Conclusions**

This work successfully demonstrated that the incorporation of κ-carrageenan in the alginate beads decreased the amount of released capsanthin