ANALYSIS OF AQUEOUS SUSPENSION STABILITY OF CHITOSAN BASED NANOENCAPSULATED VITAMINS

Lícia M. Lundstedt*, Douglas de Britto, Flávia G. Pinola, Luiz H. C. Mattoso, Odilio B. G. Assis

*Embrapa Pesca e Aquicultura. QD 104 Sul, Av. LO 1, N. 34, Conj. 4, 1°/2° Pavimentos
Palmas, TO. CEP 77020-020. Brazil. E-mail: licia.lundstedt@embrapa.br

The nutritional content of a food can be reduced as a result from natural degradation of vitamins. Most of food nutrients and in special the vitamins are susceptible to fast degradation during processing, storage, and consumption. For example, ascorbic acid (vitamin C) is chemically stable in acid pHs but unstable when in alkaline or neutral aqueous media. It also suffers intense action when subjected to oxygen, light and temperature and may reach values close to 100% of Maximum Cook Loose (MCL). In contrast folic acid (vitamin B9) is quite stable in alkaline media but unstable in neutral or acidic pH and likewise suffers degradation by oxygen, light and heat, also reaching a 100% MCL. Cyanocabalamin (vitamin B12) is relatively more stable and can withstand variations in pH, although is susceptible to oxygen and light, presenting MCL near 10%.

In order to minimize such losses, the encapsulating theses actives into polymeric nanoparticles (NPs) could offer an additional protection, extending stability during storage whether in humid or dry conditions. The composite formed by the ionic gelation process of chitosan and tripolyphosphate (Chi-TPP) has been widely used as an encapsulating matrix for several chemical compounds. This process comprised a continuous addition of TPP solution at 0.7; 1.34 and 1.38 mg/cm^3, respectively for vitamins B9, C and B12, into Chi solution (3.0 mg/cm^3). Chi was previously dissolved in an aqueous solution of acetic acid at 1% (v/v). The system was magnetically stirred at room temperature during the addition of TPP drop wise solution to the Chi/vitamin mixture. The final loaded particles have an average size of around 320 nm. The stability of the vitamins in encapsulated and non-encapsulated conditions was evaluated in aqueous suspension by UV-Visible spectroscopy when stored in dark, under light exposure and under effect of oxygen bubbling.

The results indicated that encapsulation had a positive effect in preserving the vitamins, in particular vitamin C. The adjusted curves for the vitamin C degradation showed an exponential decay. The encapsulated vitamin C also follows an exponential decay model, however, with less pronounced losses (Figure 1). The encapsulation of vitamin C preserved 47% of the initial concentration by the tenth day and around 28% after 17 days when in aqueous medium. Conversely in the non-encapsulated controls (diluted in neutral and acidic medium) losses were higher and measured proportional concentration of approximately 13% by the tenth day and almost 3% after 17 days of storage in both medium. When exposed to light and O2 the protection provided by the encapsulation was even greater.

Figure 1. Variation of concentration of nanoencapsulated vitamins C ( ) in comparison with non-encapsulated vitamin C in deionized water (●) and 1% acetic acid solution ( ) during 15 days at 30ºC and darkness. The points were adjusted to exponential decay model, with R^2 values ≥ 0.90 for all fits.