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Development of biopolymer based-nanosystems for vitamins delivery

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Vitamins are sensitive and unstable when exposed to inappropriate temperature, oxygen, light and humidity conditions. For the food industry it is important to reduce some of these limitations and being with nanosystems arise a promising solution.

This work aims at the development of nanosystems for the encapsulation of riboflavin (water-soluble) and α-tocopherol (liposoluble) using biopolymer and their further characterization. For encapsulation of riboflavin an ionotropic polyelectrolyte pre-gelation was used as production method being chitosan and alginate used as main materials. α-tocopherol was encapsulated through the self-assembly of zein, one of the major proteins of corn with an amphiphilic character.

A factorial experimental design was used to determine the optimal concentrations of used biopolymers and encapsulated vitamin that allow the highest efficiency and the production of nano-sized structures. For the alginate and chitosan system the optimal concentrations were 0.63 of alginate, 0.4 of chitosan and 0.065 mg/ml of riboflavin. For the zein system 2 and 1 mg/ml of zein and α-tocopherol, respectively, were used. Nanosystems were characterized in terms of average size, polydispersity index and zeta potential (through Dynamic Light Scattering) and vitamin entrapment efficiency. The average size (by number) for alginate/chitosan nanoparticles with riboflavin was 110.17 nm (±47.71). The nanosystems present values of polydispersity index and the zeta potential of was 0.520 (±0.041) and -29.64 mV (±0.97), respectively. The zein nanoparticles with α-tocopherol present an average size of 93.60 nm (±1.09) and a polydispersity index of 0.222 (±0.020) with a zeta potential of +26.08 mV (±2.51).

Alginate, chitosan and zein are biodegradable, biocompatible, food-grade with good physicochemical properties and can be used to the development of biopolymer-based nanosystems. This work shows that these biopolymer-based nanosystems can be used for the encapsulation of water-soluble and liposoluble vitamins with a great potential for application in food products.