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Physical-Chemical study of betalains nanoencapsulation in a glutenin matrix by electrospray

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The pitaya (Stenocereus thurberi) is a fruit from the Northwest of Mexico and its use is for human feed, mainly. This fruit has a high content of betalains, which are natural pigments with a strong antioxidant and antibacterial capacity. Betalains can be extract from the pitaya pulp, however, the pigments are unstable to environmental factors such as light, oxygen, temperature, pH, and water which leads to the degradation pigments and lose of the antioxidant and antibacterial capacity. A potential solution to this problem is nanoencapsulation, using biopolymers that are friendly to the environment and human beings, such as cereal proteins. The development of micro and nano-particles based on cereal proteins has been of interest for researchers due to their applications in foods, medicine, agriculture, etc. Among the most promising proteins is wheat gluten, composed mainly of gliadins and glutenins; of which, glutenins have a higher molecular weight. Currently one of the promising techniques for particle development is the electrospray technique due to its advantages over other techniques. In this investigation, the electrospray coaxial technique, has been studied to be a suitable technique to protect the betalains into a glutenin matrix with the purpose of maintain the pigments stability. The aim of this work was to study the effect of the parameters of the electrospray technique and the physicochemical properties of the solutions in obtaining core-shell particles of betalains-glutenins.

In obtaining the core-shell particles, the physicochemical properties of the solutions (concentration, viscosity and density) and the electrospray parameters (voltage and flow velocity) were evaluated on the physical characteristics of the particles, which were characterized by SEM, TEM, FT-IR, and LSCM techniques. The physicochemical properties of the solutions indicated that at a higher concentration, density and viscosity, particles in the micrometer range (1.151±0.179 μm) with collapsed particle morphology were obtained. In the parameters of electrospray, it was observed that increasing the voltage and decreasing the flow rate decreases the size of the particles (0.812±0.209 μm). Therefore, the morphology and size of the particles from glutenins was improved by increasing the concentration, viscosity and density of the solution and with the decrease in the flow rate (0.05 mL h-1) and the increase in voltage (20 kV). For nanoparticles betalains-glutenins, the SEM micrographs showed the spherical morphology of the particles and its size in nanometric scale. TEM and LSCM reveals the betalains and the glutenin matrix formed a core-shell structure. FT-IR analysis indicated that there are not interactions between the betalains from the extract and the glutenin matrix. Therefore, the betalains chemical structure is not affected by the encapsulation process. It is concluded, that the betalains extraction and its encapsulation using the electrospray technique can develop core-shell nanoparticles of betalains-glutenins, with potential application in food industries.

Biography

Francisco Rodríguez Félix has received her Ph.D. (2009) degree from University of Sonora, Mexico. Currently, the research professor of the Department of Food Research and Graduate Program (DIPA), at the University of Sonora, Mexico, with expertise in micro and Nano-materials science. Also, he is expert in techniques of characterization of materials as FT-IR spectroscopy, SEM, DRX, DSC-TGA, among others. He is a level 3 national researcher, the highest distinction offered by the National Council of Science and Technology of Mexico (CONACYT). During the period from December 2018 to January 2020 he was coordinator of the Postgraduate Program in Food Sciences and Technology, at the University of Sonora, Mexico. Currently, it has more than 60 scientific publications and more than 1,400 citations in international journals. From 2014 at 2018 was editor in chief of the journal BIOtecnia (http://biotecnia.unison.mx); from August 2018 to date is associate editor of the same journal. He has also been a guest editor for several international journals such as, the Journal of Renewable Materials, Journal of Nanomaterials, Frontiers in Sustainable Food Systems; and Nanomaterials.

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