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Protein-coated microparticles of calcium alginate and jamun pulp (*Syzygium cumini* L.)

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Abstract

In several scientific studies, the beneficial effects of jamun (*Syzygium cumini* L.), mainly related to its antioxidant properties, have been demonstrated due to the high content of bioactive compounds such as anthocyanins present in the fruit. However, the use of its beneficial effects is limited, since its active compounds present instability when exposed to high temperature, light and oxygen, thus altering its functional and antioxidative properties. Microencapsulation of jamun pulp is shown as a relevant alternative to increase the stability of its compounds, increasing the shelf life of the material. In addition to this, it enables the production of new food products, providing demand of population for healthy and ecologically products. Therefore, the objective of this research work was to analyze the development of microparticles of sodium alginate containing jamun pulp by ionic gelation and subsequent coating with protein by electrostatic interaction. Experimental design was performed varying the concentration of jamun pulp with core material and concentration of coating protein. The particles were produced by an adapted pressurized air spraying procedure and evaluated for their water, proteins and anthocyanin contents. It was possible to evaluate the quality of particles after their production, noting the efficacy of the proposed methodology and the efficiency of the ionic gelation and electrostatic interaction processes.

Key words: *Ionic gelation, protein, electrostatic interaction.*

Introduction

Jamun (*Syzygium cumini* L.) has a high antioxidant capacity, anthocyanins and polyphenols assigning it a potential effect against several degenerative diseases and can represent a rich source in human nutrition. Many studies have focused on researching natural antioxidants for application in food industry. In this sense, jamun presents great potential, since it is a rich source of bioactive compounds. Using these effects may be limited due to the instability of their compounds when exposed to high temperatures, light and oxygen. Thus, this research sought the development of calcium alginate microparticles containing jamun pulp by ionic gelation and coated with protein by electrostatic interaction, evaluating the retention of bioactive compounds in order to protect them from adverse conditions of surrounding environment, stabilizing and increasing the shelf life of the material, allowing to evaluate the potential of the best test particles for application in food products.

Results and Discussion

Particles were produced by an adapted system using a twin fluid atomizer with the feed solution to be encapsulated by means of a peristaltic pump which allowed a process uniformity and synchrony. In this system, the solution of alginate and jamun pulp were sprayed in small droplets into a calcium chloride solution under agitation, forming microparticles instantly and more uniform than those produced by methods already used in other researches. It was observed that the particles obtained by ionic gelation showed intense coloration while, when submitted to the process of electrostatic interaction with protein, they presented a lighter and opaque coloration due to the formation of a protective layer on their surface. The protein content of ionic gelled particles presented values between 4.6% and 6.8% and after their coating, there was a significant increase in protein content of all tests particles, indicating strong electrostatic interaction between protein and free alginate carboxylic groups, which remained after ionic gelation.

Image 1. Gelled (left) and protein-coated (right) particles.

Protein content was directly influenced by concentration of protein in coating solution, since the particles coated at 1% concentration had a protein content of 16.6% and the coated particles at 10% concentration presented protein content of 32.2%. Although electrostatic interactions are responsible for many of the forces, promoting formation of protective layer, other bonds are also related to this process, such as hydrogen bonds, covalent bonding and Van de Waals interactions, although such mechanisms of chemical interactions are not fully understood. The water content of the coated particles did not present significant differences compared to the ionic gelled particles, presenting values around 93.5%. With the adsorption of proteins in the ionic gelled particles, the content of anthocyanins in these particles decreased, due to the increasing amount of encapsulant solids added to the jamun pulp solids in particles.

Conclusions

Considering the results obtained, it is concluded that it is possible the formation of protein-coated microparticles of calcium alginate and jamun pulp, presenting high protein adsorption and anthocyanins. The spraying system by pressurized air used in this research work was considered a better method when compared to the regular methods for microparticles formation. Both particles and the spraying system have high potential for application in food industry.

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