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Food Biochemistry

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FULL ARTICLE

Development of alginate-pectin microcapsules by the extrusion for encapsulation and controlled release of polyphenols from papaya (*Carica papaya* L.)

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Abstract

The papaya fruit (*Carica papaya* L.) contains a wide variety of bioactive compounds with potential applications in the food and nutraceutical industries. The entrapment and release of such bioactive compounds remain a critical step for the development of functional, stable, and cost-effective storage and delivery systems, since the interaction of polymers on capsules and the payload molecules can influence the performance of the capsule system under operational conditions. The present study describes the encapsulation of rutin and *trans*-ferulic acid-rich extracts from papaya exocarp in a pectin-alginate composite, evaluating the performance of gallic acid encapsulation obtained through in situ and two-step entrapment methods. The best alginate:pectin ratio for gallic acid encapsulation was 55:45 and 61:39, achieving 6.1 mg and 28.1 mg GAE/g capsules when the papaya exocarp extract was encapsulated by in situ and two-step, respectively. We also evaluated the payload release performance of the obtained capsules under in vitro conditions simulating gastrointestinal conditions. Our results indicate an increased protective effect at gastric pH and targeted release of polyphenols when in situ encapsulation is used to encapsulate the extracts.

Practical applications

Currently, adding value to agroindustry processing waste is an important focus to achieve a more economically and environmentally sustainable food industry. The recovery of bioactive molecules such as polyphenols, for food supplements or formulation additives in the form of by-product extracts is gaining importance as novel sustainable processes in the agricultural industry. Thus, the encapsulation of such bioactive extracts for storage and consumption is an active research field, aiming to overcome the low storage stability and lability to gastric conditions, currently hindering their applications in food or pharmaceutical formulations. In this sense, capsule design and the development of efficient encapsulation methods are very important to obtain a suitable carrier and protector system for the capsulated bioactive extracts or molecules. This research aims to add value to papaya waste and potentially to other agroindustry wastes such as pectin and alginate, resulting in a polyphenol carrier with excellent encapsulation and targeted release properties