ENCAPSULATION OF BEETROOT EXTRACT USING SODIUM ALGINATE/SODIUM ALGINATE-CASEIN SODIUM SALT: STUDY OF PHYSICAL AND CHEMICAL PROPERTIES

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Abstract

This study aimed to develop microcapsules containing beetroot extract (BE) to enhance the stability of phenolic compounds during storage and thermal exposure. Beetroot extract was obtained using microwave-assisted extraction, resulting in an extraction yield of 9.58%. The total phenolic content (TPC) of the crude extract was determined to be 25.12±0.23 mg GAE/g extract. To improve the stability of phenolic compounds, BE was microencapsulated using natural wall materials. Sodium alginate was employed as a single wall material, while a combination of sodium alginate and casein sodium salt was used as a mixed wall system. The encapsulation efficiency and physicochemical characteristics of the resulting microcapsules were investigated. Among the tested formulations, microcapsules prepared using 3.0% (w/v) sodium alginate exhibited a more spherical morphology and smoother surface characteristics compared with other formulations. However, the optimized mixed-wall formulation using 3.0% (w/v) sodium alginate combined with 1.0% (w/v) casein sodium salt and crosslinked in 5.0% (w/v) $CaCl_2$ solution demonstrated the thermal stability and the low degradation of phenolic compounds during thermal treatment and had higher encapsulation efficiency than single wall formulation. After 14 days of storage, the total phenolic contents of microcapsules prepared with single-wall alginate and mixed-wall sodium alginate–casein sodium salt systems were 23.18±0.23 and 24.59±0.16 mg GAE/g extract, respectively. These findings indicate that microencapsulation of BE using natural biopolymeric wall materials can effectively reduce polyphenol degradation and improve the thermal stability and shelf life of beetroot phenolics, thereby enhancing the potential applications of BE in food, pharmaceutical, and nutraceutical products.

Keyword: Beetroot extract, Encapsulation, Sodium alginate, Sodium alginate-casein sodium salt