335483 Food Technology Project 1/2566

Encapsulation of gallic acid into porous cassava starch by using different ultrasonic systems

(การห่อหุ้มกรดแกลลิคด้วยสตาร์ชมันสำปะหลังมันรูพรุนโดยใช้ระบบอัลตราโซนิคที่แตกต่างกัน)

Name: Miss Ongchanita Thongkhot **ID: B6207373**
Name: Mister Wisarut Tuandon **ID: B6207922**

Advisor: Dr. Thewika Keeratiburana

Abstract

Gallic acid (G) is a phenolic organic acid known for its antioxidant properties, but it is prone to decomposition when exposed to light and heat. This project aims to study and compare effects of encapsulating gallic acid into native cassava starch (N) and porous cassava starch (P) by using different ultrasonic techniques, ultrasonic bath (UB), ultrasonic processor (UP) and using homogenizer (H) as control technique. The spray drying was used as a drying method. The yield percentage after encapsulation was in the range of 79.77–89.57%. SEM images revealed that native starch exhibited a smooth surface, while porous starch displayed porous granules. Moreover, using different encapsulation techniques did not clearly affect the granular surface. Particle size analysis indicated that 90% (D_{90}) of porous starch encapsulating gallic acid had larger particles (24.67–28.62 μm) compared to native starch (21.25–28.51 μm). Specifically, the UP technique resulted in the largest particles, with PGUP (11.23 μm) and NGUP (10.61 μm) having the highest $D_{3,2}$ values. Encapsulation efficiency (%EE) analysis demonstrated that PGUP had the highest %EE (91.04%), though this was not significantly different from the rates of PGH, PGUB, and NGH samples. In contrast, NGUB had the lowest %EE (86.97%). Results of gallic acid storage stability analysis at different temperatures (25 and 40°C) showed that encapsulated porous starch encapsulated gallic acid was more effective in preserving gallic acid compared to native starch. Antioxidant properties using the FRAP method revealed that PGUB exhibited the highest free radical inhibition after storage at 25°C and 40°C for 28 days, with antioxidant values of 17.29 and 17.89 μmol Fe2+/g at the respective temperatures. In the DPPH method at 25°C, PGUP displayed the highest percentage inhibition (%PI) at 51.87%, while PGUB achieved the highest %PI at 40°C, registering 51.62%. The project findings indicate porous cassava starch is effective in encapsulating gallic acid, and the probe-based ultrasonic technique is the optimal method for its encapsulation. This encapsulation method can be applied for the food and pharmaceutical industries.

Keywords: Gallic acid; Ultrasonic; Porous starch; Encapsulation

Thewika K.
……
(Dr. Thewika Keeratiburana)
Advisor

27/Oct/2023

References

Li, W., Chen, W., Wang, Z., Chen, W., Zhang, M., Zhong, Q., Pei, J., ... & Chen, H. (2022) Preparation and Characterization of Beads of Sodium Alginate/Carboxymethyl Chitosan/Cellulose Nanofiber Containing Porous Starch Embedded with Gallic Acid: An In Vitro Simulation Delivery Study. *Foods 2022, 11, 1394*

Mehta, N., S, J., Kumar, P., Verma, A. K., Umaraw, P., Khatkar, S. K., Khatkar, A. B., Pathak, D., ... & Sazili, A. Q. (2022). Ultrasound-Assisted Extraction and the Encapsulation of Bioactive Components for Food Applications. *Foods, 11, 192973*