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THESIS: MICROENCAPSULATION OF BAMBOO LEAVES EXTRACT FROM PAI TONG (*Dendocalamus asper* J.H. SCHUTTES) AND PAI RUAK (*Thyrsostachys siamensis* GAMBLE) AND THEIR ANTIOXIDANT PROPERTIES

ABSTRACT

Pai Tong (D. asper) and Pai Ruak (T. siamensis Gamble) are the economic important bamboos in Thailand which are growing for their woody stems and edible shoots. The leaves are normally discarded as waste or use as fertilizer. In this research, Pai Tong and Pai Ruak leaves were investigated for the antioxidant activity from ethanol extraction to determine the optimum extraction condition. Then, the microencapsulation of bamboo leaf extract using maltodextrin, β-cyclodextrin and freeze drying was performed. Simultaneously, stability of microencapsulated powder was investigated as well as its application in fat rich Moo Yor (Vietnamese style sausage).

Bamboo leaves were dried using tray dryer and ground into powder before extracted with various conditions. The average diameter by volume of dried Pai Ruak leaf powder and dried Pai Tong leaf powder was 542.98 ± 2.11 and 603.70 ± 1.55 μm, respectively. The best extraction condition for Pai Ruak leaf was 2% (w/v) bamboo leaf powder (BLP) in 75% ethanol for 48 hours, while the best condition for Pai Tong leaf extraction was 2% (w/v) BLP in 75% ethanol for 24 hours. Pai Ruak extract showed the high total phenolic compound (TPC) and total flavonoid (TF) as 6.63 ± 0.12 mg GAE/g of powder and 101.57 ± 3.57 mg CE/g of powder, respectively. The detected flavonoid in Pai Ruak extract were isoorientin 0.10 ± 0.01 mg/g sample and vitexin 0.38 ± 0.01 mg/g sample. For TPC and TF for Pai Tong extract was 5.87 ± 0.14 mg GAE/g of powder and 89.59 ± 1.58 mg CE/g of powder, respectively and the detected flavonoids in Pai Tong extract were orientin as 7.05 ± 0.59 mg/g sample, isoorientin as 3.35 ± 0.27 mg/g sample, and vitexin as 3.00 ± 0.04 mg/g sample.

The suitable microencapsulation of Pai Ruak and Pai Tong extract using BCD and MD as coating material was carried out by using freeze-drying process. From response surface methodology, the best ratio to encapsulate BLE was 5% (v/v) BLE and 95% MD with higher than 90% microencapsulation yield. Microencapsulation efficiency (ME%) of microencapsulated bamboo leaf extract (MBLE) was 85.39% for Pai Ruak and 72.82% for Pai Tong as determined by TF. Size distribution of BL powder and MBLE indicated

that 50% of the particle were less than 542.98 ± 2.11, 603.70 ± 1.55, and 223.55 ± 0.89 μm for Pai Ruak powder, Pai Tong powder, and MBLE powder, respectively

As MBLE of Pai Ruak showed better ME% than that of Pai Tong, it was chosen for the study the degradation of TF during storage at different temperature (25, 35, and 45°C) and water activities (0.53, 0.64, and 0.75). The degradation of TF in MBLE powder followed the first-order reaction kinetics because it decreased as a function of time during 8-weeks storage and it was accelerated at high temperature and high-water activity, resulting in the short half-life time (t1/2) of TF in MBLE powder. The highest half-life time or the fastest degradation of TF was found in MBLE powder stored in aw 0.53 at 45°C as 82 days, while the shortest half-life time or the slowest degradation of total flavonoids was found in MBLE powder kept in aw 0.64 at 35°C as 34 days.

Various amount of MBLE from Pai Ruak leaf extract was applied into fat-rich Moo Yor to investigate the degradation comparing with the control and commercial antioxidant. Addition of MBLE effectively reduced the development of lipid oxidation in fat-rich Moo Yor throughout 8 days of refrigerated storage. The addition of 2% (w/w) MBLE was found to be the most effective to retard the lipid oxidation. The high amount of MBLE powder added into Moo Yor showed the effect on the texture and sensory evaluation but they did not show clearly differences for the rancidity changes at low MBLE powder content.

Key words: Microencapsulation, Bamboo leaves extract, Thai Bamboo, Antioxidant, Lipid oxidation