EXTRACTION AND CHARACTERIZATION OF MUCILAGE FROM *Talinum paniculatum* (FAMEFLOWER) AND ITS APPLICATION IN BEVERAGE EMULSION

TENGKU NUR DAYANA BINTI TENGKU ZAKARIA

Thesis Submitted in Fulfillment of the Requirement for the Degree of Master of Science in the School of Food Science and Technology Universiti Malaysia Terengganu

June 2015

DEDICATION

To

My Mother
Latipah Abdul Razak
A strong and gentle soul who taught me to trust in Allah, believe in hard work
and that so much could be done with little patience

My Father
Tengku Zakaria Tengku Setapa
For earning an honest living for us and for supporting and encouraging me to
believe in myself

My Grandmother
Hjh Wan Khamsah@Khamsiah Syeikh Ali
For being my first teacher

My Siblings
Tengku Nor Dalila
Tengku Muhammad Firdaus
Tengku Nur Dinie Athirah
Tengku Muhammad Faris
Tengku Nur Durratul Azyan
Tengku Muhammad Fahmi
Tengku Muhammad Faizuddin

My Husband: Nor Azizi Ahmad
For being my supporter and advisor during my educational career

My lovely Son: Muhammad Adzeem Irfan

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfillment of the requirement for the degree of Master of Science

EXTRACTION AND CHARACTERIZATION OF MUCILAGE FROM *Talinum paniculatum* (FAMEFLOWER) AND ITS APPLICATION IN BEVERAGE EMULSION

TENGKU NUR DAYANA BINTI TENGKU ZAKARIA

June 2015

Main Supervisor   : **Nor Hayati Ibrahim, Ph.D**

Co- Supervisor   : **Yusnita Hamzah, Ph.D**

School   : **Food Science and Technology**

In this study, the extraction optimization, characterization and functionalities in food emulsion of mucilage from *Talinum paniculatum* (Fameflower) fronds were investigated. For the first two objectives, the influence of water to fronds ratio, extraction temperature and pH on extraction yield, protein content and emulsifying capacity of the mucilage was investigated using a face centered-central composite design. All responses were best fitted with quadratic model (adjusted R^2 = 0.67 − 0.97 with no lack-of-fit). The optimum conditions for mucilage extraction from *T. paniculatum* were water to fronds ratio at 8.4:1, extraction temperature at 90 ^oC and pH at 8 providing 3.44 % of mucilage yield, 29.35 % of protein content and 34.00 % of emulsifying capacity. The third objective involved characterisation of *T. paniculatum* mucilage extracted under the optimum conditions as compared to commercial gum Arabic. The moisture content (10.42 ± 0.13 %) was lower but the ash content (25.11 ± 1.11 %), water holding capacity (99.87 ± 2.64 %) and emulsifying capacity (34.67 ±0.46 %) were pronouncedly higher in *T. paniculatum*

mucilage than gum Arabic. The mucilage contained high amount of potassium (545.98 ppm) while arabinose, glucose and galactose were the monosaccharaides identified in the mucilage. The mucilage exhibited a significant higher free radical scavenging activity (68.96 ± 0.59 %) as compared to gum Arabic (32.32 ± 2.98 %). For the final objective of this study, fourteen emulsions were prepared based on a two-factor central composite design to investigate the effect of *T. paniculatum* mucilage (5 – 10%) and orange oil (6 – 10 %) concentrations on properties and stability of beverage emulsions. The prepared emulsions were found to demonstrate acceptable viscosity (5120 – 23840 mPa.s) and droplet size (0.22 – 28.87 µm) with optimum pH values (2.96 – 3.27) which were pronouncedly depended on mucilage and orange oil concentrations. The emulsions with 10% mucilage and 6% orange oil generally demonstrated good stability towards phase separation and lipid oxidation. The quadratic model was validated to be useful in predicting future data of the respective responses (adjusted R^2 > 0.9 with no lack-of-fit). Therefore, this study successfully provided evidences that *T. paniculatum* mucilage has a potential to be considered as one of alternatives to commercial gums which may offer another natural ingredient especially in beverage emulsions production.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk ijazah Sarjana Sains.

PENGEKSTRAKAN DAN PENCIRIAN LENDIR *Talinum paniculatum* (FAMEFLOWER) DAN APLIKASINYA DALAM EMULSI MINUMAN

TENGKU NUR DAYANA BINTI TENGKU ZAKARIA

Jun 2015

Penyelia Utama   **: Nor Hayati Ibrahim, Ph.D**

Penyelia Bersama   **: Yusnita Hamzah, Ph.D**

Pusat Pengajian   **: Sains dan Teknologi Makanan**

Dalam kajian ini, pengoptimuman pengekstrakan, pencirian dan fungsi dalam emulsi makanan daripada lendir pucuk *Talinum paniculatum* (Fameflower) telah dikaji. Bagi dua objektif pertama, pengaruh nisbah air kepada pucuk, suhu pengektrakan dan pH terhadap hasil pengekstrakan, kandungan protein dan kapasiti mengemulsi telah dikaji menggunakan reka bentuk komposit terpusat -permukaan berpusat. Semua respon paling sesuai dipadankan dengan model kuadratik (R^2 terlaras = 0.67 – 0.97 tanpa kekurangan padanan), membenarkan ramalan untuk data masa depan dibuat. Keadaan optimum untuk pengekstrakan lendir daripada *T. paniculatum* ialah pada nisbah air kepada pucuk 8.4:1, suhu pengekstrakan 90 ^{0}C dan pH 8 menghasilkan 3.44 % hasil lendir, 29.35 % kandungan protein dan 34.00 % kapasiti mengemulsi. Objektif ketiga melibatkan pencirian lendir *T. paniculatum* yang diekstrak pada keadaan optimum dan dibandingkan dengan gum Arab yang komersil. Kelembapan lendir (10.42 ± 0.13 %) lebih rendah tetapi kandungan abu (25.11 ± 1.11 %), kapasiti untuk memegang air (99.87 ± 2.64 %) dan kapasiti mengemulsi (34.67 ±0.46 %) lebih tinggi dalam lendir *T. paniculatum* berbanding

gam Arab. Lendir mengandungi kalium yang tinggi (545.98 ppm) manakala arabinose, glukosa dan galaktosa adalah monosakarida yang dikesan dalam lendir. Lendir ini juga menunjukkan aktiviti memerangkap radikal bebas yang lebih tinggi dan signifikan (68.96 ± 0.59 %) berbanding gam Arab (32.32 ± 2.98 %). Untuk objektif terakhir kajian ini, empat belas emulsi telah disediakan berdasarkan kepada reka bentuk komposit terpusat dengan dua faktor untuk mengkaji kesan kepekatan lendir *T. paniculatum* ($5 - 10$ %) dan minyak oren ($6 - 10$ %) ke atas ciri-ciri dan kestabilan emulsi minuman. Emulsi yang telah disediakan didapati menunjukkan kelikatan ($5120 - 23840$ mPa.s) dan saiz titisan (0.22 -28.87 μm) yang diterima dengan nilai pH yang optimum ($2.96 - 3.27$) yang dengan jelas bergantung kepada kepekatan lendir dan minyak oren. Emulsi dengan 10% lendir dan 6% minyak oren secara umumnya menunjukkan kestabilan yang baik terhadap pemisahan fasa dan pengoksidaan lemak. Model kuadratik telah disahkan untuk menjadi berguna dalam meramalkan data masa depan untuk respon tersebut (R^2 terlaras > 0.9 dengan tidak menunjukkan kekurangan padanan). Oleh itu, kajian ini berjaya menyediakan bukti bahawa lendir *T. paniculatum* mempunyai potensi untuk dipertimbangkan sebagai salah satu alternatif untuk gam komersial yang boleh dijadikan sebagai satu lagi bahan semula jadi terutamanya dalam pengeluaran emulsi minuman.