

**PHYSICOCHEMICAL ANALYSIS AND STORAGE STABILITY OF  
UNPASTEURISED AND PASTEURISED JUICE POWDER FROM SWEET  
POTATO (*Ipomoea batatas* L.) HAULM**

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**UNIVERSITI SAINS ISLAM MALAYSIA**

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SWEET POTATO (*Ipomoea batatas* L.) HAULM**

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Thesis submitted in fulfilment for the degree of

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## AUTHOR DECLARATION

I hereby declare that the work in this thesis is my own unless specified and duly acknowledged by quotation.

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## APPROVAL FOR SUBMISSION

I certify that this thesis entitled “**PHYSICOCHEMICAL ANALYSIS AND STORAGE STABILITY OF UNPASTEURISED AND PASTEURISED JUICE POWDER FROM SWEET POTATO (*Ipomoea batatas L.*) HAULM**” was prepared by **NURHANI FATIHAH BINTI MOHD HANIFAH** has met the required standard for submission in partial fulfilment of the requirements for the Master of Science (Food Biotechnology).

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## ABSTRAK

Penggunaan sisa bio yang terhad dan rendah menyebabkan desakan modenisasi dalam pertanian melibatkan makanan yang berasaskan tumbuhan sebagai pemangkin untuk pulangan keuntungan yang lebih baik. Kawasan penanaman pertanian untuk tanaman kontan ubi keledak adalah yang kedua terbesar di Malaysia selepas jagung (3, 623 hektar). Sisa pertanian daripada pokok ubi keledak (bahagian atas pokok yang mengandungi batang dan daun yang tidak digunakan) berpotensi dijadikan sumber bahan bioaktif dan antioksidan. Namun begitu, data berkenaan dengan jus daripada sisa pertanian ubi keledak yang dikeringkan masih belum dilaporkan. Oleh itu, objektif untuk kajian ini adalah, i) untuk menentukan sifat fisikokimia serbuk jus sisa pertanian ubi keledak (SJSPUK) yang tidak dipasteur dan dipasteur, dan ii) untuk mengkaji kestabilan penyimpanan serbuk jus sisa pertanian ubi keledak (SJSPUK) yang tidak dipasteur dan dipasteur dengan menentukan jumlah kandungan fenol (TPC) dan ujian penurunan ferik (FRAP) selama 180 hari. Hasil kajian menunjukkan SJSPUK yang dipasteur mempunyai kandungan mineral (13.24 g/100 g dw) dan indeks larutan air (24.30–31.36 g/100 g) yang lebih tinggi dan aktiviti air (0.34  $a_w$ ), kandungan karbohidrat (39.33 g/100 g dw) dan asid fitik (0.01 g/100 g dw) yang lebih rendah daripada SJSPUK yang tidak dipasteur secara signifikan ( $p < 0.05$ ). Kedua-dua SJSPUK menghasilkan kandungan protein minimum sebanyak 35.23 g/100 g dw. Aktiviti FRAP SJSPUK yang tidak dipasteur dan dipasteur di bawah keadaan cahaya masing-masing menuruti degradasi kinetik tertib pertama dengan kadar tindakbalas sebanyak  $1.3 \times 10^{-3}$  dan  $2.2 \times 10^{-3}$  hari<sup>-1</sup>, dan separuh hayat 533 hari dan 315 hari. Separuh hayat TPC SJSPUK yang dipasteur di bawah keadaan cahaya dan gelap masing-masing adalah 100 dan 136 hari dan didegradasikan pada kadar  $6.9 \times 10^{-3}$  hari<sup>-1</sup> dan  $5.1 \times 10^{-3}$  hari<sup>-1</sup>, juga menggambarkan model kinetik tertib pertama. Manakala, aktiviti FRAP dan TPC SJSPUK yang dipasteur di bawah keadaan gelap adalah stabil untuk for 180 hari penyimpanan. Secara keseluruhan, kajian ini akan memperlihatkan potensi produk hiliran daripada sisa pertanian ubi keledak sebagai sumber antioksidan yang berterusan dan protein berasaskan tumbuhan yang inovatif.

*Kata kunci: sisa pertanian, ubi keledak, fisikokimia, FRAP, TPC, kestabilan*

## ABSTRACT

Limited or low optimisation of biowaste has pushed modernisation in agriculture that involves food-based plants being grown as a buffer for better profit returns. For cash crop plantation, the plantation area for Sweet potato (*Ipomoea Batatas* L.) is the second widest after sweet corns in Malaysia (3, 623 hectares). Haulm (unused tops of the plants consisting of stem and leaf) from the sweet potato plant is a potential source for bioactive materials and antioxidants. However, no data is reported on the sweet potato haulm dried juice. Hence, the objectives of this study are: i) to determine the physicochemical properties of unpasteurised and pasteurised sweet potato haulm juice powder, and also ii) to investigate storage stability of unpasteurised and pasteurised sweet potato haulm juice powder (SPHJP) using Ferric Reducing Antioxidant Power (FRAP) assay and Total Phenolic Content (TPC) in 180 days. Results show that pasteurised SPHJP has higher mineral content (13.24 g/100 g dw) and water solubility index (24.30–31.36 g/100 g) than unpasteurised SPHJP. Compared to unpasteurised SPHJP, pasteurised SPHJP also has lower water activity (0.34  $a_w$ ), carbohydrate content (39.33 g/100 g dw) and phytic acid (0.01 g/100 g dw) ( $p < 0.05$ ). Both SPHJP have produced a minimum protein content of 35.23 g/100g dw. The FRAP activity of unpasteurised and pasteurised SPHJP under light condition followed first-order kinetic degradation with reaction rate of  $1.3 \times 10^{-3}$  and  $2.2 \times 10^{-3} \text{ day}^{-1}$ , and half-life of 533 days and 315 days, respectively. The half-life of TPC in pasteurised SPHJP under light and dark condition are 100 and 136 days, degraded at  $6.9 \times 10^{-3} \text{ day}^{-1}$  and  $5.1 \times 10^{-3} \text{ day}^{-1}$ , also displayed first-order kinetic model. Meanwhile, the FRAP activity and TPC of pasteurised SPHJP under dark conditions have been stable for 180 days of storage. This study has revealed that the haulm from sweet potato has the potential to be transformed into a sustainable source of antioxidants and an innovative plant-based protein.

*Keywords: haulm, sweet potato, physicochemical, FRAP, TPC, stability*

## الملخص

يشمل الدفع باتجاه التحديث في الزراعة زراعة النباتات القائمة على الغذاء كمخزن لتحقيق عوائد ربح أفضل. تعد البطاطا الحلوة (*Ipomoea Batatas L*) ثاني أكبر محصول حقل بعد الذرة الحلوة في ماليزيا (3,623 هكتار). Haulm (قمم غير مستخدمة من النباتات تتكون من الساق والأوراق) من نبات البطاطا الحلوة مصدر محتمل للمواد النشطة بيولوجيا ومضادات الأكسدة. ومع ذلك ، لم يتم الإبلاغ عن أي بيانات عن عصير البطاطا الحلوة المجفف. ومن ثم ، يهدف هذا المشروع إلى إنشاء بيانات حول العصير المجفف من البطاطا الحلوة المزروعة في ماليزيا من خلال: (i) تحديد الخصائص الغذائية والمضادة للتغذية لمسحوق عصير البطاطا الحلوة غير المبستر والمبستر ، وأيضًا عن طريق (ii) التحقق من استقرار تخزين مسحوق عصير البطاطا الحلوة غير المبستر والمبستر (SPHJP) أثناء التخزين باستخدام مقاييس القدرة المضادة للأكسدة الحديدية (FRAP) وإجمالي محتوى الفينول (TPC). يحتوي SPHJP المبستر على محتوى معدني أعلى (13.24 g/100 g dw) ، ومؤشر الذوبان في الماء (24.30–31.36 g/100 g) ، ونشاط مائي أقل (0.34 aw) ، ومحتوى كربوهيدرات (39.33 g/100 g dw) وحمض الفيتيك (0.01 <math>p</math> <math>< 0.05</math> g/100 g dw) يتبع نشاط FRAP لـ SPHJP غير المبستر والمبستر تحت ظروف الإضاءة التدهور الحراري من الدرجة الأولى مع معدل تفاعل  $1.3 \times 10^{-3}$  و  $2.2 \times 10^{-3}$  يوم<sup>-1</sup> ، ونصف عمر 533 يومًا و 315 يومًا ، على التوالي. يبلغ عمر النصف لـ TPC في SPHJP المبستر تحت ظروف الإضاءة والظلام 100 و 136 يومًا ، ويتدهور في  $6.9 \times 10^{-3}$  يوم<sup>-1</sup> و  $5.1 \times 10^{-3}$  يوم<sup>-1</sup> ، ويعرض أيضًا نموذجًا حركيًا من الدرجة الأولى. وفي الوقت نفسه ، فإن نشاط FRAP و TPC لـ SPHJP المبستر في ظروف مظلمة كانا مستقرين لمدة 180 يومًا من التخزين. كشفت هذه

الدراسة أن الحصة من البطاطا الحلوة لديها القدرة على التحول إلى مصدر مستدام لمضادات الأكسدة

وبروتين نباتي مبتكر.

الكلمات المفتاحية: فوم، بطاطا حلوة، فيزيائي كيميائي، FRAP، TPC، ثبات

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## LIST OF ABBREVIATIONS

<b>AOAC</b>	Association of Official Analytical Chemists
<b>ANOVA</b>	Analysis of Variance
<b>FAO</b>	Food Agriculture and Organization
<b>POD</b>	Peroxidase
<b>USDA</b>	U.S. Department of Agriculture
<b>N</b>	Newton
<b>cm</b>	Centimetre
<b>mm</b>	Milimetre
<b>nm</b>	Nanometre
<b>µm</b>	Micrometre
<b>mL</b>	Mililitre
<b>g</b>	Grams
<b>rpm</b>	revolution per minute

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