



**UNIVERSITI PUTRA MALAYSIA**

**CHARACTERISTICS AND POTENTIAL USE OF GUAVA  
(PSIDIUM GUAJAVA L) FOR PROCESSING OF  
CONCENTRATE**

**SALMAH BINTI YUSOF**

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**DOCTOR OF PHILOSOPHY  
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CONCENTRATE**

**By**

**SALMAH BINTI YUSOF**

**Thesis Submitted in Fulfilment of the  
Requirements for the Degree of Doctor of Philosophy  
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Dedicated to beloved husband:

Zakaria Abd. Rahman

sons:

Azlan Sazali

Izham

Razwan

Ahmad Faisal

and daughter:

Liyana Yasmin



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## LIST OF ABBREVIATIONS

kg	kilogram
g	gram
mg	milligram
m	meter
mm	millimetre
ml	millilitre
mt	metric tonne
cm	centimeter
sq	square
min	minute
hr	hour
ppm	parts per million
ha	hectare
N	normality
$\mu$	micron
r.p.m.	revolution per minute



Abstract of the Thesis Presented to the Senate of  
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June, 1989

Supervisor : Abdullah Abu Bakar Ph. D.

Co-supervisor: Suhaila bt. Mohamed Ph. D.

Faculty : Food Science and Biotechnology

Studies were conducted to determine the characteristics of guava (Psidium guajava L) cv. Vietnamese of its potential use for processing it into guava concentrate. A maturity study showed that the guava took 16 weeks to reach maturity. The best indices of maturity were size, moisture, sugars and tannin contents. The moisture content at the mature stage was 94%. The fructose, glucose and sucrose contents were 2.02%, 1.08% and 1.54%, respectively. The tannin content in the matured guava was low (37.0 mg/10 gm sample) but the vitamin C content was high (76 mg/100 g sample).



The structure of stone cells in guava fruits were examined microscopically. The stone cells became more prominent with increase in fruit maturity, hence the prepared puree were pulverised in order to improve its texture. Studies on the quality of puree produced from fruits at different stages of maturation showed that a puree of desirable quality was obtained from fruits at the yellow green stage (stage 4). Artificial ripening was necessary to soften the fruits to make them ideal for processing into concentrate or puree. Fruits at the yellow green stage had an increase in soluble pectin content to 67%. This increased the viscosity of puree. The vitamin C content also increased from 79.7 mg - 131.1 mg/100 g sample. The puree showed less tendency to turn brown due to the low tannin contents (21 mg/10 g samples).

The optimum conditions of pH, processing temperature and total soluble solids content (brix) to produce an acceptable guava concentrate was determined using a Response Surface Methodology. Maximum overall acceptability was obtained from guava concentrate having an optimum pH = 3.3 - 3.9; processing temperature = 79.1°C and brix = 35°B - 55°B was chosen.

Storage studies on guava concentrate showed that browning and pulp separation were the main problems, followed by losses in ascorbic acid content and titratable acidity. There were no significant changes in amino nitrogen content, total sugars,



brix and pH. Temperature showed no influence on the rate of loss of viscosity. The use of 0.1% and 0.3% sodium carboxymethyl cellulose (NaCMC) was effective in stabilizing the pulp for 9 weeks.



Abstrak Tesis Yang Dikemukakan Kepada Senat  
Universiti Pertanian Malaysia Sebagai Memenuhi Syarat  
Keperluan Untuk Ijazah Doktor Falsafah

**CIRI-CIRI DAN POTENSI PENGGUNAAN BUAH JAMBU  
(PSIDIUM GUAJAVA L) JENIS VIETNAM UNTUK PEMROSESAN  
PATI JAMBU**

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Kajian telah dijalankan untuk mengkaji ciri-ciri buah jambu (Psidium guajava L) kultivar Vietnam tentang potensinya untuk pemprosesan pati jambu. Kajian kematangan menunjukkan buah jambu mengambil masa 16 minggu untuk mencapai kematangan. Petunjuk kematangan yang terbaik ialah saiz, kandungan kelembapan, gula dan tannin. Kandungan kelembapan buah di tahap kematangan ialah 94%. Kandungan fruktosa, glukosa dan sukrosa ialah masing-masing 2.02%, 1.08% dan 1.54%. Kandungan tannin didapati rendah (37.0 mg/10 g sampel) tetapi kandungan vitamin C adalah tinggi (76 mg/100 g sampel).



Struktur sel batu didalam buah jambu telah diteliti dengan menggunakan mikroskop. Sel-sel batu didapati menjadi bertambah besar semakin buah masak, oleh itu pulpa yang disediakan perlu dihaluskan untuk memperbaiki tekstur puri. Kajian ke atas kualiti puri yang dihasilkan dari buah pada tahap kematangan yang berlainan menunjukkan bahawa puri yang mempunyai kualiti yang diperlukan dapat dihasilkan dari buah pada peringkat kekuningan (peringkat 4). Proses pemeraman diperlukan untuk melembutkan buah supaya mudah diproses kepada pati atau puri jambu. Buah di peringkat masak kuning hijau mempunyai kandungan pektin larut air yang bertambah kepada 67%. Ini menjadikan puri lebih pekat. Kandungan vitamin C bertambah dari 79.7 mg - 131.1 mg/100 g sampel. Puri yang didapati juga tidak mudah bertukar warna menjadi perang disebabkan kandungan tannin yang rendah (21 mg/10 g sampel).

Keadaan optimum bagi pH, suhu pemprosesan dan kandungan pepejal larut (brix) bagi menghasilkan pati jambu yang sesuai telah ditentukan dengan menggunakan kaedah 'Response Surface.' Satu kombinasi yang sesuai bagi penerimaan keseluruhan yang maksimum, pH = 3.3 - 3.9; suhu pemprosesan = 79.1°C dan brix = 35°B - 55°B telah dipilih.

Keputusan kajian simpanan keatas pati jambu menunjukkan bahawa pemerangan dan perpisahan pulpa menjadi masalah utama, diikuti dengan kehilangan kandungan asid askorbik dan



keasidan. Tiada perubahan yang ketara didapati bagi kandungan amino nitrogen, gula, brix dan pH. Suhu tiada mempengaruhi kadar penurunan kepekatan puri. Penggunaan 0.1% dan 0.3% naterium karboksimetilselulos (NaCMC) didapati berkesan menghalang pemisahan pulpa sehingga 9 minggu.





## CHAPTER 1

### INTRODUCTION

Guava (Psidium guajava) has been cultivated in Malaysia for a long time (Allen, 1967) but has never received as much attention as today. The plant which originated from tropical America (Ruehle, 1948) has spread to all tropical and subtropical countries and has become especially important in Cuba (Coit, 1945), Hawaii (Hayes, 1957) and India (Samson, 1980).

The genus Psidium consists of about 150 species of which only Psidium guajava is of economic importance. Numerous varieties are in existence ranging from the wild or unselected forms having small thick rinded, thin fleshed fruits to highly improved productive precocious clones with large excellent fruits. Previously, in Malaysia, it was reported that there were 18 varieties grown (Mohd. Noor et al., 1980). However, due to their relatively low fruit quality coupled with difficult maintenance none of the recommended varieties (Gu 3, Gu 4, Gu 5, Gu 6 and Gu 7) had been grown on large scale.

Guava fruit is a very rich source of vitamin C. The plant is very hardy and is able to grow in a wide range of soil condition. In countries like Cuba and Hawaii guavas have become a million dollar industry. Locally, it was only during late seventies and early 1980 that there was renewed interest

