



UNIVERSITI PUTRA MALAYSIA

**OPTIMIZATION OF PROCESSING PARAMETERS FOR THE
PRODUCTION AND STORAGE OF DRUM-DRIED JACKFRUIT
(*ARTOCARPUS HETEROPHYLLUS*) POWDER**

PUA CHUN KIAT

FSTM 2006 18



**OPTIMIZATION OF PROCESSING PARAMETERS FOR THE PRODUCTION
AND STORAGE OF DRUM-DRIED JACKFRUIT (*ARTOCARPUS
HETEROPHYLLUS*) POWDER**

By

PUA CHUN KIAT

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in
Fulfilment of the Requirement for the Degree of Master of Science**

July 2006



ESPECIALLY DEDICATED TO MY BELOVED FAMILY



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

OPTIMIZATION OF PROCESSING PARAMETERS FOR THE PRODUCTION AND STORAGE OF DRUM-DRIED JACKFRUIT (*ARTOCARPUS HETEROPHYLLUS*) POWDER

By

PUA CHUN KIAT

July 2006

Chairman : Nazimah Sheikh Abdul Hamid, PhD

Faculty : Food Science and Technology

This study concerns with the optimization of formulation and processing parameters of drum-dried jackfruit powder using response surface methodology (RSM). In formulating the jackfruit powder, various concentrations of soy lecithin and gum arabic ranging from 1 to 5% and 5 to 15 %, respectively were tested. The optimum formulation for jackfruit powder contained 2.65% of soy lecithin and 10.28% of gum arabic with 40% v/w water. Soy lecithin and gum arabic significantly ($p < 0.05$) affected the moisture content, bulk density, Hunter L , a , b values and hedonic scores of jackfruit powder with each response following the second-order polynomial model.

Optimum processing parameters for drum drying were found when drum clearance of drum dryer was set at 0.01 inch, pool level at 10 cm, and drum rotation speed of 1 to 3 rpm with 3.0 to 4.4 bars of steam pressure. The results showed that the moisture content,



water activity, solubility, Hunter L , a , b value, and sensory attributes of jackfruit powder were significantly ($p < 0.05$) influenced by both steam pressure and rotation speed of the drum dryer. The optimum steam pressure and rotation speed of drum dryer were 3.36 bars and 1.2 rpm respectively with predetermined drum clearance of 0.01 inch and 10 cm of pool level.

Total colour difference (ΔE), moisture sorption rates and sensory attributes of drum-dried jackfruit powder packaged in aluminum laminated polyethylene (ALP) and metallized co-extruded biaxially oriented polypropylene (BOPP/MCPP) pouches stored at accelerated storage (38°C, with 50, 75 and 90% relative humidity (RH)) were determined over 12 weeks period. The changes in total colour followed zero order reaction kinetics. Packaging materials, storage temperature and RH values significantly ($p < 0.05$) influenced the moisture sorption rates of jackfruit powder. There was a significant ($p < 0.05$) decrease in the intensities of the fruity odour, taste and increase in the lumpiness of the jackfruit powder stored at 38°C with 90% RH. The shelf life of jackfruit powder stored at 38°C and 90% RH was limited by both overall acceptability and the three sensory attributes intensities at week 8 of storage. Jackfruit powder stored at 28°C remained stable and acceptable throughout the storage period for all RH values. The powder packaged in ALP significantly ($p < 0.05$) reduced total colour change, moisture sorption rates, lumpiness intensity of jackfruit powder and was rated higher in terms of overall acceptability over BOPP/MCPP. Results of this study suggested that ALP packaging with storage conditions of 28°C and RH less than 75% was better suited for keeping jackfruit powder.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**PENGOPTIMUMAN PARAMETER PEMROSESAN UNTUK PENGHASILAN
DAN PENYIMPANAN SERBUK NANGKA (*ARTOCARPUS HETEROPHYLLUS*)
YANG DIKERINGKAN SECARA DRAM**

Oleh

PUA CHUN KIAT

Julai 2006

Pengerusi : Nazimah Sheikh Abdul Hamid, PhD

Fakulti : Sains dan Teknologi Makanan

Kajian ini berkenaan pengoptimuman rumusan dan parameter pemprosesan serbuk nangka yang dikeringkan secara dram dengan menggunakan metodologi respons permukaan (“Response Surface Methodology”, RSM). Dalam merumuskan serbuk nangka, pelbagai kepekatan lesitin soya dan gam arabic dalam lingkungan 1 hingga 5% dan 5 hingga 15%, masing-masing telah diuji. Rumusan yang optimum bagi serbuk nangka mengandungi 2.65% lesitin soya dan 10.28% gam arabic dengan 40% v/w air. Lesitin soya dan gam arabic mempengaruhi kandungan kelembapan, ketumpatan pukal, nilai Hunter L , a , b dan skor hedonik serbuk nangka secara bererti ($p < 0.05$) dengan setiap respons mengikuti model polinomial turutan kedua.

Parameter pemprosesan yang optimum bagi pengeringan dram didapati apabila jurang antara dram bagi pengering dram telah ditetapkan pada 0.25 mm, paras takungan pada



10 sm, dan kelajuan putaran dram pada 1 hingga 3 rpm dengan 3.0 hingga 4.4 bar tekanan stim. Keputusan menunjukkan bahawa kandungan kelembapan, aktiviti air, keterlarutan, nilai Hunter L , a , b dan ciri sensori serbuk nangka telah dipengaruhi oleh kedua-dua tekanan stim dan kelajuan putaran pengering dram secara bererti ($p < 0.05$). Tekanan stim dan kelajuan putaran pengering dram yang optimum adalah 3.36 bar dan 1.2 rpm, masing-masing dengan jurang antara dram 0.25 mm dan paras takungan 10 sm yang dipratentukan.

Jumlah perbezaan warna (ΔE), kadar penyerapan lembapan dan ciri sensori serbuk nangka yang dikeringkan secara dram telah dibungkus dengan beg polietilina yang dilapisi aluminium (ALP) dan beg polipropilena berarahkan dua-paksi yang disaluti logam (BOPP/MCPP) yang disimpan pada keadaan penyimpanan yang dipercepatkan (38°C , dengan 50, 75 dan 90% lembapan relatif (RH)) telah ditentukan selama 12 minggu. Perubahan pada jumlah warna mengikuti tindakbalas kinetik turutan sifar. Jenis bahan pembungkus, suhu penyimpanan dan nilai RH mempengaruhi kadar penyerapan lembapan serbuk nangka secara bererti ($p < 0.05$). Terdapat pengurangan yang bererti ($p < 0.05$) pada keamatan bau, rasa buah dan penambahan pada pengetulan serbuk nangka yang disimpan pada suhu 38°C dengan 90% RH. Jangka hayat serbuk nangka yang disimpan pada 38°C dan 90% RH telah dihadkan oleh kedua-dua kebolehterimaan keseluruhan dan keamatan tiga ciri sensori pada minggu penyimpanan yang ke-lapan. Serbuk nangka yang disimpan pada 28°C tetap stabil dan boleh diterima sepanjang jangka masa penyimpanan untuk semua nilai RH. Serbuk yang dibungkus dengan ALP menunjukkan jumlah perbezaan warna, kadar penyerapan lembapan, keamatan

pengetulan serbuk nangka yang rendah lagi bererti ($p < 0.05$) dan telah dinilai lebih tinggi dari segi penerimaan keseluruhan daripada BOPP/MCPP. Keputusan kajian ini mencadangkan bahawa pembungkusan ALP dengan keadaan penyimpanan 28°C dan RH kurang daripada 75% adalah sesuai untuk penyimpanan serbuk nangka.

ACKNOWLEDGEMENTS

I would like to express my most sincere gratitude and appreciation to my supervisory committee chairman, Dr. Nazimah Sheikh Abdul Hamid, for her invaluable guidance, advice and constant encouragement throughout the course of my research study. Her constructive criticisms and suggestions provided me the strength and perseverance to complete this thesis despite several obstacles encountered throughout the course of this research, which at times seemed insurmountable. Appreciation also goes to the members of my supervisory committee, Professor Dr. Gulam Rusul Rahmat Ali and Professor Dr. Russly Abdul Rahman for their support and invaluable suggestions to guide me during my study.

I wish to express my gratitude to all members of the Faculty of Food Science and Technology, UPM for providing the research facilities and technical assistance during my graduate study. Acknowledgement is also due to all my friends, Voon Yit Yang, Ong Bee Tein, Chin Sung Tong, Kuan Tuck Keong, Lee Wai Cheng; and those who have given me the moral encouragement and support to complete my graduate study.

I would like to thank Dr. Patrick Loi from Packaging Research Centre Sdn. Bhd. (Shah Alam, Selangor, Malaysia) for his valuable advice regarding packaging material and contributing the packaging materials used in my study. I would like to acknowledge the financial support provided by IRPA grant (03-02-04-0156-EA001) awarded to Dr. Nazimah Sheikh Abdul Hamid for this study. Acknowledgement is also due to the PASCA scholarship for granting me the opportunity to pursue my master degree.



I am also greatly indebted to my beloved parents and siblings, for their love, spiritual encouragement and support. I wish also to express my deepest appreciation to my girl friend, for her understanding, concern, faith and love.



I certify that an Examination Committee has met on 7 July 2006 to conduct the final examination of Pua Chun Kiat on his Master of Science thesis entitled "Optimization of Processing Parameters for the Production and Storage of Drum-Dried Jackfruit (*Artocarpus heterophyllus*) Powder" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

Yaakob Bin Che Man, PhD

Professor
Faculty of Food Science and Technology
Universiti Putra Malaysia
(Chairman)

Jamilah Bakar, PhD

Professor
Faculty of Food Science and Technology
Universiti Putra Malaysia
(Internal Examiner)

Roselina Karim, PhD

Lecturer
Faculty of Food Science and Technology
Universiti Putra Malaysia
(Internal Examiner)

Manjeet S. Chinnan, PhD

Professor
Faculty of Food Technology
Universiti of Georgia
(External Examiner)

HASANAH MOHD. GHAZALI, PhD

Professor/Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:



This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee are as follows:

Nazimah Sheikh Abdul Hamid, PhD

Lecturer

Faculty of Food Science and Technology

Universiti Putra Malaysia

(Chairman)

Gulam Rusul Rahmat Ali, PhD

Professor

School of Industrial Technology

Universiti Sains Malaysia

(Member)

Russly Abdul Rahman, PhD

Professor

Faculty of Food Science and Technology

Universiti Putra Malaysia

(Member)

AINI IDERIS, PhD

Professor/Dean

School of Graduate Studies

Universiti Putra Malaysia

Date: 9 NOVEMBER 2006



DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

PUA CHUN KIAT

Date:



TABLE OF CONTENTS

	Page
DEDICATION	ii
ABSTRACT	iii
ABSTRAK	v
ACKNOWLEDGEMENTS	viii
APPROVAL	x
DECLARATION	xii
LIST OF TABLES	xvi
LIST OF FIGURES	xviii
LIST OF ABBREVIATIONS	xix
CHAPTER	
I GENERAL INTRODUCTION	1
II LITERATURE REVIEW	5
Jackfruit (<i>Artocarpus heterophyllus</i>)	5
Composition	6
Flavour	8
Food Dehydration	8
Drum Drying	11
Drum Drying Operating Parameters	15
Applications of Drum Dryers in the Food Industries	24
Fruit Powder and Flakes	26
Food Emulsifiers	29
Soy Lecithin	31
Gum Arabic	32
Physical Properties of Food Powders	34
Moisture Content	34
Water Activity	34
Colour	36
Kinetics of Colour Degradation in Food Materials	37
Bulk Density	39
Hygroscopicity	39
Caking Phenomena	40
Shelf Life and Storage Studies of Food Powders	40
Factors Influencing Shelf Life	46
Packaging Material	46
Temperature	50
Moisture/Relative Humidity (RH)	51
Response Surface Methodology (RSM)	52



III	PRODUCTION OF DRUM-DRIED JACKFRUIT (<i>ARTOCARPUS HETEROPHYLLUS</i>) POWDER WITH DIFFERENT CONCENTRATION OF SOY LECITHIN AND GUM ARABIC	55
	Introduction	55
	Materials and Methods	57
	Jackfruit	57
	Preparation of Jackfruit Puree for Drying	58
	Drum Drying Operation	58
	Physical and Instrumental Analyses	59
	Hedonic Test	61
	Experimental Design	61
	Results and Discussion	62
	Model Fitting	62
	Effect of Soy Lecithin and Gum Arabic on Moisture Content and Water Activity	64
	Effect of Soy Lecithin and Gum Arabic on Bulk Density	69
	Effect of Soy Lecithin and Gum Arabic on Colour	69
	Effect of Soy Lecithin and Gum Arabic on Sensory Evaluation	70
	Optimization of Jackfruit Formulation to Produce Drum-Dried Fruit Powder	71
	Conclusion	73
IV	OPTIMIZATION OF DRUM DRYING PROCESSING PARAMETERS FOR PRODUCTION OF JACKFRUIT (<i>ARTOCARPUS HETEROPHYLLUS</i>) POWDER USING RESPONSE SURFACE METHODOLOGY	74
	Introduction	74
	Materials and Methods	76
	Jackfruit	76
	Preparation of Jackfruit Puree for Drying	76
	Drum Drying Operation	77
	Physical and Instrumental Analyses	77
	Sensory Evaluation	79
	Experimental Design	80
	Results and Discussion	81
	Model Fitting	81
	Moisture Content and Water Activity	81
	Hunter <i>L</i> , <i>a</i> , <i>b</i> Value	87
	Quantitative Descriptive Analysis (QDA) and Hedonic Test	88
	Optimization of Drum Drying Processing Parameters to Produce Jackfruit Powder	90
	Conclusion	92



V	STORAGE STABILITY OF JACKFRUIT (<i>ARTOCARPUS HETEROPHYLLUS</i>) POWDER PACKAGED IN TWO DIFFERENT PACKAGING MATERIALS DURING ACCELERATED STORAGE (38°C, WITH 50, 75 AND 90% RH)	93
	Introduction	93
	Materials and Methods	95
	Preparation of Jackfruit Powder	95
	Packaging Materials	95
	Assessment of Stability of Jackfruit Powder	96
	Colour Measurement	97
	Kinetics of Total Colour Change During Storage	97
	Moisture Content	98
	Sensory Evaluation	99
	Statistical Analysis	100
	Results and Discussion	100
	Total Colour Difference (ΔE)	100
	Kinetics of Total Colour Difference Change in Jackfruit Powder During Storage	107
	Moisture Uptake of Jackfruit Powder During Storage	109
	Sensory Quality of Jackfruit Powder during Storage	112
	Shelf Life Prediction	121
	Conclusion	122
VI	GENERAL CONCLUSION AND RECOMMENDATIONS	123
	REFERENCES	126
	APPENDICES	138
	BIODATA OF THE AUTHOR	146
	LIST OF PUBLICATIONS	147



LIST OF TABLES

Table		Page
1	Chemical composition of ripe jackfruits from different regions of India (g per 100g fresh edible portion)	7
2	Mineral and vitamin composition of ripe jackfruit (mg per 100g edible portion)	7
3	Volatile constituents of two fruit varieties of <i>Artocarpus heterophyllus</i>	9
4	Summary of novel and conventional drying techniques for food	11
5	Drum drying processing parameters employed by some researchers	16
6	The effect of water activity (a_w) on the growth of microorganisms	35
7	Storage studies of food powders, flakes and paste	42
8	Independent variables and their levels for central composite design in optimization of jackfruit powder formulation	62
9	Central composite design and experimental result of response functions for the optimization of jackfruit powder formulation	63
10	Analysis of variance on the jackfruit powder formulation as linear, quadratic and interaction terms on the response variables	65
11	Regression coefficients of the second-order polynomial for the response variables in optimization of jackfruit powder formulation	67
12	Independent variables and their levels for central composite design in optimization of drum drying processing parameters	80
13	Central composite design and experimental results of response function for the optimization of drum drying processing parameters	82
14	Analysis of variance on the drum drying processing conditions as linear, quadratic and interaction terms on the response variables	83
15	Regression coefficients of the second-order polynomial for the response variables in optimization of drum drying processing parameters	84



16	Effect of interaction of storage period, temperature, relative humidity and packaging material on physicochemical changes of drum dried jackfruit powders	101
17	Kinetic parameters from zero and first order reaction kinetics of total colour difference of jackfruit powder stored under different storage conditions	109
18	Variation in QDA scores for the intensity of fruity odour of jackfruit powder packaged in ALP and BOPP/MCPP pouches during storage at 28°C, and at humidity levels of 50, 75 and 90% RH	113
19	Variation in QDA scores for the intensity of fruity odour of jackfruit powder packaged in ALP and BOPP/MCPP pouches during storage at 38°C, and at humidity levels of 50, 75 and 90% RH	113
20	Variation in QDA scores for the intensity of fruity taste of jackfruit powder packaged in ALP and BOPP/MCPP pouches during storage at 28°C, and at humidity levels of 50, 75 and 90% RH	114
21	Variation in QDA scores for the intensity of fruity taste of jackfruit powder packaged in ALP and BOPP/MCPP pouches during storage at 38°C, and at humidity levels of 50, 75 and 90% RH	114
22	Variation in QDA scores for the intensity of lumpiness of jackfruit powder packaged in ALP and BOPP/MCPP pouches during storage at 28°C, and at humidity levels of 50, 75 and 90% RH	115
23	Variation in QDA scores for the intensity of lumpiness of jackfruit powder packaged in ALP and BOPP/MCPP pouches during storage at 38°C, and at humidity levels of 50, 75 and 90% RH	115
24	Variation in hedonic scores for the overall acceptability of jackfruit powder packaged in ALP and BOPP/MCPP pouches during storage at 28°C, and at humidity levels of 50, 75 and 90% RH	116
25	Variation in hedonic scores for the overall acceptability of jackfruit powder packaged in ALP and BOPP/MCPP pouches during storage at 38°C, and at humidity levels of 50, 75 and 90% RH	116



LIST OF FIGURES

Figure		Page
1	The contour plots of moisture content, bulk density, Hunter <i>L</i> , <i>a</i> , <i>b</i> value and hedonic score of drum dried jackfruit powder as affected by the percentages of soy lecithin and gum arabic incorporated	68
2	Superimposed contour plot of significant response variables in optimization of jackfruit powder formulation	72
3	The surface plots of (a) moisture content, (b) water activity, (c) Hunter <i>L</i> -value, (d) Hunter <i>b</i> -value, (e) QDA-yellowness, (f) QDA-Fruitiness, (g) QDA-Processed flavour and (h) hedonic test of drum-dried jackfruit powder as affected by the drum drying processing conditions	86
4	Superimposed contour plot of significant ($p \leq 0.05$) response variables in optimization of drum drying processing parameters	91
5	Total colour difference (ΔE) of jackfruit powder packed in ALP and BOPP/MCPP pouches during storage at 28 and 38°C and (a) 50%RH, (b) 75%RH, (c) 90%RH	106
6	Moisture content changes of jackfruit powder packed in ALP and BOPP/MCPP pouches during storage at 28 and 38°C and (a) 50%RH, (b) 75%RH, (c) 90%RH	110



LIST OF ABBREVIATIONS

ΔE	Total Colour Difference
ANOVA	Analysis Of Variance
ALP	Aluminum Laminated Polyethylene
a_w	Water Activity
BOPP/MCPP	Biaxially Oriented Polypropylene laminated with Metallized Cast Polypropylene
FFA	Free Fatty Acid
HDPE	High Density Polyethylene
HDPP	High Density Polypropylene
HMF	Hydroxymethyl Furfural
IR	Infra Red
LDPE	Low Density Polyethylene
LLDPE	Linear Low Density Polyethylene
MPP	Metallized Polyester/Polyethylene
OTR	Oxygen Transmission Rate
PET	Polyethylene Terephthalate
PP	Polypropylene
ppm	Part Per Million
psi	Pound Per Square Inch
Q	Quality Attribute
QDA	Quantitative Descriptive Analysis
RH	Relative Humidity



rpm	Revolution Per Minute
RSM	Response Surface Methodology
TBA	Thiobarbituric Acid
UV	Ultra Violet
v/w	Volume Over Weight
w/v	Weight Over Volume
WVTR	Water Vapour Transmission Rate
w/w	Weight Over Weight



CHAPTER I

GENERAL INTRODUCTION

Jackfruit (*Artocarpus heterophyllus*) belongs to the family of *Moraceae*. The genus *Artocarpus* contains about 50 species; most are native to Asia and jackfruit is one of the 15 species that produce edible starchy fruits (Nakasone & Paull, 1998). The jackfruit bulbs are normally eaten fresh but also processed into various products such as canned jackfruit juice (Seow & Shanmugam, 1992), jackfruit leather (Che Man & Sin, 1997) and carbonated beverage (John and Narasimham, 1993). In a mature state, the water content of jackfruit makes it more susceptible to decomposition by microorganisms, chemical and enzymatic reactions. As a climacteric fruit, jackfruit is extremely perishable and cannot be marketed or exported as fresh produce. The development of a shelf stable product from fresh fruit is an important consideration to reduce post-harvest losses.

Food dehydration is a process particularly important for fruit and vegetables, which contain a large proportion of water, and their preservation becomes critical (Tsami et al., 1999). According to Fitzpatrick and Ahrné (2005), the development of formulation engineering concepts in food manufacturing and the demand for diversity in food products have driven a substantial market increase for food ingredients. Drum drying is extensively used in commercial drying of a variety of foodstuffs such as yeast creams, fruit purees, baby foods, mashed potatoes, dry soup mixtures and pregelatinized starches (Bonazzi et al., 1996; Moore, 1995). The main advantage of drum dryers compared to



other continuous flow dryers is their much shorter retention time and their ability to maintain a high drying capacity even when the initial moisture of the product is extremely high (Kristensen et al., 2005).

Emulsifiers are widely used in foods in order to improve texture, reduce crumb firmness, and complex with starches (baked goods); to improve the shelf life of flavours; and to increase stability and prevent phase separation in food emulsions (Stauffer, 1996). Lecithin is used in many food products, such as chocolate, confectionery products, margarines, bakery goods and pasta products. Many of these applications are still active today for its emulsifying, wetting, colloidal, antioxidant, and physiological properties. Gum arabic is a hydrocolloid emulsifier and exists in nature as a neutral or slightly acidic salt of a complex polysaccharide. Its major use as a food additive is to provide desirable properties that affect viscosity, body, and texture of foods (Enriquez et al., 1989). It is used as an emulsifier in beverages for citrus oil and flavours, as a crystallization retarder and emulsifier in confectioneries, and as a stabilizer in dairy and bakery products (Somogyi, 2005).

The major food powder issue with regard to food ingredient powders is maintaining the stability of ingredient functionality from production right through to final powder application. Environmental factors such as temperature, humidity, oxygen, and light can trigger several reaction mechanisms that may lead to food degradation. Maintaining the quality of the dehydrated product during storage will depend on the choice of packaging material capable of preventing or retarding deteriorative reactions such as, loss of



nutrients, non-enzymatic browning, lipid oxidation, discolouration and increase of moisture to critical levels (Labuza, 1982).

There is considerable evidence in the literature that temperature plays a major role in causing changes in food quality during storage. Higher storage temperatures generally lead to increased quality deterioration. Some researchers have done extensive studies on the quality changes of mango powder during storage. Kumar and Mishra (2004) reported that colour change in mango soy fortified yoghurt powder was affected by both storage time and packaging material under accelerated storage condition ($38\pm 1^{\circ}\text{C}$, 90% RH). Jaya and Das (2005) predicted the shelf life of vacuum-dried mango powder to be 114.68 days and reported that the colour change of powder followed first order reaction kinetics under accelerated storage condition ($38\pm 2^{\circ}\text{C}$, 90% RH). Hymavathi and Khader (2005) reported that physicochemical and nutrient changes were less pronounced in the mango powders packaged in metallized polyester/polyethylene than the powders in the polypropylene packaging. According to Esse and Saari (2004), many manufactured food products are adversely affected by moisture changes which directly impact their shelf-life and quality. These foods will lose desirable texture characteristics if allowed to lose or gain excessive moisture.

Therefore, the objectives of this study were:

1. To determine the optimum concentration of soy lecithin and gum arabic in producing drum-dried jackfruit powder.
2. To determine the optimum drum drying processing parameters for jackfruit powder production.



3. To study the stability of jackfruit powder packaged in aluminium laminated polyethylene (ALP) and metallized co-extruded biaxially oriented polypropylene (BOPP/MCPP) pouches during accelerated storage (38°C, with 50, 75 and 90% RH).

