DEVELOPMENT OF FROZEN GRATED CASSAVA PASTE AS A BASE FOR MALAYSIAN TRADITIONAL CAKES

GAN HORNG ENG

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DEVELOPMENT OF FROZEN GRATED CASSAVA PASTE AS A BASE FOR MALAYSIAN TRADITIONAL CAKES

By

GAN HORNG ENG

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

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Dedicated to My Beloved Parent, Wife and Teachers
Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

DEVELOPMENT OF FROZEN CASSAVA GRATED PASTE AS A BASE FOR MALAYSIAN TRADITIONAL CAKES

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Chairman : Roselina Karim, PhD
Faculty : Food Science and Technology

The optimum formulation for production of baked cassava cake i.e. a type of Malaysian traditional cake was determined using response surface methodology (RSM). The effects of amount of ingredients such as sugar (10-30%) and coconut milk (15-35%) on the instrumental textural characteristics and sensory acceptance of cakes were investigated. Based on superimposed plots, the basic formulation for production of baked cassava cake with desired sensory quality was obtained by incorporating 25 % of white granulated sugar and 20 % of coconut milk to the basic formulation.

Physicochemical analyses were carried out to evaluate the changes in the quality of frozen cassava paste whereas; instrumental measurements and sensory tests were performed to assess the quality of baked cassava cake at monthly interval for a period of six months during frozen storage. The drip loss was increased initially for the three months of storage and decreased slightly in the following month onwards. The
prolonged frozen storage had led to a brighter frozen grated cassava paste. The ice crystals formation and enlargement had negative impact on textural properties i.e. firmness and rheological of the cassava paste during frozen storage. When viewed under an electron microscope, it was confirmed that the cell wall structures and membranes of cassava paste were damaged during the frozen storage. Furthermore, both the changes in the textural profile and sensory attributes of baked cassava cake had also showed similar trend of results with the instrumental data and this further supported the changes in the quality of baked cassava cake was solely due to the freezing process, frozen storage and subsequent thawing. The degree of acceptability of all the attributes was also reduced after six months of frozen storage and the recommended storage period for frozen grated cassava paste was up to four months.

The effects of different concentration of xanthan gum (0 %, 0.2 %, 0.4 %, 0.6 % and 0.8 %, w/w) on frozen grated cassava paste were also studied. Results showed that xanthan gum had effectively reduced the drip loss and at the same time improved the textural properties i.e. firmness and rheological parameter of the cassava paste during frozen storage. However, the degree of acceptability for the sensory attributes of baked cassava cake were reduced as the concentration of xanthan gum was increased. Hence, the most suitable concentration of xanthan gum to be added was 0.2% w/w.

The effect of five successive freeze-thaw cycles on physicochemical, textural and rheological properties as well as sensory qualities of frozen grated cassava paste was studied. The drip loss was significantly higher in sample that was subjected to five freeze-thaw cycles when compared with the control (zero cycle). The firmness and rheological properties of the cassava paste as well as the degree of acceptability of the baked cassava cake was decreased gradually as the number of cycles was increased.
Pengoptimuman formulasi bagi penghasilan bingka ubi kayu iaitu sejenis kuih tradisi di Malaysia telah ditentukan dengan menggunakan kaedah respons permukaan (RSM). Kesan kandungan bahan seperti gula kasar (10-30%) dan santan kelapa (15-35%) keatas sifat tekstur dan penerimaan sensori bingka ubi kayu telah disiasat. Berdasarkan plot superimposisi, formulasi asas bagi menghasilkan bingka ubi kayu yang mempunyai kualiti sensori yang disukai telah dicapai dengan mencampurkan 25% gula kasar dan 20% santan kelapa ke dalam formulasi asas.

Analisis fizikokimia dijalankan untuk menilai perubahan kualiti bagi pes ubi kayu yang disejukbeku, manakala, pengukuran instrumentasi dan ujian sensori dijalankan bagi menilai perubahan kualiti bingka ubi kayu setiap bulan selama 6 bulan penyimpanan sejukbeku. Semasa penyimpanan sejukbeku, peratusan kehilangan air meningkat pada tiga bulan yang pertama dan menurun sedikit pada bulan berikutnya. Peningkatan tempoh penyimpanan sejukbeku juga mengakibatkan warna ubi kayu menjadi semakin...

Kesan penambahan kepekatan gum xanthan yang berbeza (0 %, 0.2 %, 0.4 %, 0.6 % dan 0.8 %, w/w) ke atas ubi kayu yang disejukbeku juga telah dikaji. Keputusan menunjukkan bahawa gam xanthan sangat effektif dalam menahan kehilangan air dan dalam masa yang sama memperbaiki sifat teksturseperti kekerasan dan reologi pes ubi kayu parut semasa penyimpanan sejukbeku dan nyah-penyejukbeku. Akan tetapi, darjah penerimaan bagi atribut sensori bingka ubi kayu menurun apabila kepekatan gam xanthan bertambah. Oleh itu kepekatan gum xanthan yang paling sesuai untuk ditambah ialah 0.2% berdasarkan berat basah.

Kesan daripada lima kitaran sejukbeku-nyahsejukbeku terhadap sifat fizikokimia, tekstur, reologi dan juga kualiti sensori pes ubi kayu parut yang disejukbeku juga dikaji. Peningkatan kehilangan air dapat dilihat secara ketara dalam sampel yang diberi perlakuan lima kitaran sejukbeku-nyahsejukbeku berbanding dengan kawalan (sampel tanpa kitaran). Kekerasan dan reologi pes ubi kayu diparut dan juga darjah penerimaan
bagi semua atribut sensori bingka ubi kayu telah menurun perlahan-lahan apabila bilangan kitaran yang dialami bertambah.
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I certify that an Examination Committee has met on date of viva to conduct the final examination of Gan Horng Eng on his Master of Science thesis entitled “Development of Frozen Grated Cassava Paste As A Base For Malaysian Traditional Cakes” 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:

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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.

______________________
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEDICATION</td>
<td>ii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>v</td>
</tr>
<tr>
<td>AKNOWLEDGEMENT</td>
<td>viii</td>
</tr>
<tr>
<td>APPROVAL</td>
<td>x</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>xii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xvi</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xvii</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>xxii</td>
</tr>
</tbody>
</table>

## CHAPTER

1. GENERAL INTRODUCTION  
   Objective  

2. LITERATURE REVIEW  
   Plant Tubers  
   Background of Cassava  
   Chemistry of Cassava  
   Production of Cassava  
   Traditional Cake  
   Optimization of the Basic Formulation and Process  
   Condition for Baked Cassava Cake  
   Response Surface Methodology (RSM)  
   Freezing  
   Freezing Process  
   Freezing Rates and Ice Crystal Formation  
   Freezing Operation-Blast Freezing  
   Frozen Foods  
   Freezing Vegetables  
   The Quality Changes During Frozen Storage  
   Physicochemical Changes  
   Drip Loss  
   Textural Changes  
   Rheological Changes  
   Microstructure Changes  
   Thawing  
   Freeze-thaw Cycles  

13
3 OPTIMIZATION OF THE BASIC FORMULATION OF A TRADITIONAL BAKED CASSAVA CAKE USING RESPONSE SURFACE METHODOLOGY

Introduction 38
Materials and Methods 40
  Method of Grated Cassava Preparation 40
  Experimental Design 40
  Textural Analysis 41
  Sensory Analysis of Baked Cassava Cake 42
  Quantitative Descriptive Analysis (QDA) 42
  Hedonic Scale 43
  Optimization and Verification of Model 43
Results and Discussions 44
  Model Fitting from RSM 44
  Effect of Amount of Sugar and Coconut Milk 46
    Textural Characteristics of Baked Cassava Cake 48
    Sensory Attributes of Baked Cassava Cake 49
  Optimization of Basic Formulation and Verification of the Model 53
Conclusions 55

4 EFFECTS OF FROZEN STORAGE ON THE PHYSICOCHEMICAL PROPERTIES OF GRATED CASSAVA PASTE AND SENSORY CHARACTERISTICS OF BAKED CASSAVA CAKE MADE FROM IT

Introduction 57
Materials and Methods 59
  Sample Preparation of Frozen Grated Cassava Paste 59
  Physicochemical Analysis 60
  Instrumental Textural Test 63
  Sensory Analysis of Baked Cassava Cake 63
  Statistical Analysis 64
Results and Discussion 64
Conclusion 76

5 EFFECTS OF XANTHAN GUM ADDITION AND FREEZE-THAW CYCLES ON THE QUALITY OF FROZEN GRATED CASSAVA PASTE

Introduction 78
Materials and Methods 81
  Samples Preparation 81
  Effect of Xanthan Gum Addition 81
Effect of Freeze-thaw Cycles 82
Centrifugal Drip Loss 82
Penetration Test 83
Rheological Analysis 83
Hedonic Scale 84
Statistical Analysis 84
Results and Discussion 85
The Effect of Xanthan Gum on the Frozen Grated Cassava Paste 85
The Effect of Freeze-thaw Cycles on the Frozen Grated Cassava Paste 90
Conclusions 96

6 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS 99

REFERENCES 102
APPENDICES 112
BIODATA OF THE STUDENT 127
LIST OF PUBLICATION 128
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Chemical composition of cassava tuber (per 100g of edible portion)</td>
<td>7</td>
</tr>
<tr>
<td>2.2</td>
<td>Characteristics and qualities of tapioca</td>
<td>10</td>
</tr>
<tr>
<td>2.3</td>
<td>Typical surface heat transfer coefficient ((h)) for various freezing</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>processing</td>
<td></td>
</tr>
<tr>
<td>2.4</td>
<td>Analysis of variance (ANOVA) showing the linear, quadratic and interaction</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>and the lack of fit of the response variables</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>Estimated regression coefficients of the fitted second-order polynomial</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>for the response variables</td>
<td></td>
</tr>
<tr>
<td>2.6</td>
<td>Predicted and experimental values of the response variables</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>at optimum formulation of Baked Cassava Cake</td>
<td></td>
</tr>
<tr>
<td>Figure</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Structure of amylose</td>
<td>9</td>
</tr>
<tr>
<td>2.2</td>
<td>Structure of amylopectin</td>
<td>10</td>
</tr>
<tr>
<td>2.3</td>
<td>A comparison of slow freezing curves for pure water and an aqueous solution containing one solute</td>
<td>17</td>
</tr>
<tr>
<td>2.4</td>
<td>Viscoelastic response of a material, derived from oscillatory assey</td>
<td>26</td>
</tr>
<tr>
<td>2.5</td>
<td>Structure of xanthan gum</td>
<td>36</td>
</tr>
<tr>
<td>2.6</td>
<td>Response surface plot of the effects of amount of sugar and coconut milk on the hardness (instrumental data) of baked cassava cake</td>
<td>47</td>
</tr>
<tr>
<td>2.7</td>
<td>Response surface plot of the effects of amount of sugar and coconut milk on the chewiness (instrumental data) of baked cassava cake</td>
<td>47</td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>2.8</td>
<td>Response surface plot of the effects of amount of sugar and coconut milk on the sensory score on colour of baked cassava cake</td>
<td>49</td>
</tr>
<tr>
<td>2.9</td>
<td>Response surface plot of the effects of amount of sugar and coconut milk on the mean score on firmness of baked cassava cake</td>
<td>50</td>
</tr>
<tr>
<td>2.10</td>
<td>Response surface plot of the effects of amount of sugar and coconut milk on the mean score on cassava flavour of baked cassava cake</td>
<td>51</td>
</tr>
<tr>
<td>2.11</td>
<td>Response surface plot of the effects of amount of sugar and coconut milk on the mean score on overall acceptability of baked cassava cake</td>
<td>51</td>
</tr>
<tr>
<td>2.12</td>
<td>Superimposed plots of six response variables of baked cassava cake</td>
<td>53</td>
</tr>
<tr>
<td>2.13</td>
<td>Effect of frozen storage on the drip loss of grated cassava paste</td>
<td>65</td>
</tr>
<tr>
<td>2.14</td>
<td>Effect of frozen storage on the firmness of grated cassava paste</td>
<td>66</td>
</tr>
</tbody>
</table>
2.15 Effect of frozen storage on the rheological properties of grated cassava paste

2.16 Scanning electron microscopy (SEM) view of the surface of frozen grated cassava paste immediately after it was blast-frozen (500X magnification)

2.17 Scanning electron microscopy (SEM) view of the surface of frozen grated cassava paste after six months of frozen storage (500X magnification)

2.18 Scanning electron microscopy (SEM) view of the surface of frozen grated cassava paste after six months of frozen storage (4000X magnification)

2.19 Effect of frozen storage on the colour of frozen grated cassava paste

2.20 Effect of frozen storage on the textural properties of baked cassava cake made from frozen grated cassava paste

2.21 Cobweb configuration of sensory attributes of baked cassava cake during frozen storage
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.22</td>
<td>Mean score for acceptability of different attributes of baked cassava cake during frozen storage using Hedonic scale</td>
</tr>
<tr>
<td>2.23</td>
<td>Effect of different xanthan gum concentration on the drip loss of frozen grated cassava paste</td>
</tr>
<tr>
<td>2.24</td>
<td>Effect of different xanthan gum concentration on the firmness of frozen grated cassava paste</td>
</tr>
<tr>
<td>2.25</td>
<td>Effect of different xanthan gum concentration on the rheological properties of frozen grated cassava paste</td>
</tr>
<tr>
<td>2.26</td>
<td>Sensory acceptance on the baked cassava cake, made from frozen grated cassava paste containing different xanthan gum concentration</td>
</tr>
<tr>
<td>2.27</td>
<td>Effect of freeze-thaw cycles on the drip loss of frozen grated cassava paste</td>
</tr>
<tr>
<td>2.28</td>
<td>Effect of freeze-thaw cycles on the firmness of frozen grated cassava paste</td>
</tr>
<tr>
<td>2.29</td>
<td>Effect of freeze-thaw cycles on the rheological quality of frozen cassava paste</td>
</tr>
</tbody>
</table>
grated cassava paste

2.30 Mean sensory score (Hedonic scale) on the baked cassava cake, made from frozen grated cassava paste subjected up to five freeze-thaw cycles
LIST OF ABBREVIATIONS

- g    gram
- kg   kilogram
- mg   milligram
- °C   degree celsius
- μ    micrometre
- RSM  Response Surface Methodology
- G’   storage modulus
- G”   loss modulus
- tan δ (G’/G”)  storage tangent
- SEM  Scanning Electron Microscopy
- R²   regression coefficient
- N    Newton
- cm   centimeter
CHAPTER 1

GENERAL INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is an important vegetable crop in the tropical regions and on a food energy production basis it ranks forth after rice, wheat and corn as a source of complex carbohydrates. Cassava is grown for various uses. In the Western countries, the dried chips are used for the production of starch employed in the cosmetic, pharmaceutical and animal feed industries. In the tropics, cassava roots are consumed after they were either boiled or after processing into fried products such as ‘gari’ or ‘farina’ or into fermented pastes for use in local foods such as ‘fufu’, ‘miondo’, ‘bobolo’ and ‘kumkum’ (Beleia *et al*., 2005). However, in Malaysia, besides being consumed directly after cooking, cassava is also used as the base for producing many types of traditional cake. The fresh cassava flesh when mixed with other ingredients can be used to make baked cassava cake (‘bingka ubi kayu’), steamed cassava cake (‘lepat ubi kayu’) and fried cassava cake (‘ubi ketuk’). The traditional way of preparing these traditional cakes is also time-consuming and tedious. It involves washing, peeling and soaking and molding prior to mixing and baking, steaming or frying and the cassava flesh is usually prepared daily to maintain its freshness. Furthermore, the demand of frozen market has steadily grown in recent years due to as more and more consumers enter the work place, the demand for convenient food ingredient and high quality frozen products is on the increase. Thus, this work concentrates on studying the behaviour, characteristics as well as the changes on quality of cassava flesh during frozen storage in
an attempt to develop a convenient grated cassava base for making certain Malaysian traditional cassava cakes.

Baked cassava cake, which is made from cassava flesh, is one of the famous traditional cakes among the Malay society. The ingredients for making this cake include grated cassava flesh, sugar, coconut milk and small amount of salt. Even though the formulation for making this cake is recommended by several homemade recipes books, no study on the optimization of the basic formulation of this cake is carried out.

Response surface methodology (RSM) is a statistical tool that can be used for optimization of the formulation in term of ingredient levels, processing condition and type of raw materials to be used in the final products. RSM consists of a group of mathematical and statistical procedures that can be used to study the relationships between one or more responses (dependent variables) and factors (independent variables) and to minimize the numbers of trials and provide multiple regression approach to achieve optimization (Murphy et al., 2003). Hence, the optimization of the basic formulation using RSM is carried out to produce good quality baked cassava cake. The best formulation will be adopted in studying the changes of cassava flesh during frozen storage and subsequent thawing.

Freezing is a common method of preservation of food products which promotes and extends the shelf life of many food products. The effects of freezing on the quality of tubers such as potatoes and sweet potatoes have been studied (O’leary et al., 2000; Redmond et al., 2002; Redmond et al., 2003). However, data on the influence of frozen