

**UNIVERSITI TEKNOLOGI MARA**

**EFFECT OF CHITOSAN-PALM STEARIN  
EDIBLE COATING ON THE POSTHARVEST  
LIFE OF STAR FRUITS (*Averrhoa carambola* L.)**

**NURUL HANANI BINTI MOHAMAD ZAKI**

Thesis submitted in fulfilment  
of the requirements for the degree of  
**Master of Science**

**Faculty of Applied Sciences**

June 2013

## AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledge as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student : Nurul Hanani Binti Mohamad Zaki

Student I.D. No. : 2009289116

Programme : Master of Science

Faculty : Applied Sciences

Thesis Title : Effect of Chitosan-Stearin Edible Coating on The  
Postharvest Life of Star Fruits (*Averrhoa carambola*  
L.).

Signature of Student :  .....

Date : June 2013

## ABSTRACT

This study was conducted to develop an edible coating containing combined hydrophilic (chitosan) and hydrophobic (palm stearin) components and investigate its effect on the postharvest life of star fruits (*Averrhoa carambola* L.). The emulsions of chitosan (C) and palm stearin (S) were prepared by using different concentrations of C:S which were in the ratios of 1:0, 1:1, 1:2, 1:3. The chitosan-palm stearin emulsion were characterised in terms of viscosity, particle size and stability. Each coating emulsion was then applied on star fruits by using dipping technique and after complete drying, star fruits were stored at room temperature (26-28 °C) and chilled temperature (5-7 °C). The physicochemical properties of the coated star fruits were evaluated for weight loss, firmness, ethylene and respiratory gases concentrations, colour, glossiness, pH, total soluble solids (TSS) and visual appearance. Microscopic observation also was carried out by using scanning electron microscopy (SEM). The results obtained showed that increasing stearin concentration increased the viscosity but decreased the stability and particle size of emulsions ( $P < 0.05$ ). C:S=1:1 was the most stable emulsion and had the lowest viscosity. Results obtained on coated fruits showed that coating reduced weight loss, slowed down the production of respiratory gasses and ethylene production, and maintained the firmness and appearance of star fruits. Generally for both storage temperatures, the effectiveness of coating decreased as the concentration of stearin increased as observed by increases in weight loss, lower firmness retention, higher ethylene and carbon dioxide concentrations and lower oxygen concentration. However, changes in pH, TSS, colour and glossiness were generally not significant. SEM results revealed that increase in stearin concentration resulted in rough appearance of coated fruits. Overall, C:S=1:1 was the best coating formulation as it showed good moisture barrier properties as reflected by significant reduction in weight loss and high firmness retention. C:S=1:1 also showed good gas barrier properties as reflected by significantly lower ethylene and carbon dioxide concentrations, thus slowing down the ripening of star fruits. C:S=1:1 could extend the postharvest life of star fruits by five days at room temperature and by ten days at chilled temperature of storage.

## ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my supervisor, Associate Professor Dr. Halimahton Zahrah Mohamed Som for her continuous guidance, support and encouragement throughout this study. I would also like to thank my co-supervisor, Dr. Zaibunnisa Abdul Haiyee for her guidance and suggestions.

I wish to thank Cik Hariyah Hashim, Puan Norahiza Mohd Soheh, Puan Siti Marhani Mardi, and other staff of Faculty of Applied Sciences for their helpful assistance with the lab methods and equipment handling. Also, I would like to thank Encik Azinuddin, Science Officer at Universiti Malaysia Pahang (UMP) for his service in analysing my Scanning Electron Microscope (SEM) samples.

I would like to thank all my fellow graduate students especially at IOS lab for their assistance and kindness in supporting me to finish up my master study. I must thank my parents for their great help and support during my entire study. Their constant encouragement had inspired me to finish up my study.

Finally, my gratitude and love are dedicated to my husband and my two little kids for their patience, time and for understanding my responsibility to complete this study.

## TABLE OF CONTENTS

<b>AUTHOR'S DECLARATION</b>	ii
<b>ABSTRACT</b>	iii
<b>ACKNOWLEDGEMENTS</b>	iv
<b>TABLE OF CONTENTS</b>	v
<b>LIST OF TABLES</b>	viii
<b>LIST OF FIGURES</b>	ix
<b>LIST OF ABBREVIATIONS</b>	xi
<b>CHAPTER ONE : INTRODUCTION</b>	1
1.1 Background and Problem Statement	1
1.2 Significance of Study	3
1.3 Objectives of Study	3
<b>CHAPTER TWO : LITERATURE REVIEW</b>	4
2.1 Fruits	4
2.1.1 Physiology of Climacteric and Non Climacteric Fruits	4
2.1.2 Star fruit ( <i>Averrhoa carambola</i> L.)	5
2.1.3 Ripening Changes	7
2.1.4 Chilling Injury	8
2.2 Edible Coatings	9
2.2.1 Lipid-Based Edible Coating	9
2.2.1.1 Palm Stearin	10
2.2.1.2 Physicochemical Properties of Palm Stearin	10
2.2.2 Polysaccharide-Based Edible Coating	11
2.2.2.1 Chitosan	11
2.2.2.2 Use of Chitosan as a Coating Material	12
2.2.3 Protein-Based Edible Coating	12
2.2.4 Emulsion Based Edible Coating	13
2.2.5 Emulsion Based Edible Coating Containing High Melting Point of Lipids.	14
2.2.6 Effect of Homogenisation Process on The Emulsion	15
2.3 Destabilisation Phenomena of Emulsions	16