UNIVERSITI TEKNOLOGI MARA

EFFECTS OF HYDROCOLLOIDS ON PHYSICOCHEMICAL PROPERTIES, ACRYLAMIDE FORMATION AND ACCEPTABILITY OF *PISANG AWAK* (*Musa acuminata x balbisiana cv.*) FRITTERS

MARYAM 'AFIFAH BT ABDUL LATIF

MSc

February 2021

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 results of my own work, unless otherwise indicated or acknowledged 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	:	Maryam 'Afifah Bt Abdul Latif
Student I.D. No.	:	2013880672
Programme	:	Master of Science (Food Technology) – AS752
Faculty	:	Applied Sciences
Thesis Tittle	:	Effects of hydrocolloids on physicochemical properties, acrylamide formation and acceptability of Pisang Awak (Musa acuminata x balbisiana cv.) fritters
Signature of Student	:	MARYAM 'AFIFAH ……..
Date	:	February 2021

ABSTRACT

Banana fritters are common snacks food among Malaysians. The high oil and acrylamide content in such products are of concern owing to its association with obesity, cancer and related health disorder. Thus, reducing and minimising the fat and acrylamide content of fried foods by application of hydrocolloids into the batter mixture is an alternative to fulfil with both health concerns and consumer preferences. This study aims to determine the effects of pectin, carboxymethyl cellulose (CMC) and guar gum on the oil uptake, acrylamide content, physicochemical properties and acceptability of banana fritters during repeated oil deep-fat frying. Banana of maturity index 6 were peeled, cut and dipped into batter formulations containing 0.5% and 1% hydrocolloids and without hydrocolloid as a control, and then deep-fried in 5L cooking oil at 170±5°C for 6 hours over 3 consecutive days without oil replenishment. The moisture, oil content, colour and acrylamide content of banana fritters were evaluated at the first and every 10^{th} frying cycle, while the coating performance, texture, microstructure and sensory acceptability were evaluated only at the first frying cycle. Results show a significant increase ($p<0.05$) in batter pick-up and cooked yield for 1% guar gum treated banana fritters. The oil content increased while the moisture content decreased with increased in frying cycles. The guar gum treated banana fritters at 1% level had the highest oil reduction (73.20%) and moisture content (54.27%) compared to the others. Further, it was observed that there was significant decrease ($p<0.05$) in oil uptake and increase in moisture content with increase in level of all hydrocolloids. The lightness (L^*) and yellowness (b^*) values decreased with increased in frying cycles while the redness (a^*) values increased with increased in frying cycles for all formulations. The hardness of banana fritters increased with increase in hydrocolloids concentration indicating harder texture of the samples and 1% guar gum treated banana fritters had the highest value (9.43N). Addition of hydrocolloids at different concentration also show changes in the microstructure of banana fritters. The acrylamide content of control and 1% guar gum treated banana fritters significantly increased with increase in frying cycles from 1 to 30. However, no significant ($p>0.05$) difference in the acrylamide content of 1% CMC treated banana fritters subjected to increased number of frying cycles. In term of different treatment, 1% guar gum shows the best hydrocolloid since it reduced acrylamide content in banana fritters as much as 15.31 to 22.01%. The sensory study indicated no significant differences ($p<0.05$) in crispiness, oiliness and taste among the treated samples, except for appearance and overall acceptability. In conclusion, addition of hydrocolloids into batter mixture helps to reduce oil absorption. The guar gum performed better in terms of overall sensory acceptability, reducing the oil absorption and acrylamide content.

ACKNOWLEDGEMENT

In the name of Allah, the Most Beneficient, the Most Merciful.

Alhamdulillah, all praises to Allah for the strength and His blessings in completing this thesis.

First and foremost, I would like to express my sincere appreciation and deepest gratitude to my beloved supervisor Prof. Dr. Norizzah Abd. Rashid for her supervision, contributions of time, understanding, generous efforts, guidance, patience and constant encouragement towards the completion of this research. It has been a great pleasure and honour to have her as my supervisor. Not forgotten, my appreciation to my co-supervisor, Assoc. Prof. Dr. Zaibunnisa Abdul Haiyee for her support and knowledge throughout this research.

Besides my advisors, my sincere thanks are also extended to Dr. Maimunah Sanny for her guidance and immense knowledge. My acknowledgement also goes to laboratory staff members, En. Ahmad Kambali, Pn. Norahiza, Pn. Siti Marhani, Cik Hariyah and Cik Shuhada for their help and guidance to the success of this research.

I would be thankful to my best friends Siti Hafsah, Noorakma, Raihan, Noorasma and my teammate, Emilia, Fazilah and Akram for their valuable assistance and supporting me spiritually throughout the journey of this research.

Lastly, and most importantly, I would like to thank my family and family in law for all their love and encouragement. For my beloved parents Abdul Latif Mohamed and Noreya Ibrahim who raised me with love and supported me in all my pursuits. Also, I wish to thank my loving brother and sisters, Nadhirah, Usamah, Adilah and Zahidah for their support and valuable prayers. And most heartfelt appreciation is given to my beloved husband, Abdul Hafiz Hazizan, my sons, Naufal, Adib and Muaz for their endless support, sacrifice, understanding and prayers. To those indirectly contributed to this research, your kindness means a lot to me.

Alhamdulillah.

TABLE OF CONTENTS

		Page
CONFIRMATION BY PANEL OF EXAMINERS		**ii**
AUTHOR'S DECLARATION		**iii**
ABSTRACT		**iv**
ACKNOWLEDGEMENT		**v**
TABLE OF CONTENTS		**vi**
LIST OF TABLES		**x**
LIST OF FIGURES		**xi**
LIST OF PLATE		**xii**
LIST OF SYMBOLS		**xiii**
LIST OF ABBREVIATIONS		**xv**
CHAPTER ONE: INTRODUCTION		**1**
1.1	Background of Study	1
1.2	Problem Statements	3
1.3	Significance of Study	4
1.4	Objectives of Study	4
1.5	Scope and Limitation of Study	5
CHAPTER TWO: LITERATURE REVIEW		**6**
2.1	Banana and Its Production in Malaysia	6
	2.1.1 *Pisang Awak* and Its Nutritional Composition	7
2.2	Deep-Fat Frying Process	9
2.3	Oil Absorption	10
	2.3.1 Mechanism of Oil Absorption	10
	2.3.1.1 Water Replacement	10
	2.3.1.2 Cooling Phase Effect	10
	2.3.1.3 Surface Active Agents	11
	2.3.2 Factors Affecting Oil Absorption	12
	2.3.2.1 Size, Shape and Product's Surface	12