

UNIVERSITI TEKNOLOGI MARA

**EFFECT OF COCONUT SHELL POWDER (CSP) ON
CURE CHARACTERISTICS, PHYSICAL AND
MECHANICAL PROPERTIES OF NITRILE
RUBBER (NBR) COMPOSITES**

NURLIYANA BINTI MOHD SHARIF

Thesis submitted in fulfillment
of the requirement for the degree of
Bachelor of Science (Hons.)
(Polymer Technology)

Faculty of Applied Sciences

January 2020

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 : Nurliyana binti Mohd Sharif

Student I.D. No. : 2016329043

Programme : Bachelor of Sciences (Hons.) Polymer Technology – AS243

Faculty : Applied Sciences

Thesis Title : Effect of Coconut Shell Powder (CSP) on Cure Characteristics, Physical and Mechanical Properties of Nitrile Rubber (NBR) Composites

Signature of Student :

Date : January 2020

ABSTRACT

Coconut Shell Powder (CSP) was used as reinforcing agent in Nitrile rubber (NBR). Untreated CSP and alkali treated CSP were used as filler materials in the preparation of NBR composites. The influence of filler loading alkali treatment on the cure characteristics, physical and mechanical properties of the composites were analyzed. The characteristics of the untreated and treated CSP were confirmed from FTIR studies through the shifting and broadness of the absorption peak. The NBR composites incorporated with treated CSP (10 phr) achieved the optimum cure time, the highest tensile strength (2.80 MPa) and elongation at break (128.12 %). However, the hardness and the tensile modulus of the NBR composites increasing with the addition of the treated CSP filler loading. The alkali treatment on CSP can be concluded to enhance the curing characterization, physical and mechanical properties of NBR composites.

TABLE OF CONTENT

	PAGE
CONFIRMATION BY PANEL OF EXAMINERS	ii
AUTHOR'S DECLARATION	iii
ABSTRACT	iv
ABSTRAK	v
ACKNOWLEDGEMENTS	vi
TABLE OF CONTENT	vii
LIST OF TABLES	x
LIST OF FIGURES	xi
LIST OF SYMBOLS	xii
LIST OF ABBREVIATION	xiii
CHAPTER ONE: INTRODUCTION	1
1.1 Research Background	1
1.2 Problem Statement	2
1.3 Significance of Study	2
1.4 Objective of Study	3
CHAPTER TWO: LITERATURE REVIEW	4
2.1 Nitrile Rubber (NBR) Composites	4
2.1.1 NBR Properties	4
2.2 Natural Filler	5
2.2.1 Coconut Shell as Natural Filler	6
2.2.2 Micron Size Filler	7
2.3 Pre-treatment of Filler	7
CHAPTER THREE: METHODOLOGY	9
3.1 Raw Materials	9
3.1.1 Nitrile Rubber (NBR)	9

3.1.2	Preparation of Coconut Shell Powder (CSP)	9
3.1.3	Chemicals	10
3.2	Preparation of CSP/NBR Composites	11
3.2.1	Formulation of CSP/NBR Composites	11
3.2.2	Compounding of CSP/NBR Composites	12
3.3	Characterization of CSP Filler	12
3.3.1	Determination Size of CSP	12
3.3.2	Fourier Transform Infrared Spectroscopy (FTIR)	12
3.4	Cure Characteristics of CSP/NBR Composites	13
3.5	Physical Properties of CSP/NBR Composites	13
3.5.1	Crosslink Density	13
3.5.2	Hardness	14
3.6	Tensile Properties of CSP/NBR Composites	14
3.7	Process Flowchart	16
CHAPTER FOUR: RESULTS AND DISCUSSION		17
4.1	Particle Size Distribution of Coconut Shell Powder (CSP)	17
4.2	Fourier Transform Infrared (FTIR) Analysis of Untreated Coconut Shell Powder (uCSP) and Treated Coconut Shell Powder (tCSP)	18
4.3	Cure Characteristic of Untreated Coconut Shell (uCSP) and Treated Coconut Shell (tCSP) Filled NBR Composites	20
4.4	Crosslink Density of Untreated Coconut Shell (uCSP) and Treated Coconut Shell (tCSP) Filled NBR Composites	21
4.5	Hardness of Untreated Coconut Shell (uCSP) and Treated Coconut Shell (tCSP) Filled NBR Composites	22
4.6	Tensile Properties of Untreated Coconut Shell (uCSP) and Treated Coconut Shell (tCSP) Filled NBR Composites	23
CHAPTER FIVE: CONCLUSION AND RECOMENDATIONS		27
5.1	Conclusion	27
5.2	Recommendations	28