

UNIVERSITI TEKNOLOGI MARA

**CASSAVA STARCH/
CARBOXYMETHYLCELLULOSE
BIOCOMPOSITE FILM FOR FOOD
PAPER PACKAGING WITH
TURMERIC OIL AS ANTIFUNGAL
AGENT**

NURUL FATIN ALIA BINTI MUSTAPHA

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ABSTRACT

Paper and paperboard are commonly laminated with polyethylene (PE) to enhance its functionality but defeated its purpose as recyclable material. In an effort to encounter the issue, biopolymer composite film from cassava starch and carboxymethylcellulose (CMC) was studied as alternative of PE as film coating material. In this study, glycerol and turmeric oil was added in the biopolymer film as plasticizer and antifungal agent, respectively. Firstly, 5% w/w cassava starch was gelatinized at temperature 75°C and glycerol was added at different values (15% and 30% v/w starch). Meanwhile, CMC was dissolved in 100 mL distilled water at different weight percentage which are 5, 10, 20, 30, 40 and 50% w/w starch. The solutions were then mixed and viscosity was measured. Turmeric oil was then added in solution mixtures at different volume (5, 10, 15, 20, 25 and 30 μ L). Casting method was used to apply film-forming solution on kraft paper. Drying of solution takes place at 60°C for two and half hours and characterization studies was conducted. Tensile strength, strain to break and wettability measurements indicated that the biopolymer film containing 30% (v/v starch) glycerol and 10% (w/w) CMC labelled as BF 5 had the highest tensile strength (15 MPa) but had the lowest value of strain to break, and exhibit hydrophobic properties. Meanwhile, addition of turmeric oil into developed BF 5 showed insignificant changes in tensile strength and percentage of strain to break but exhibit hydrophilic properties except for film with 15 μ L turmeric oil. A comparison study of BF 5 with commercially (PE-coated) used in food packaging showed that BF 5 exhibit almost similar hydrophobic properties but had higher tensile strength than the commercial. Besides, thermogravimetric analysis identified that BF 5 had less residue than PE-coated and this indicated that BF 5 film degraded faster. Response surface methodology (RSM) was employed to study the effect of coating thickness and antifungal agent volume on the functional properties and biodegradability of BF 5. The functional properties of the BF 5 were determined through the release of antifungal agent and antifungal activity meanwhile biodegradation study was conducted in typical condition of home composting system. The results of the study showed that both of the coating thickness and turmeric oil volume significantly affected all the responses. From the response surface plot, the highest value of inhibition zone of *Aspergillus niger* occurred at the lowest percentage of antifungal agent release. This indicates that released of antifungal agent sources occurred at right stipulated period of time required for growth of the *A. niger*. The weight loss percentage of the biopolymer film after degradation process decreased with increasing coating thickness and the lowest value were identified at the same point of the lowest percentage of antifungal agent release. Therefore, the results suggested that applying the biopolymer film containing turmeric oil as kraft paper coating may improve its functionality in prolongs the shelf life of foods. Besides, all the samples able to degrade in typical conditions of soil which showed that it can be disposed in landfills after been used. Thus, it can be stated that the develop biofilm could replace the currently used petroleum based derivative plastic in the food industry.

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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	xi
LIST OF FIGURES	xiii
LIST OF PLATES	xvii
LIST OF SYMBOLS	xviii
LIST OF ABBREVIATIONS	xx
CHAPTER ONE: INTRODUCTION	1
1.1 Research Background	1
1.2 Problem Statement	3
1.3 Objectives	4
1.4 Scopes and Limitations of Study	5
1.5 Significance of Study	6
CHAPTER TWO: LITERATURE REVIEW	7
2.1 Introduction	7
2.2 Scenario in Food Industry	7
2.2.1 Food Packaging Materials	7
2.2.1.1 <i>Paper and Paperboard</i>	8
2.2.1.2 <i>Plastics</i>	8
2.2.2 Foods Spoilage	9
2.2.2.1 <i>Control of Bread Spoilage</i>	10

2.3	Green-Technology for Food Packaging	11
2.3.1	Biopolymer Film Coatings on Paper Packaging Materials	11
2.3.1.1	<i>Lipid-Based Coatings</i>	14
2.3.1.2	<i>Protein-Based Coatings</i>	14
2.3.1.3	<i>Polysaccharide-Based Coatings</i>	15
2.3.1.4	<i>Cassava Starch As Based For Biopolymer Film</i>	17
2.3.1.5	<i>Natural-Based Plasticizer</i>	17
2.3.1.6	<i>Composite Biopolymer Films</i>	19
2.3.2	Antimicrobial Biopolymer Film	21
2.3.2.1	<i>Turmeric Oil as an Antimicrobial Agent</i>	25
2.3.2.2	<i>Extraction Method</i>	26
2.3.3	Method of Paper Coatings	27
2.3.4	Mode of Action in Antimicrobial Packaging System	30
2.4	Characterisation of Packaging Properties	31
2.4.1	Physical Properties	31
2.4.1.1	<i>Thickness</i>	31
2.4.1.2	<i>Hydrophilic/Hydrophobic Properties</i>	32
2.4.2	Chemical Properties	33
2.4.2.1	<i>Fourier-Transform Infrared Spectroscopy</i>	33
2.4.2.2	<i>Antimicrobial Agent Release</i>	34
2.4.3	Mechanical Properties	35
2.4.4	Thermal Stability and Behaviour	37
2.4.4.1	<i>Differential Scanning Calorimetry analysis</i>	37
2.4.4.2	<i>Thermogravimetric Analysis</i>	37
2.4.5	Microbial Analysis	37
2.4.5.1	<i>Inhibition Zone</i>	37
2.4.6	Biodegradation Test	39
2.4.7	Experimental Design and Statistical Analysis	40
2.4.7.1	<i>Model Adequacy Checking</i>	45
2.5	Summary of the Review	47
CHAPTER THREE: RESEARCH METHODOLOGY		49
3.1	Introduction	49