

**THE PRODUCTION OF BIODEGRADABLE MULCH FILM BY USING
SPENT COFFEE GROUND AS FILLER AND WASTE COOKING OIL AS
BIO-RESIN**

NURAIZAH HANUM BINTI MUHAMAD SABUDDIN

**Final Year Project Report Submitted in
Partial Fulfillment of the Requirements for the
Degree of Bachelor of Science (Hons.) Biology
in the Faculty of Applied Sciences
Universiti Teknologi MARA**

AUGUST 2023

This Final Year Project Report entitled “**The production of biodegradable mulch film by using spent coffee ground as filler and waste cooking oil as bio-resin**” was submitted by Nuraizah Hanum binti Muhamad Sabuddin in partial fulfillment of the requirements for the Degree of Bachelor of Science (Hons.) Applied Chemistry, in the Faculty of Applied Sciences, and was approved by

Dr. Nur Nasulhah Kasim
Supervisor
B. Sc. (Hons) Applied Chemistry
Faculty of Applied Science,
University Teknologi MARA,
02600 Arau,
Perlis

Siti Nurlia Binti Ali
Project Coordinator
B. Sc. (Hons) Applied Chemistry
Faculty of Applied Science,
University Teknologi MARA,
02600 Arau,
Perlis

Dr. Nur Nasulhah Binti Kasim
Head of Programme
Faculty of Applied Science,
University Teknologi MARA,
02600 Arau,
Perlis

AUGUST 2023

ABSTRACT

THE PRODUCTION OF BIODEGRADABLE MULCH FILM BY USING SPENT COFFEE GROUND AS FILLER AND WASTE COOKING OIL AS BIO-RESIN

Coffee is the second most popular beverage in the world next to the water. Spent coffee grounds (SCGs) are the leftover grounds from coffee consumption that are typically thrown away and eventually land in landfills. Due to the huge amount of SCG, it will give the negative effects on the environment which it requires a lot of oxygen to breakdown the SCG in landfills. Therefore, to save the environment SCG need to be develop into product with added value. In this research, SCG was used as filler with added of PLA as a natural polymer into the biodegradable mulch film. The biomass tested in this study are spent coffee ground (SCG), and poly(lactic) acid(PLA) was used to mix with the biomass in a different compositions (0, 10, 20, 30, and 40 wt%). Three main tests including Fourier Transform Infrared Spectroscopy (FTIR), soil burial test and tensile strength test were taken place to study the characterize of biodegradable PLA mulch film. As a result of soil burial test, the percentage of weight loss of PLA/SCG film after 10 days was 7, 6.25, 6.19, 5.96 and 5.5%. It means that the higher the SCG content, the lower the weight loss of PLA/SCG film. Next, at ratio of 40% of SCG and 50% PLA has the tensile strength of 0.1880 MPa, elongation at break at 2.9430 MPa and the Young's Modulus is 12.72 MPa. It has the highest of tensile strength and elongation at break which causes the mechanical characteristics of the composite material has been improved and the SCG filler have increased the flexibility and ductility of the PLA/SCG film. 40 wt% of SCG: 50 wt% PLA is the best among the ratio, in terms of higher tensile strength and increase of elongation at break. Hence, ration of 40 wt% of SCG and 50 wt% of PLA is the most suitable biomass to use as biodegradable mulch film.

TABLE OF CONTENTS

	Page
ABSTRACT	i
ABSTRAK	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	vi
LIST OF FIGURES	vii
LIST OF SYMBOLS	viii
LIST OF ABBREVIATIONS	ix
CHAPTER 1 INTRODUCTION	
1.1 Background of Study	1
1.2 Problem Statement	4
1.3 Research Questions	6
1.4 Objectives and Aims of Study	6
1.5 Significance of Study	7
1.6 Expected Outcome	8
CHAPTER 2 LITERATURE REVIEW	
2.1 Biomass	9
2.1.1 Spent Coffee Ground	9
2.2 Natural Polymer	11
2.2.1 Poly(lactic) acid (PLA)	11
2.3 Plasticizer	13
2.3.1 Waste Cooking Oil (WCO)	13
2.3.2 Bio-resin	12
2.4 Mulching Film	16
2.4.1 Mulching in agriculture	16
2.4.2 Biodegradable Mulching Film	18
2.4.3 Potential of Biodegradable Mulching Film	20
CHAPTER 3 METHODOLOGY	
3.1 Materials	23
3.1.1 Chemicals	23
3.2 Apparatus	23
3.3 Preparation of Spent Coffee Ground (SCG)	24
3.4 Preparation of Epoxidized WCO	24
3.4.1 Preparation of the PLA/SCG film	25
3.5 Characterization and Testing of Sample	26
3.5.1 Fourier Transform Infrared Spectroscopy	26

	(FTIR)	
3.5.2	Soil Burial Test (SBT)	27
3.5.3	Tensile Strength	27

CHAPTER 4 RESULT AND DISCUSSION

4.1	Analysis of FTIR spectra	29
	4.1.1 Composition of SCG	29
	4.1.2 Epoxidized of WCO	30
	4.1.3 PLA/SCG film	32
4.2	Soil Burial Test (SBT)	33
4.3	Tensile Strength of PLA/SCG film	36

CHAPTER 5 CONCLUSION AND RECOMMENDATION

5.1	Conclusion	39
5.2	Recommendation	40