

**THE EFFECT OF ETHYLENE GLYCOL: CITRIC ACID
CONCENTRATION AS PLASTICIZER IN CARBOXYMETHYL
CELLULOSE (CMC) BIOPLASTIC**

NUR ATHIRAH BINTI MUHAMAD RAZIF

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

AUGUST 2023

This Final Year Project Report entitled “**The Effect of Ethylene Glycol: Citric Acid Concentration as Plasticizer in Carboxymethyl Cellulose (CMC) Bioplastic**” was submitted by Nur Athirah binti Muhamad Razif in partial fulfilment of the requirements for the Degree of Bachelor of Science (Hons.) Applied Chemistry, in the Faculty of Applied Sciences, and was approved by

Dr Rizana Yusof
Supervisor
B. Sc. (Hons.) Applied Chemistry
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

Dr Nurlia Ali
Project Coordinator
B. Sc. (Hons.) Applied Chemistry
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

Dr Nur Nasulhah Kasim
Head of Programme
B. Sc. (Hons.) Applied Chemistry
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

Date: _____

ABSTRACT

THE EFFECT OF CITRIC ACID: ETHYLENE GLYCOL CONCENTRATION AS PLASTICIZER ON CARBOXYMETHYL CELLULOSE (CMC) BIOPLASTIC

Nowadays, the creation of biodegradable polymers for industrial and commercial uses is crucial due to the negative environmental effects of synthetic plastics. Environmental contamination in the land, water, and air has been brought on by the rise in plastic trash, the majority of which is made from petroleum plastics. In order to create biodegradable bioplastics, renewable sources like cellulose and deep eutectic solvent (DES) are added to bioplastics. Commonly, bioplastics would become brittle with any cellulose. Utilizing DES is crucial for improving material flexibility and ensuring durability. The objective of this study is to prepare bioplastics made of carboxymethyl cellulose (CMC) with different concentrations of DES, citric acid, and ethylene glycol that act as plasticizers. Furthermore, the characteristics of CMC-DES bioplastic were analyzed in terms of physical and mechanical properties. The samples were examined for various parameters such as Fourier Transform Infrared (FT-IR), thickness tensile properties, bioplastic degradability test, moisture content, and solubility content. The findings demonstrated that CMC-DES 1% is best suited for food packaging because it exhibits low moisture content, water absorption, and water solubility. This bioplastic film of CMC-DES 3% has excellent properties, including great elasticity and flexibility at 0.3719 MPa. Furthermore, compared to traditional plastics, CMC-DES bioplastics can deteriorate significantly more quickly. As a result, because CMC bioplastic is affordable, biodegradable, and environmentally safe, its usage in package production may be expanded globally. Thus, this study will contribute to the development of bioplastics in the packaging industry.

TABLE OF CONTENTS

	Page
ABSTRACT	iii
ABSTRAK	iv
ACKNOWLEDGEMENT	v
TABLE OF CONTENTS	vi
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF SYMBOLS	x
LIST OF ABBREVIATIONS	xi
CHAPTER 1 INTRODUCTION	
1.1 Background of study	1
1.2 Problem statement	5
1.3 Significance of study	7
1.4 Objectives and Aim	8
CHAPTER 2 LITERATURE REVIEW	
2.1 Bioplastic	9
2.2 Bioplastic based - cellulose	13
2.3 Deep eutectic solvent	15
2.4 Effect of DES as plasticizer	18
CHAPTER 3 METHODOLOGY	
3.1 Preparation of deep eutectic solvent	22
3.2 Preparation of bioplastic	22
3.3 Characterization of bioplastic	23
3.3.1 Physical properties	23
3.3.1.1 Thickness	23
3.3.1.2 Density	23
3.3.1.3 Moisture content	24
3.3.1.4 Water solubility	24
3.3.1.5 Water Absorption	25
3.3.2 Mechanical properties	25
3.3.2.1 Tensile	25
3.3.3 Fourier Transform Infrared (FT-IR)	26
3.3.4 Biodegradability Test	26

3.4	Experimental designs/ flowchart	27
CHAPTER 4 RESULTS AND DISCUSSION		
4.1	Characterization of bioplastic	28
4.1.1	Physical properties	28
4.1.1.1	Thickness	28
4.1.1.2	Density	29
4.1.1.3	Moisture content	31
4.1.1.4	Water Solubility	33
4.1.1.5	Water Absorption	34
4.1.2	Mechanical properties	36
4.1.2.1	Tensile strength	36
4.1.2.2	Elongation at break	37
4.1.2.3	Young's Modulus	37
4.1.3	Fourier Transform Infrared (FT-IR)	38
4.1.4	Biodegradability Test	40
CHAPTER 5 CONCLUSION AND RECOMMENDATIONS		43
CITED REFERENCES		45
GANTT CHART		51
CURRICULUM VITAE		53