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DEVELOPMENT OF BIOPLASTIC FROM CHEMPEDAK PEEL PECTIN AND SUGARCANE BAGASSE CELLULOSE FOR SUSTAINABLE PACKAGING APPLICATIONS

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ABSTRACT

DEVELOPMENT OF BIOPLASTIC FROM CHEMPEDAK PEEL PECTIN AND SUGARCANE BAGASSE CELLULOSE FOR SUSTAINABLE PACKAGING APPLICATIONS

The use of conventional plastics poses environmental problems due to their low biodegradability. Sugarcane bagasse is a cellulose-rich agricultural by-product with strong potential as a sustainable raw material for bioplastic production due to its abundance and biodegradability. However, cellulosed-based bioplastics often suffer from brittleness and poor water resistance, limiting their practical applications. To address these limitations, this study explores the incorporation of pectin extracted from chempedak (*Artucarpus integer*) peel, an underutilized agro-waste, as a natural biopolymer additive. In this study, bioplastic films were produced by blending cellulose from sugarcane bagasse with varying concentration of chempedak peel pectin using glycerol as a plasticizer via the casting method. The chemical, mechanical, and physical properties of the films were evaluated using Fourier Transform Infrared (FTIR) spectroscopy, thickness measurement, tensile strength, water absorption, transparency, and biodegradability tests. FTIR analysis of the bioplastic films shows that pectin was successfully incorporated into the cellulose matrix without changing the basic chemical structure of the bioplastic films. Pectin interacted with cellulose mainly through hydrogen bonding, as indicated by the broad O-H stretching band with the range of 3200-3400 cm^{-1}, rather than forming new covalent bonds. The pectin-cellulose bioplastic exhibited uniform thickness, reduced water absorption, and transparency comparable to low-density polyethylene (LDPE) film, although a reduction in tensile strength was observed at higher pectin content. Biodegradability tests demonstrated that the bioplastic films decomposed readily within a short period under natural conditions. In conclusion, the bioplastic film prepared from the pectin-cellulose mixture at a ratio of 3:2 (w/w), Sample 4, exhibited the most balanced mechanical, physical, and biodegradation properties, demonstrating its strong potential as a sustainable alternative to conventional LDPE packaging.

TABLE OF CONTENTS

	Page
ABSTRACT	ii
ABSTRAK	iii
ACKNOWLEDGEMENTS	iv
TABLE OF CONTENTS	v
LIST OF TABLES	vi
LIST OF FIGURES	vii
LIST OF SYMBOLS	viii
LIST OF ABBREVIATIONS	xi
CHAPTER 1 INTRODUCTION	
1.1 Background of Study	1
1.2 Problem Statement	4
1.3 significance of Study	5
1.4 Objectives of Study	6
CHAPTER 2 LITERATURE REVIEW	
2.1 Overview of Plastic Pollution	7
2.2 Bioplastics Overview	9
2.3 Sugarcane Bagasse as a Source of Cellulose	11
2.4 Pectin from Chempedak Peel	13
2.5 Cellulose in Bioplastic Production	15
2.6 A Biopolymer of Pectin	17
2.7 Physical, Mechanical and Barrier Properties of Bioplastics	19
CHAPTER 3 METHODOLOGY	
3.1 Materials and Chemicals	22
3.2 Equipment and Instrument	23
3.3 Methodology	
3.3.1 Preparation of Sample	24
3.3.2 Cellulose Extraction from Sugarcane Bagasse	24
3.3.3 Pectin Extraction from Chempedak Peel	26
3.3.4 FTIR Analysis for Cellulose, Pectin Extract and Bioplastics	26
3.3.5 Development of Bioplastic Films	28
3.3.6 Characterization and Testing	29