UNIVERSITI TEKNOLOGI MARA

CHARACTERIZATION AND MECHANICAL PROPERTIES OF TARO STARCH/POLY(LACTIC ACID) FILM

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TABLE OF CONTENT

ACKNOWLEDGEMENT	**I**
TABLE OF CONTENT	**II**
LIST OF TABLES	**IV**
LIST OF FIGURES	**V**
LIST OF SYMBOLS	**VI**
LIST OF ABBREVIATION	**VII**
ABSTRACT	**VIII**
ABSTRAK	**IX**

CHAPTER 1 : INTRODUCTION

1.1 Background of Study	1
1.2 Problem Statement	3
1.3 Significant of Study	4
1.4 Objectives	4

CHAPTER 2 : LITERATURE REVIEW

2.1 Polylactic Acid (PLA)	5
2.2 Starch	7
2.3 Taro Starch (TS)	9
2.4 Preparation Technique of Taro Starch Extraction	9
2.5 Biodegradable Polymer and Starch Mixture	11
2.6 Maleic Anhydride (MA)	12

CHAPTER 3 : METHODOLOGY

3.1 Material 13

3.2 Extraction of Starch from Taro Plant 13

3.3 Preparation of Biodegradable Films 13

3.4 Characterization Testing

3.4.1 Fourier Transform Infrared (FTIR) 14

3.4.2 Differential Scanning Calorimeter (DSC) 15

3.5 Water Absorption Test 16

3.6 Mechanical Testing

3.6.1 Tensile Test 17

3.7 Biodegradable Test 18

3.8 Flow Chart of Methodology 19

CHAPTER 4 : RESULTS AND DISCUSSIONS

4.1 Fourier Transform Infrared (FTIR) Analysis 20

4.2 Differential Scanning Calorimeter (DSC) Analysis 23

4.3 Water Absorption Test 25

4.4 Tensile Test 27

4.5 Biodegradable Test 29

CHAPTER 5 : CONCLUSION AND RECOMMENDATION

5.1 Conclusion 31

5.2 Recommendation 31

CITED REFERENCES 32

CURICULUM VITAE 36

ABSTRACT

CHARACTERIZATION AND MECHANICAL PROPERTIES OF TARO STARCH/POLYLACTIC ACID FILM

Polylactic acid (PLA) is thermoplastic aliphatic polyester derived from the polymerization of lactic acid. Production process of PLA involves the fermentation of sugar and starch. PLA is suitable for biodegradable packaging, such as bottles, food containers, bags and wrappers. However, due to its brittleness and expensiveness, PLA has limited in the plastic packaging industry. Therefore, blending PLA with starch, such as, taro starch (TS), is probably the most convenient solution to overcome its brittleness, reducing its cost and improve the biodegradability of PLA. Starch is an attractive material to be blended with PLA since it is made from starch, which is naturally abundant, cheap, renewable, non-toxic, biodegradable and compostable. Since, PLA is hydrophobic and starch is hydrophilic, they may provide poor interfacial bonding, which lead to the reduction of mechanical properties of PLA. The addition of maleic anhydride (MA) may help to control this problem. In this project, the blending of PLA/TS/MA was developed to produce the biodegradable film for plastic packaging industry. PLA, TS and MA were dissolved by chloroform and casted on the perty dish. There 5 sample of PLA:TS:MA film with different ratio, starting with 100:0:0, 85:10:5, 75:20:5, 65:30:5, 55:40:5. The physical and mechanical properties of the films were compared between each other. The higher tensile strength, 6.329 MPa, was recorded at the optimum content of TS, which is 10phr. However, the strength of PLA gradually dropped when the amount of TS was continually added. Similar result was obtained in DSC analysis, whereas, the optimum value of glass transition temperature (Tg) was obtained at 10% of TS content with a value of 62˚C, plus, the addition of TS had increased the melting temperature of PLA to 151˚C. In FTIR analysis, the formation of hydrogen bonding between the polymer chain of PLA and TS was found at 3940 cm^{-1} had resulted in the increasing of tensile strength at 10 phr. Nevertheless, the larger pore size of the TS had provide a lot of space for water to be trapped and had enhance the biodegradability of PLA by weaken the hydrogen bond and break down the polymer chains of PLA. It was resulted in the water absorption test and biodegradable test with the value of 26.7% and 27.69% respectively, where the increasing of starch content had increase the amount of water uptake and degradability of PLA.