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BIOPLASTIC FROM MANGO LEAVES

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ABSTRACT

Plastic is a synthetic material made from a wide range of organic polymers such as polyethylene, PVC, nylon, and others. It can be moulded into shape while soft, and then set into a rigid or slightly elastic form. In Malaysia, it is generally used for food packaging, toys furniture and other applications. Even though it is very convenient, plastics derived from petroleum are not biodegradable. More than 80 million tonnes of plastic enters the world's oceans each year. Meanwhile, bioplastic is a type of biodegradable plastic derived from biological substances rather than petroleum. The demand for bioplastic is increasing along with the rising concern towards environmental problems caused by petroleum-based plastic. Global production capacity of bioplastic increased by 68% per year during 2003 until 2007 and predicted to reach 3.4 million tonnes in 2020. The objective of this study was to produce bioplastic from mango leaves. Mango trees are widely available in Malaysia and not fully utilized. In this project, the cellulose was extracted from the mango leaves through oxidation and bleaching. Then, the extracted cellulose was used in the production of bioplastic by using solution casting. The results showed that the lignocellulose content of our mango leaves were 29.6 % lignin, 33.9 % cellulose and 36.5 % hemicellulose. The bioplastic from mango leaves cellulose has shown good flexibility and strength as well as good opacity. In conclusion, bioplastic from mango leaves research was successfully prepared and can be developed as plastic bag or food packaging.

Keywords: bioplastic, mango leaves, cellulose, biodegradable

1. INTRODUCTION

Plastic is a synthetic material made from a wide range of organic polymers such as polyethylene, PVC, nylon, and others. It can be moulded into shape while soft, and then set into a rigid or slightly elastic form. In Malaysia, it is generally used for food packaging, toys furniture and other applications. Even though it is very convenient, plastics derived from petroleum are not biodegradable. More than 80 million tonnes of plastic enters the world's oceans each year.

Meanwhile, bioplastic is a type of biodegradable plastic derived from biological substances rather than petroleum. The demand for bioplastic is increasing along with the rising concern towards environmental problems caused by petroleum-based plastic. Global production capacity of bioplastic increased by 68% per year during 2003 until 2007 and predicted to reach 3.4 million tonnes in 2020 [1]. The objective of this study was to produce bioplastic from mango leaves. Mango trees are widely available in Malaysia and not fully utilized. In this project, the cellulose was extracted from the mango leaves through oxidation and bleaching. Then, the extracted cellulose was used in the production of bioplastic by using solution casting.

2. MATERIALS AND METHODS

Mango leaves were collected from neighborhood in Kajang, Selangor. Cassava starch was purchased from local shop. Chemicals such as sodium chlorite, potassium hydroxide, hydrogen peroxide and glycerol in this

experiment were analytical grade and used without further purification. Distilled water was used throughout the experiment.

Equipment and method that have been used in the work must be stated clearly and subtitles should be used when necessary. Results of the work and supporting figures, tables and images of the results should take part in the extended abstract. Not having appropriate content can cause disapproval of the sent declarations before judge's assessment.

2.1. Extraction of Cellulose from Mango Leaves

Mango leaves were ground using grinding machine into small particle size. The extraction method was done according to the procedure from previous study [2]. 10g of ground mango leaves were mixed with 5% NaClO and stirred at 70°C. Then, the mixture was washed with distilled water and dried in oven overnight. Then the sample was treated with 6% of potassium hydroxide and washed and rinsed few times with distilled water. Then, oxidation was done by reaction the treated mango leaves with 5% hydrogen peroxide for 24hrs. The composition of lignin, hemicellulose and cellulose were calculated.

2.2. Synthesis of Bioplastic from Mango Leaves

Bioplastic of cellulose-starch was prepared by solution casting and evaporation process using cassava starch as polymer matrix and glycerol as plasticizer according to previous study [2]. 30g of cassava starch was suspended in 1000ml distilled water and heated at 80°C for 30min for gelatinization. Cellulose solution was added slowly to the gelatinized starch and stirred until al cellulose mixed well in the gelatinized starch. The amount of cellulose was 0% (Sample 1), 25% (Sample 2) and 50% (Sample 3). The mixture was cooled and cast on petri dish and air dried. The mechanical strength of the mango bioplastic: tensile strength and elongation at break were determined.

3. RESULTS AND DISCUSSION

Figure 1 shows composition of mango leaves. Mango leaves consist of 33.9% of cellulose, 36.5% hemicellulose and 29.6% of lignin. This cellulose is very useful to be used in the production of bioplastic.

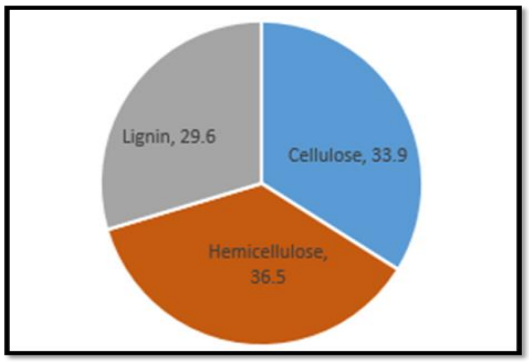

Figure 1. Composition of mango leaves.

Tensile strength and elongation at break tell us the mechanical properties of the Bioplastic. The addition of cellulose decreased the tensile strength. However, the elongation at break of bioplastic increased with the

addition of cellulose especially at 25% of cellulose. Figure 2a and 2b show the tensile strength and elongation at break of bioplastic from mango leaves.

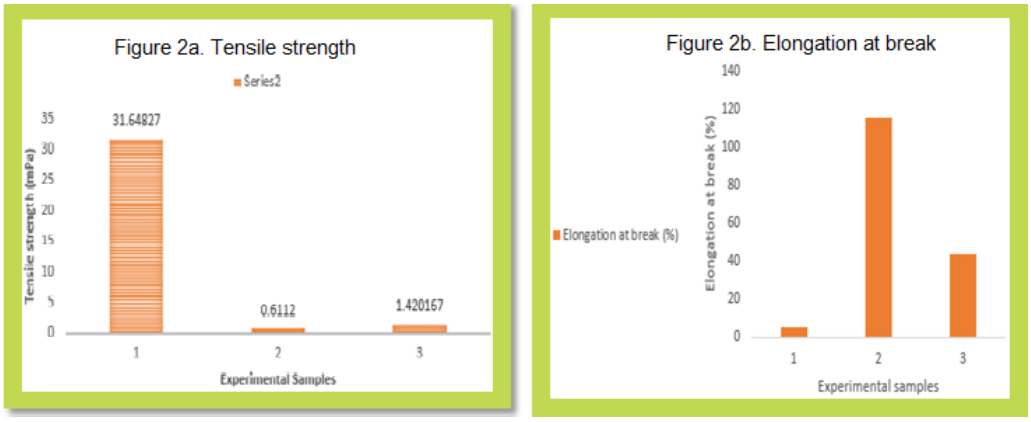

Figure 2(a). Tensile strength and **Figure 2(b)** elongation at break of mango leaves bioplastic.

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