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CHARACTERIZATION OF POLYETHYLENE STARCH BASED FILM INCORPORATED WITH CRUDE PALM OIL AND ALOE VERA GEL

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ABSTRACT

Fully degradable plastic has not get positive industrial application until today and had lead researchers to focus on developing partially biodegradable plastic. The objective of this paper was to determine the impact of different plasticizer (glycerol, aloe vera gel, crude palm oil) towards the characteristics of LDPE starch films. The effectiveness of crude palm oil is uncertain when incorporated into synthetic polymer, while aloe vera gel in polyethylene product is still questionable. The films were prepared via melt blending method before being transferred to hot press to obtained a flat sheet film. Based on FTIR result, the addition of aloe vera gel has no visible effect on the functional group of LDPE while incorporation of crude palm oil into the film mixture has helped the intermolecular bonding between thermoplastic starch and LDPE. From TGA analysis, the best processing temperature for this thermoplastic starch film is below 200°C. X-Ray diffraction (XRD) analysis has shown that the crystallinity of PE film has been disrupted by the presence of intermolecular hydrogen bonding between PE and other materials. As a conclusion, aloe vera gel and crude palm oil has potential to be one of the plasticizer in film packaging.

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INTRODUCTION

1.1 Research Background

Petroleum-based synthetic polymers (plastics) which are non-biodegradable polymers have been used widely in food packaging due to their low cost, durability and water resistance properties. However, concerns over the disposal of these non-biodegradable plastic-based packaging materials, growing environmental problems and safety issues have led to an increase interest in the development of biodegradable and eco-friendly materials for use in food packaging (Callegarin, Gallo, Debeaufort, & Voilley, 1997; Maniglia, De Paula, Domingos, & Tapia-Blácido, 2015; Spotti, Cecchini, Spotti, & Carrara, 2016; Sukhija, Singh, & Riar, 2016).

The process of TPS production involved the use of native and slightly modified starches. The advantages of using starch are cheap, abundant and renewable. However, (Kalambur & Rizvi, 2006) mentioned that the used of starch itself in bio-plastic manufacturing is unsuitable because of various disadvantages. These include brittleness of the material in the absence of suitable plasticizers and the hydrophilic nature of starch. As a result, the mechanical properties deteriorate upon exposure to environmental conditions like humidity. Thus, starch needs to be blended with other synthetic polymers or plasticizer in order to eliminate these disadvantages. In order to overcome this situation, a plasticizer was used to strengthen the bond between molecules in the film. In this study, crude palm oil (CPO) and glycerol were chosen to be used as the plasticizer.

1.2 Problem Statement

There are a few problems that arise prior to this research which makes this research exist in the first place. As of currently, polyethylene is a substance of a stable chemical compounds that largely created as a component for making plastics. Because it is so chemically stable, it is going to take a long time for the plastics to decompose or degrade which will lead to pollution problems. In order to overcome the degradation problems, a natural substance; starch which can be obtained from plants of variety kind is added to the mixture that makes up the plastic. But the natural