UNIVERSITI TEKNOLOGI MARA

CHARACTERIZATION OF RIPE EMPTY FRUIT BUNCH (EFB) OIL ON THE PROPERTIES OF STARCH-PLA BIO-BASED PLASTIC

NOR AFIQAH BINTI AHMAD ZAKI

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ABSTRACT

In recent decades, biodegradable and renewable polymers have intensively attracted attention due to their huge influence on cutting the human pollution. Blending of Poly (lactic acid) PLA with starch will increase the biodegradability of the polymers. In this study, ripe empty fruit bunch (EFB) oil was used as a compatibilizer to improve the thermoplastic starch (TPS) /poly lactic acid (PLA) blend. A different amount of ripe EFB oil (0, 2.5, 5.0, 7.5, 10g) and poly lactic acid (PLA) (0.05g and 0.1g) were used to produce the bio-based plastic with gelatinization process and dried at 40 °C for 48 hours. The produced bio-based plastic was named as Starch-PLA-B and characterized using Fourier Transform Infrared Spectroscopy (FTIR), Universal Tensile Testing Machine, Water Solubility, Water Vapour Permeability (WVP) and Biodegradation test. The FTIR analysis shows the O-H bonding, C-H bonding and N-H bonding decreases as the composition of ripe EFB oil incorporated with the Starch-PLA-B matrix increases. The Starch-PLA-B have a tensile strength, Young's Modulus and Percentage of elongation in the range of 1.8-7.95MPa, 27.6-79.7Mpa and 19.8-52.7%, respectively. The solubility of the Starch-PLA-B is in the range of 6.25-20.83% when incorporated with ripe EFB oil. Water Vapour Permeability of the Starch-PLA-B is between 0.82×10^{-11}g/m.s.Pa and 2.00×10^{-11}g/m.s.Pa. The blend of TPS/PLA has proven to have a characteristic of bio-plastic as it is biodegradable when buried in soil.

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TABLE OF CONTENT

CHAPTER ONE
INTRODUCTION

1.1 Research Background

Polymer is a building blocks of small molecules into a macro-molecules through polymerization process. Polymer can be categorized as synthetic polymer and natural polymer. Synthetic polymer are derived from petroleum oil and are made by scientist and engineer using chemical method while natural polymers is obtain from plants and animals which are naturally formed. However, there is an addition of a new type of polymer in recent years which are known as bio-based polymer.

Bio-based polymers are sustainable polymers synthetically made of renewable resources such as biomass rather than the typical fossil fuel resources such as petroleum oil and natural gas, in preference based on biological and biochemical processes. They are characterized by the nature of carbon neutral or carbon offset in which the atmospheric carbon dioxide concentration does not increase even after their incineration [1].

Most of these polymers which are natural, synthetic or bio-based are used in the manufacturing of plastics. The properties of the polymers used will affect the properties of the plastics produced. Nowadays, there are many types of plastic being manufactured and there is a lot of new type of plastic that is still under ongoing research, study and under development process.

These various type of plastic are bio-based plastic, biodegradable plastic, engineering plastics, epoxy resins, expanded polystyrene, fluoropolymers, polyolefin, polystyrene, polyurethanes, polyvinyl chloride, and thermoplastics. All of these materials is a family of plastics. The differences between all of these plastic is the type of polymer used as raw material during the manufacturing process.

To date, plastic is one of the most important material in the world for the various manufacturing industries from textile, packaging, parts of equipment and devices, insulating cable and wire, marine equipment, medical application and etc. Generally, all the devices, equipment and material around us consist of plastics or fully manufactured using plastics.