

UNIVERSITI TEKNOLOGI MARA

**A STUDY OF THERMAL PROPERTIES AND
WATER ABSORPTION OF THERMOPLASTIC
STARCH FILM REINFORCE WITH RICE HUSK
BIOCHAR**

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ABSTRACT

The aim of this study was to analyse thermal properties and water absorption of thermoplastic starch reinforced with rice husk biochar. The sample was prepared by using a conservative casting technique by blending starch with plasticizer, sulphur, acetic acid, and rice husk biochar. As observed, FTIR was used to investigate the chemical interaction between the different components. Water absorption of the film was tested under room temperature with an ambient humidity. As a result it showed that thermoplastic starch without any reinforcement rice husk biochar have the highest percentage of water absorption which is 45.23% while with 7% concentration of rice husk biochar give the lowest percentage of water absorption of 27.37%. The analysis of thermoplastic starch included with the increment of the rice husk biochar concentration to the thermoplastic starch it showed that the percentage of water absorb decreases. The behaviour of thermal properties of thermoplastic starch with rice husk biochar was investigated by using thermogravimetric analysis (TGA) and as a result the thermal stability seems to be increasing with the increasing of rice husk biochar concentration. However the sample with 5% of rice husk biochar seems to undergo the highest rate of mass change. This indicates that it goes through an easier thermal degradation.

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CHAPTER 1

INTRODUCTION

1.1 Summary

Thermoplastic based on petrochemical can cause pollution to the environment. Due to large volume of plastic used over the past few decades, researchers have been focusing more on the study of creating and improving environmental friendly plastic. The progress in producing biodegradable and environmental friendly plastic has been further and thermoplastic starch is discovered. Starch is an important productive polysaccharide because the material availability is low cost, renewable and biodegradable. The processing of starch based polymers involves multiple chemical and physical reactions. Thermoplastic starch is a renewable resource for polymers in bioplastic that consists of starch and plasticizer and has high potential for economic growth. The function of incorporation of starch in thermoplastic was to make the material biodegradable and also to reduce the production cost. The studies of biodegradable plastic was widely done in hope to reduce the demand of synthetic polymers as well as give a positive effect on both environmentally and economically.

Thermoplastic starch is a material that can be obtained by disrupting the starch granule structure while it is processed with low water content together with thermal and mechanical forces with presence of plasticizer. Generally, starches compose of carbon hydrogen and oxygen with a ratio of 6:10:5($C_6H_{10}O_5$). Starch can be obtained in plants such as potatoes, wheat, cassava, rice, and maize. the starch used in the process of thermoplastic is *tacca leontopetaloides*. Starch is widely used because of the abundant resources, cheap as well as renewable. Even so, Kalambur et al, (2006) stated that starch is not suitable for bioplastic manufacture due to its hydrophilic nature and causes brittleness on the materials without a suitable plasticizer. At the end product, the thermal and mechanical properties degraded when exposure to humidity. As a solution, plasticizer was blended together with the starch to overcome the disadvantages.