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SURFACE MODIFICATION ON OIL PALM FROND BY SODIUM HYDROXIDE AND ITS EFFECTS ON POLYPROPYLENE COMPOSITE PROPERTIES

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ABSTRACT

This research aim is to study the effects of Sodium Hydroxide (NaOH) treatment on oil palm (*Elaeis guineensis*) frond particle surface that influence the properties of the treated particle-polypropylene composite. Samplings were divided into three major parts, which are i) Part I: Effects of particle size and filler loading, ii) Part II: Effect of addition of Maleic Anhydride and iii) Part III: Effect of NaOH treatment on the composite. In Part I, particle size do play significant role in determining the mechanical and water absorption characteristics of the composite. It is observed that the particle size of 250 and 425µm have contributed in better performance of mechanical properties but not to water absorption. Large particle size has led to the increasing of water absorption behaviour and this might be due to the void spaces exist on the filler surface. Hence, the study then is intended to improve the interfacial adhesion between the oil palm frond filler and polypropylene to reduce the voids problem. Looking at the effect of filler loading, high filler loading has resulted in weakening the properties of the composite. Coupling agent of Maleic Anhydride Polypropylene was used with intention to improve the properties. Part II evaluated the effect of Maleic Anhydride Polypropylene (MAPP) as coupling agent on the composite performances. It was observed that 3% MAPP contribute at its best on the composite with high filler loading of 50wt% as compared to the low filler loading of 10wt%. This may be attributed to the inadequate amount of 10wt% filler to receive the crosslinking action by MAPP. Part III discussed the effect of NaOH treatment on the oil palm frond-polypropylene composite with and without the coupling agent. Composites that filled with the treated filler and cross-linked with coupling agent exhibit better performance in mechanical properties and water absorption behavior. Regression analysis has proved the positive trend of composite properties performance when the filler was treated with NaOH. The R^2 of all the derived equations for each board properties at 50wt% filler loading were above 60% without any exception. This showed a strong relationship between NaOH treatment, MAPP addition and the OPF-PP composite properties. Morphological study of Scanning Electron Micrographs viewed the oil palm frond particle surfaces before and after treatment. It is observed that the clogging of unwanted cementing materials on the treated particles were reduced leaving the cell cavity hollow and clean. Scanning on the composite fractured surface showed some reductions of pull outs when the filler was treated with the help of crosslinking action by Maleic Anhydride. Fourier Transform Infrared has detected some functional groups corresponding to the effect of NaOH treatment and the addition of the coupling agent.

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TABLE OF CONTENT

CHAPTER ONE
INTRODUCTION

1.1 Research Background

Structural wood has been used as building material since thousands of years. The advantage of using wood in industry is that it has high physical and mechanical strength, low processing cost and aesthetically pleasing character (Kuzman et al., 2012). However, wood is prone to be deteriorated by environmental variations and thus limit its properties (Blanchette, 1990). The drawbacks in inherent properties of wood can be minimized by fabricating engineered composite (Sumaila et al., 2006). Composite can be defined as a material made by combining two or more substances. The two substances have different properties and will not dissolve or blend into each other. When they act together as a composite, they form a much stronger unit compared to original material (RSC, 2016).

Plastic is widely used and in neat form tends to be expensive. For cost saving plastic matrix can be filled in with lignocellulosic and therefore lessen the usage of the plastic. Lignocellulosic fibers such as oil palm, hemp, banana leaves, jute and sisal have been successfully used as reinforcing materials in many plastic matrices. Amount of biomass at oil palm plantation was reported to be abundant especially oil palm frond (Yacob, 2007). Oil palm biomass such as empty fruit bunches, oil palm frond and oil palm trunk have been used in many researches to fabricate composite (Abdul Khalil et al., 2010). Oil palm frond has been successfully processed as fiber in pulp and paper (Singh et al., 2013) and bio-composite lumber (Mat Rasat et al., 2014). Apart from that, Abdul Khalil et al. (2010) have studied on the potential of oil palm frond to be alternative filler in polypropylene composite.

Hence, oil palm frond could be the alternative lignocellulosic filler in plastic matrix. Plastic such as polypropylene may surround and holds the oil palm frond together as a continuous matrix and the final composite product could be moulded to shapes (Teuber et al., 2016). These combinations of materials with different properties are generally known as lignocellulosic thermoplastic composite. The composites have advantages such as good fatigue resistance, good chemical resistance, provide environmental protection, low cost, low carbon dioxide emission and stress cracking