UNIVERSITI TEKNOLOGI MARA

STRENGTH AND DURABILITY OF COMPRESSION MOULDED HIGH FILLER LOADING KENAF CORE AND BAST FIBRE PARTICULATE REINFORCED POLYETHYLENE COMPOSITE

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulation of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledge as referenced work. The topic has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Kenaf bast fibre and kenaf core have been used in the production of wood plastic composite (WPC) mainly for automotive applications and also as particleboard. However, there is a lack of study on the usage kenaf in WPC for decking application. Therefore, the aim of this study is to develop WPC with high filler loading of kenaf core/bast for decking application. This composite was made using matrix of high-density polyethylene (HDPE) with kenaf core and bast as filler. Kenaf core/bast polyethylene composite (KPC) was made through extrusion and compression (hot-press) moulding with varying formulations based on different percentage of kenaf core and bast fibre (70/0, 60/10, 50/20, 40/30)wt.% incorporated into high-density polyethylene (HDPE) matrix. The experimental works have been divided into four phases. First phase is to determine the best molarity of chemical solution for treatment of the kenaf fibre based on analyse of surface morphology, density and tensile strength. Second phase is to optimise the flexural properties, moisture absorption and thickness swelling of composite by varying the weight percentages (wt.%) of kenaf core filler. In the phase three, the physical and mechanical properties of KPC at higher filler loading were investigated. The best formulation of KPC from phase three were further investigated on physical and flexural properties of KPC expose to different environmental conditions (20°C-65%RH, 20°C-95%RH, 30°C-95%RH, 50°C-95%RH as well as soaking in water at room temperature). In fourth phase the diffusion theory has been applied to understand the mechanism of moisture absorption in composites. Two mathematical models were developed in this work; one model is to simulate the moisture movement through the composites in long-term exposure and another model is to describe the hygroscopic swelling process of KPC. The effects of moisture absorption on the flexural and dynamic mechanical of KPC were further investigated. Based on the experimental results, it was observed that KPC filled with 60 wt.% of core and 10 wt.% of bast treated with 0.06M $MgCl_2$ indicate the optimum formulation due to high values in flexural strength, MOE, tensile strength, tensile modulus and impact energy. As for long time exposure, the moisture absorption of KPC increased as temperature and relative humidity increased. However, flexural strength and MOE of the composite is slightly higher than the standard requirement according to ASTM D 6662-01.

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