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EFFECT OF *CASUARINA EQUISETIFOLIA* FILLED UNSATURATED POLYESTER COMPOSITES ON THE PHYSICAL AND MECHANICAL PROPERTIES

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ABSTRACT

Recent years, the potential usage of natural fibre as filler in composite technology has been increased gradually. This study was focusing on the *Casuarina equisetifolia (C.equisetifolia)* leaf as natural fibre filler due its leaf always become litter towards the environment and it has natural surface roughness. Mostly, only its wood was being used for others application such household simple furniture. The aim of this study was to investigate the effect of various weight loadings to the mechanical and physical properties of *C.equisetifolia* leaf incorporated unsaturated polyester resins (UP). The composite samples were fabricated by using hot press machine with mould dimension of (15x15x0.3) cm. There are six types of samples involve in this study with virgin UP, 10wt%/(*C.eq*/UP), 20wt%/(*C.eq*/UP), 30wt%(*C.eq*/UP), 40wt%/(*C.eq*/UP), and 50wt%/(*C.eq*/UP). The testing involved is tensile test, flexural test (three-point bending), Izod impact test, density test, water absorption and morphological study via scanning electron microscopy (SEM). From the mechanical testing, the overall results show decrement with the increment of *C. equisetifolia* by percentage weight loadings. The tensile test result decreases at the increases of percentage loading of *C.equisetifolia.* As for three-point bending result, as percentage of weight loading of *C.equisetifolia* increases from 10wt% to 20wt% the strength was increases about 17.2% (from 27.79MPa to 32.56MPa) and gradually decreases as increment of *C.equisetifolia* weight loading. However, this is contradictory from Izod impact result which shown an increment from 10wt% to 40wt% weight loading of the *C.equisetifolia* but at maximum percentage weight loading (50wt%) the impact strength decreases significantly. The result for physical testing on density and water absorption shows as the weight loading of *C. equisetifolia* increases, the potential for the composites to absorb more water is high due to high percentage of hydrophilic fibre properties. This result can influence on the mechanical properties of the composite.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF STUDY

Composite materials are defined as combinations of materials that are added together in order to achieve a particular function or to form a new material with enhanced properties. There are some examples for the combinations; either the combinations come from the same group such as two metals (Al, Fe, Cu, Ni, Pb, and others), or in a different group for instance, a glass fibre and a plastic [1] [2]. The reasons of these materials combined are often result in lightweight structures and having high stiffness according to its requirements on their applications. In other example, polymer composite is also widely known as a combination of a polymer (such as polyolefin, polyester and epoxy resins) and one (or more) solid fillers allows obtaining several advantages. The most favourable fillers used in polymer composites are calcium carbonate, talc, kaolin, mica, wollastonite, silica, graphite, synthetic fillers, (such as PET or PVA-based fibres) and high performance fibres (carbon, aramidic and others) [3]. In 1908, fibre-reinforced plastic (FRP) composites had begun with cellulose fibre in phenolics, later FRP extended to used urea and melamine, and in 1940s they reached merchandise status with glass fibre in unsaturated polyesters [4].

Previously, the most recommended composites are the composites that made from strong fibres which held together with a binder. Aramid for instance has high strength due to the attribute to the alignment of the polymer chains along the fibre as opposed to the randomly entangled arrangement in bulk polymer. However, strong fibres cannot be used alone because of the compression or transverse loads which cannot sustain. This is because the particles or flakes are considered as reinforcements, yet they are not as effective as fibres. There is the oldest composite back then which is natural wood. This natural wood consists of cellulose fibres in a lignin matrix. In the composite industry back then, natural fibres were referring to wood fibre and agro based bast, leaf, seed, and stem fibres. These fibres were often used due to the greatly contribution on the structural performance of the plant and when used in plastic composites, it provide significant performance [5]. While, the