DEVELOPMENT OF COMPOSITE PANELS FOR SHORT SPAN BRIDGE CONSTRUCTION USING INDIGENOUS AGRO - BASED RESOURCES: FABRICATION AND MECHANICAL TESTING

AHMAD HUSSEIN BIN ABDUL HAMID

(2001499413)

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Faculty of Mechanical Engineering

Universiti Teknologi MARA (UiTM)

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" I declared that this thesis is the result of my own work except the ideas and summaries which I have clarified their sources. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any degree "

Signed : .....

Date : 18 APRIL 2005

Ahmad Hussein bin Abdul Hamid

UiTM No. : 2001499413

ABSTRACT

Bridges are mainly made of steel and concrete. Researchers have been working towards exploring the potential of such new natural fiber composite materials and their adequate application to structural engineering design. Oil palm empty fruit bunch (OPEFB) fiber, oil palm frond (OPF) fiber mat and sugar cane (SC) husk, which is rich in cellulose, relatively inexpensive and have fairly good possibilities in waste management due to their biodegradability has the potential for polymer-reinforced composite. Fiber reinforced plastics are used whenever there is the need for very high mechanical properties combined with low weight. In that respect natural fibers are of basic interest since they do not only have the functional capability to substitute the widely used man-made fibers but also possess advantages from the point of view of weight and fiber–matrix adhesion. The composites were produced by pouring compounding into the mould and let it cured for at least one day. Two different values of fiber mass fraction, m_f, namely 10% and 20% were studied for OPEFB fiber composite. Other composites samples were made from OPF fiber mat and 10% mass fraction SC husk. The matrix used in the experiments was epoxy with two to one epoxy-hardener ratio. The mechanical properties of each fiber–matrix combination have been investigated by conducting mechanical tests using ASTM standards. Results indicate that the most important factors for determining impact toughness were the interface behavior. This behavior determined the fiber debonding and pullout behavior. The impact strength of the composites was found to be increasing with fiber content. The tensile strength of the composites containing 10% mass fraction was found to be higher than that of homogeneous epoxy resin by 35%. Other composites had a lower tensile strength than the homogeneous epoxy resin. There are no improvement in flexural strength of epoxy composite. Increasing the density of fibers in the composite resulted in reduction of flexural strength, which OPF fiber mat composite has the lowest flexural strength

compared to the other composites that being studied. Optical camera microscopic were used to examine the fiber–matrix adhesion and fiber breakage. The fiber pullout behavior and its effects on mechanical properties with different types of fiber as well as fiber mass fraction were investigated.

TABLE OF CONTENTS