TENSILE AND IMPACT PROPERTIES OF POLYSTYRENE MATRIX COMPOSITES REINFORCED BY PALM NATURAL FIBERS AND CARBON FIBERS

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ABSTRACT

The Palm natural fiber and carbon fiber reinforced polystyrene matrix composites were prepared by hand-lay-up with 50% Palm natural fibers and 50% carbon fibers . The weight fractions of Palm fiber and carbon fiber are (10, 20, 30, 40,50, and 60% by weight wt). The tensile and impact properties of composites were determined by the tensile and impact tests. The maximum impact strength is (175Kj/m^2) at the weight fraction of (60 % wt) of fibers, comparison with (19Kj/m^2) for virgin polystyrene material ,and The maximum tensile strength is (358Mpa) at the weight fraction of (60 % wt) of fibers , comparison with (59Mpa) for virgin polystyrene material.

Keywords: Palm natural fibers, Polystyrene resin, Tensile and impact properties

INTRODUCTION

The study on using natural fibers to reinforce composite materials increased dramatically during the last few years. Fiber-reinforced composites consist of reinforcing fibers and a polymer matrix, which acts as a binder for the fibers (Srinivasababu *et al.,* 2010). There is a growing interest in the use of natural fibers as reinforcing components for both thermoplastic and thermoset matrices, because of the ideal benefits offered by natural fibers such as convenient renewability, biodegradability, and environmentally friendliness(Athijayamani *et al.*, 2009). The natural fibers have the potential to be used as a replacement for glass or other traditional reinforcement materials in composites. These fibers are abundant, cheap and renewable (Dip, 2010). Currently, automotive and construction industries have been interested in composites reinforced with natural plant fibers as alternative materials for glass fiber reinforced composites in structural applications with modest demands on strength reliability (Srinivasababu *et al.,* 2009).

The chemical composition of natural fibers varies depending upon the type of fibers. The chemical composition as well as the structure of the plant fibers is fairly complicated (Amar *et al.,* 2005). Plant fibers are a composite material designed by nature. The fibers are basically a rigid, crystalline cellulose micro fibril-reinforced amorphous lignin and/or with hemi cellulosic matrix. Most plant fibers, except for cotton, are composed of cellulose, hemicellulose, lignin, waxes, and some water-soluble compounds, where cellulose, hemicelluloses, and lignin are the major constituents (Bledzki, Gassan, 1999).

MATERIALS AND TESTS

The experimental work includes the following points :

Materials

a. Matrix material, Polystyrene resin

b. Reinforcing fibers: Two types of fibers used here : Palms fibers , Carbon fibers as woven roving fibers(0º - 90º) . These types of fibers used as consecutive layers in same matrix with 50% palms fibers and 50% Carbon fibers.

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Samples Fabrication and Tests

a- Impact Samples: impact samples fabricated according to the (ASTM-E23) standard suitable to Charpy Impact Instrument .Notch depth is (0.5mm) and notch base radius is (0.25mm). Charpy Impact Instrument was used to determine the impact strength of composite material.

b- Tensile Strength Samples: these samples manufactured according to the (ISO-R-527) standard. Tensile test was used to calculate the tensile strength of composite material under uniaxial load .The universal test instrument manufactured by (ZheJinang TuGong Instrument Co., Ltd) used to measure this property with a (20KN) load.

RESULTS & DISCUSSION

Figure 1 represents the impact strength value with fibers contents .Generally ,the impact strength considered low to the resins due to brittleness of these materials ,but after reinforcing it by fibers the impact strength will be increased because the fibers will carry the maximum part of the impact energy which exposition on the composite material .All this will raise and improved this strength .The impact strength will continue to increase with increased of the fibers reinforcing percentage (Craig, Sanadi, 2007) .

Figure 2 represents the tensile strength value with fibers contents the resin considered as brittle materials where its tensile strength is very low as shown in this figure ,but after reinforcing by fibers this property will be improved greatly ,where the fibers will withstand the maximum part of loads and by consequence will raise the strength of composite material .The tensile strength will be increased as the fibers percentage addition increased , where these fibers will be distributed on large area in the resin (Maleque, Belal, 2007).

CONCLUSIONS

From the obtained results we get: Impact and Tensile properties of polystyrene resin was low. Improvement of mechanical properties after reinforcement by palms and carbon fibers , where The maximum impact strength is (175Kj/m^2) at the weight fraction of (60 % wt) of fibers, comparison with (19Kj/m^2) for virgin polystyrene material ,and The maximum tensile strength is (358Mpa) at the weight fraction of (60 % wt) of fibers , comparison with (59Mpa) for virgin polystyrene material.

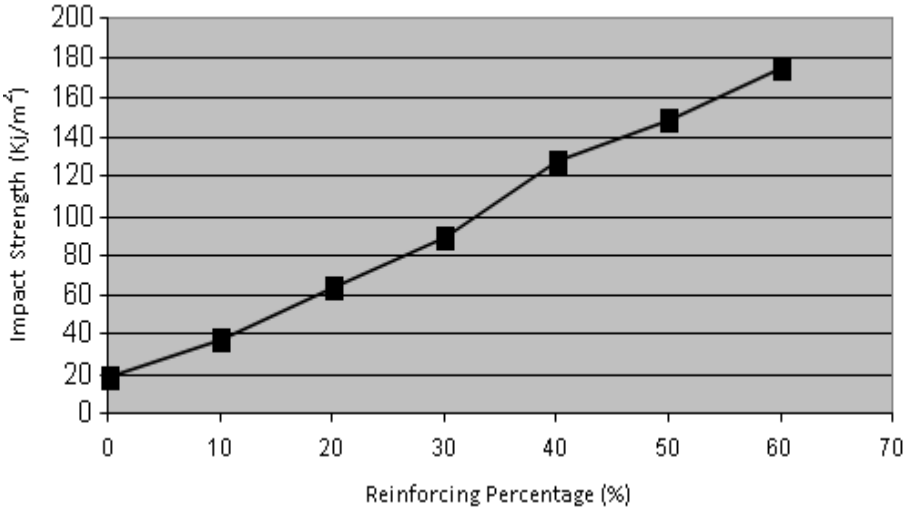

Figure 1. Impact Strength

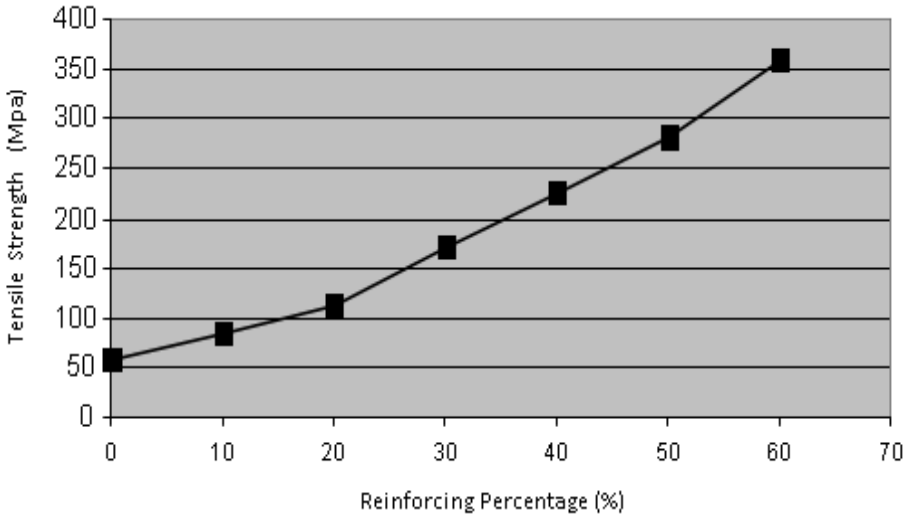

Figure 2. Tensile Strength

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