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Mechanical Properties of Recycled Bamboo Fibers Reinforced Composite

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ABSTRACT

Mechanical properties of epoxy composite reinforced with recycled plants fibers were studied. Impact strength, tensile strength, flexural strength and hardness were studied for composite material. These fibers were mixed with polypropylene resin in different reinforcement percentage (0%-60%) and the effect on the above mechanical properties was studied. It has shown an enhancement in these mechanical properties after reinforcement by fibers the value of mechanical properties will increase with increasing percentage of reinforcement.

Key words: Recycled plants fibers, Composite, Mechanical Properties

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INTRODUCTION

Increased environmental awareness and consciousness throughout the world has developed an increasing interest in natural fibers and its applications to various fields. Natural fibers are now considered as a serious alternative to synthetic fibers for use in various fields [1]. The use of natural fibers as reinforcing materials in both thermoplastic and thermo set matrix composites provide positive environmental benefits with respect to ultimate disposability and best utilization of raw materials [2]. Currently, studies on use of lignocelluloses bio fibers in place of synthetic fibers as reinforcing materials are being pursued vigorously [3]. These bio fibers are being extensively used for the production of cost effective ecofriendly biocomposites [4].

The advantages of natural fibers over traditional reinforcing materials such as glass fiber, carbon fiber etc are their specific strength properties, easy availability, light weight, ease of separation, enhanced energy recovery, high toughness, non-corrosive nature, low density, low cost, good thermal properties, reduced tool wear, reduced dermal and respiratory irritation, less abrasion to processing equipment, renewability and biodegradability [5].

Plant fibers themselves can be thought of as composite materials with the stiff and strong cellulose micro fibrils embedded in a hemicelluloses/lignin matrix. However, the composite structure in plant fibers is rather complex (e.g. two-phase matrix and cell wall layers). Moreover, plant fibers are part of a larger biological system, i.e. the plants, with a long evolutionary history, and their properties have, therefore been highly optimized with respect to the functional requirements of plants. Thus, the study of plant fibre mechanical properties is not just an assessment of the reinforcement potential of plant fibers in man-made composites, but might as well provide insight into the form and function of a sophisticated composite material [6].

METHODOLOGY

Materials

There are three types of materials employed in this study: polypropylene resin Bamboo fibers (as randomly matt) .

Composite Samples Fabrication

Hybrid composite of polypropylene - Bamboo fibers can be fabricated by the hand layup technique using laboratory compression moulding machine. Ultrasonic waves were used to clean bamboo fibers from husks and dirt. Four types of samples were manufactured as follows:

- Impact samples: The impact strength was determined using Izod Impact tester for un-notched samples conforming to (ASTM D 256) specification.
- Tensile strength samples: The standard dumb bell samples are cast according to (ASTM D 638).
- Compression strength samples: these Samples fabricated according to (ASTM-D618) standard.

Seven samples were manufactured for each tests which different by the resin and reinforcement percentage as shown in Table-1.

Table - 1 Structure of Samples

Samples number	1	2	3	4	5	6	7
Resin (weight %)	100	90	80	70	60	50	40
Fibres (weight %)	0	10	20	30	40	50	60

Determination of Mechanical Properties

Izod Impact tester for un-notched samples was used to evaluated impact strength .The universal test instrument manufactured by (ZheJinang TuGong Instrument Co., Ltd) was used to measure the tensile strength with a (20KN) load. Compression strength can be measured by three-point test by using universal hydraulic press (Leybold Harris No.36110) to calculate the maximum load exposed in the middle of the sample.

RESULTS & DISCUSSION

Fig.1 represents impact strength values of composite material vs. fibers reinforcing percentage .Generally, the impact resistance considered low to the resins due to brittleness of these materials, but after reinforcing it by fibers the impact resistance will be increased because the fibers will carry the maximum part to the impact energy which exposition on the composite material .All this will rise and improved this resistance. The impact resistance will continue to increase with increased of the fibers reinforcing percentage [7].

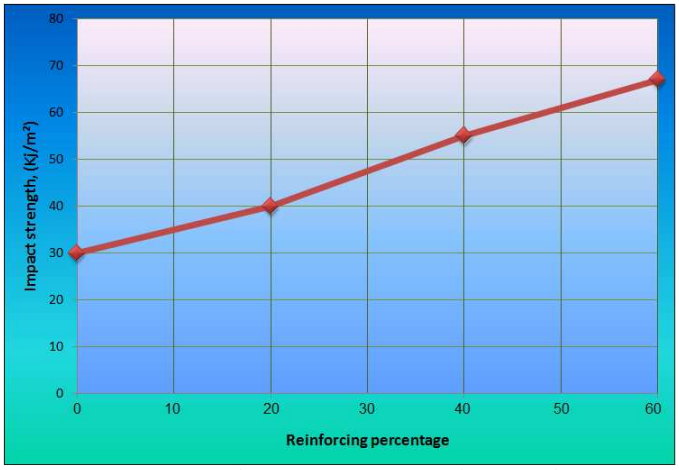

Fig. 1 Impact strength values of composite material vs. fibers reinforcing percentage

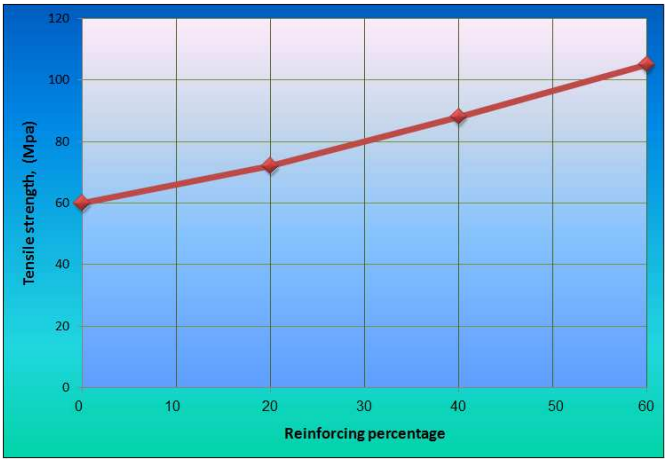

Fig. 2 Tensile strength values of composite material vs. fibers reinforcing percentage

Fig.2 represents tensile strength of composite material vs. fibers reinforcing percentage .The resin considered as brittle materials where its tensile strength is very low as shown in this Figure, but when 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 [8]. The tensile strength will be increased with the fibers' percentage addition increased, where these fibers will be distributed on large area in the resin [9]. Even reinforcing by fibers will enhance tensile strength.

Fig.3 shows the compression strength results before and after reinforcing with fibers .As we have seen from this figure, the compression strength of resin will be low before reinforcement because the brittleness of resin. However, after added the fibers to this resin the flexural strength would be raised to the producing material because the high modulus of elasticity of these fibers will help to carry a large amount of loads and raise this strength [10].

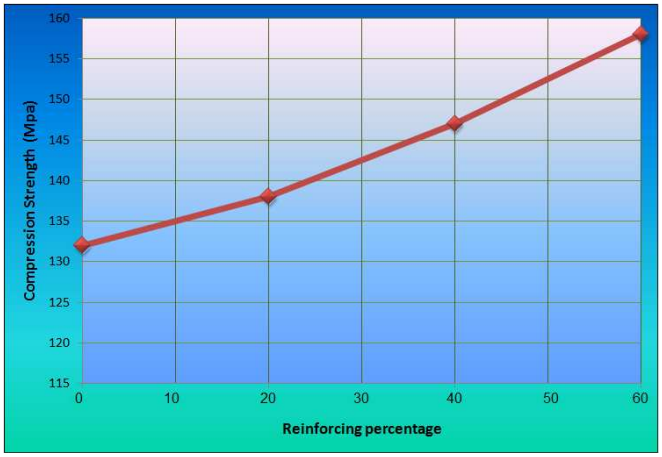

Fig. 3 Compression strength values of composite material vs. fibers reinforcing percentage

CONCLUSION

- The addition of Bamboo fibers improves the impact strength, tensile strength, and compression strength polypropylene resin.
- Low cost for fabricated composite compared with those reinforced by synthesis fibers.
- Reduce environmental damage through recycling agricultural waste for Bamboo.

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