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Analysis of Weight % of Bamboo and Wood Fiber and Its Fabrication with Polypropylene Based Composites

Akhlas Ahmad [1], Mohd. Afzal [2], Mohd Suhail [3]

Department of Mechanical Engineering
Integral University
Lucknow - India

ABSTRACT

Natural fiber like Bamboo has found various applications in human life for centuries. In recent years however, bamboo has generated interest from researchers as a candidate to replace environmental unfriendly glass as fiber in fiber reinforced composites. This is due to the sustainable properties of bamboo that has high specific strength and stiffness besides being biodegradable, easy availability, cheap, economical and renewable. In this paper, A Review is revealed on the properties of bamboo reinforced composites from numerous characterization studies of bamboo that are available in the literatures. The review is based on characterization studies on several types of bamboo reinforced composites such as laminated bamboo fiber reinforced composite, randomly oriented bamboo reinforced composite, hybrid fiber reinforced composite, bamboo fiber reinforced bio-composite and bamboo fiber sandwiched structure composite. It can be said that the laminated bamboo composite in general gives higher mechanical properties compare to other structural forms of bamboo composite. In addition Bamboo fiber is compared with glass fiber from various aspects and in some parts it has advantages over the glass fiber.

Keywords:- Low density Polypropylene, Natural fibre (bamboo), Injection moulding, UTM, Hardness and Impact testing.

I. INTRODUCTION

Polymer composite materials have been widely used in various industries such as aircraft, automotive and submarine, building and construction due to their great mechanical and thermal properties. However, the end of life disposal of polymer and synthetic materials cannot be defined and therefore non-biodegradable, indirectly these synthetic fibers are not eco-friendly to our Environment. Therefore, the utilization and the manufacturing procedure of these materials will harm the nature. In contrast, our natural fibers are renewable and environmentally friendly materials; they have low density, low price, almost everywhere available and Reasonable mechanical Properties. Hence, many scientists are interested in replacing them with synthetic materials to conserve the environment. As stated earlier, FRPCs are made by combining fibers and PP. PP is a binder or 'matrix' and holds the fibers in place. A brief description on both of them is given in this section.

II. FIBER

Fiber is a class of material that is a continuous filament or discrete elongated pieces, similar to the lengths of thread or hair. They can be divided into filaments, rope or string. The two main sources of natural fibers are plants and animals. The main component of animal-based fibers is protein82: examples include mohair, wool, silk, alpaca, angora, and so on. Natural fibers base on their sources are divided into three categories: plant fibers (sisal, hemp, flax, bamboo, etc.), animals parts involving protein (silk, hair, wool, etc.) and minerals. The main parts of Plant fibers are cellulose, hemicellulose, lignin, and pectin. In the structure of plant fibers lignin and hemicellulose matrix held cellulose fibrils together [2]. By increasing the amount of cellulose the mechanical properties of fibers can be increase [1]. Cellulose fiber has been applied as reinforced polymer composite in building, bridge construction, and aircraft industries and automotive or in robotics field

III. POLYPROPYLENE

It is obtained by three major sources. Usually, most propylene monomer comes from the steam-cracking process by utilizing naphtha which is a valuable fraction of crude oil. Generally, the target product of naphtha cracker's is ethylene monomer. Propylene is a byproduct of the cracking process and is

produced at numerous ratios depending on the crude oil feedstock. The second largest production of propylene is from the gasoline refining process. Finally, and most recently, a new process by which propane is dehydrogenated into propylene monomer is being utilized to produce propylene.

IV. FABRICATION OF NFRPCS

NFRPCs are mainly fabricated by Injection Molding Method

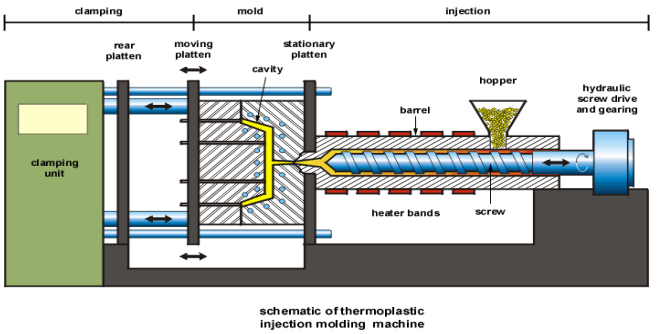


Fig.1 Schematic View of Experimental Set Up

Injection molding is a process that usually involves forcing or injecting a plastic material into a closed mold of desired shape. The molding compound is fed into injection chamber through the feed hopper. In the injection chamber, the molding compound is heated and therefore it changes into liquid form. It is forced into the injection mold by the plunger. This method is normally used for high-volume and lowcost component manufacturing. Both thermoplastic and thermoset are subjected to injection molding removed. But in thermoset injection molding, A high thermoplastic material is first melted and then forced through an orifice into the mold which is kept relatively cool. This method is suitable for high-volume and low-cost component manufacturing. But the method is limited to short fibre Composites of five different compositions i.e.20 gm, 30gm, 40gm, 50gm, 60gm are made. Specimens of suitable dimension are cut for different tests

Material Used:

This chapter describes the details of processing of the composites and the experimental procedures followed for their characterization and evaluation. The raw materials used in this work are

1. Natural Fibre

- Bamboo Fiber
- Wood Fibre

2. Polypropylene

Specimens

Fibre Treatment

The procedure involves water washing and drying. Natural fibres are extracted from their parent plant. Bamboo is extracted from the back of their stems, while wood are extracted from their plant. The natural fibres, after being extracted, are washed with water to remove gums. The fibres are then treated with sodium hydroxide solution and rammed. The treated fibre was allowed to dry in the sun for 3 days. After which the fibres are laid in the mold with the resin at the ratio of 20% to 60%.

V. RESULTS

The test results are shown and discussed in this section. Average values of three replications of the Tensile test, Hardness test and the Impact test.

Tensile Strength

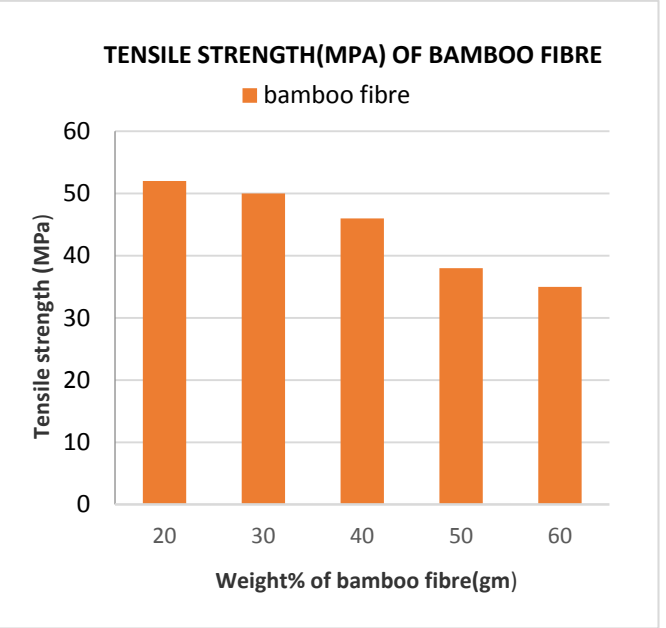
The tensile tests were performed using a testing machine model 8889. The width and the thickness of the specimens were measured and recorded (360 mm by 20 mm by 5 mm). The tensile tests were carried out according to ASTM D 038-01. The tensile strengths were calculated from this test.

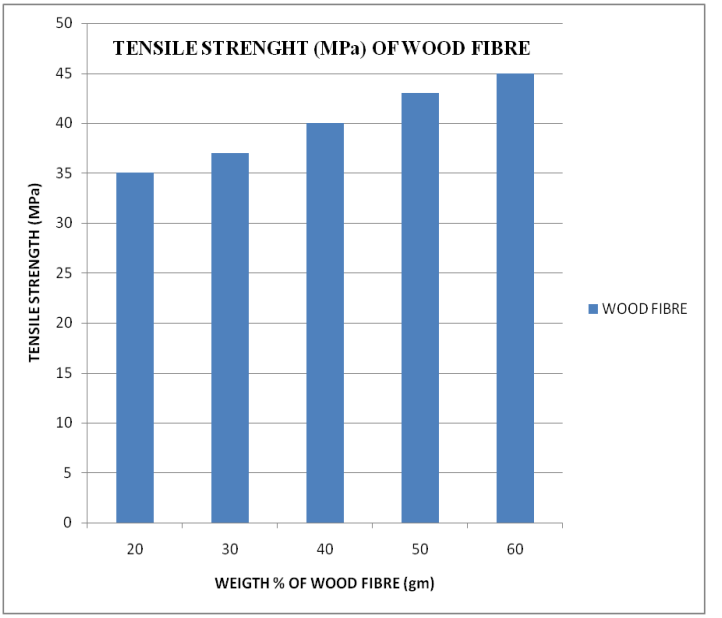
Tensile Properties of bamboo fiber

S NO.	Weight of bamboo fiber (gm)	Weight of PP (gm)	Maximum Stress (MPa)
1	20	250	52
2	30	250	50
3	40	250	46
4	50	250	38
5	60	250	35

S. NO.	Weight of wood fibre (gm)	Weight of PP (gm)	Maximum Stress (MPa)
1	20	250	35
2	30	250	37
3	40	250	40
4	50	250	43
5	60	250	45

Tensile Properties of wood fiber





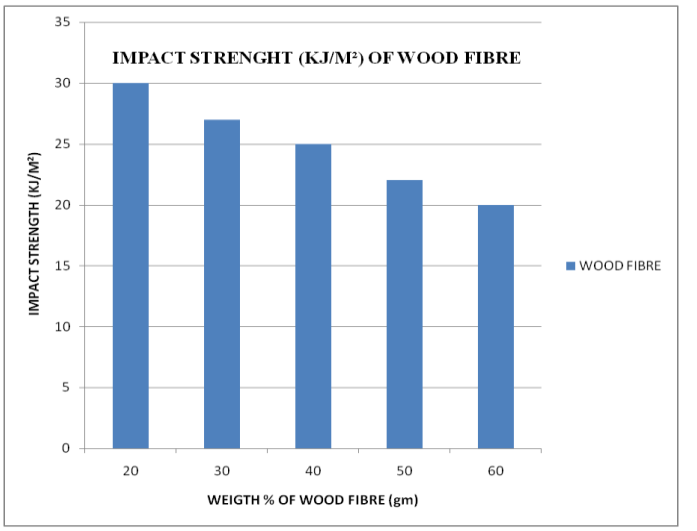
Ultimate tensile Test with specimen

Impact Strength

The impact strength of bamboo laminate hybrid composites is presented in Table 2. It is observed that the laminate composite is exhibiting higher impact strength than the wood reinforced composite. The Bamboo hybrid composite impact strength is higher than wood reinforced composite but lower than glass fiber reinforced composite.

S NO.	Weight of wood fibre (gm)	Weight of PP (gm)	Impact Strength (KJ/m2)
1	20	250	30
2	30	250	27
3	40	250	25
4	50	250	22
5	60	250	20

Impact Properties of wood fiber

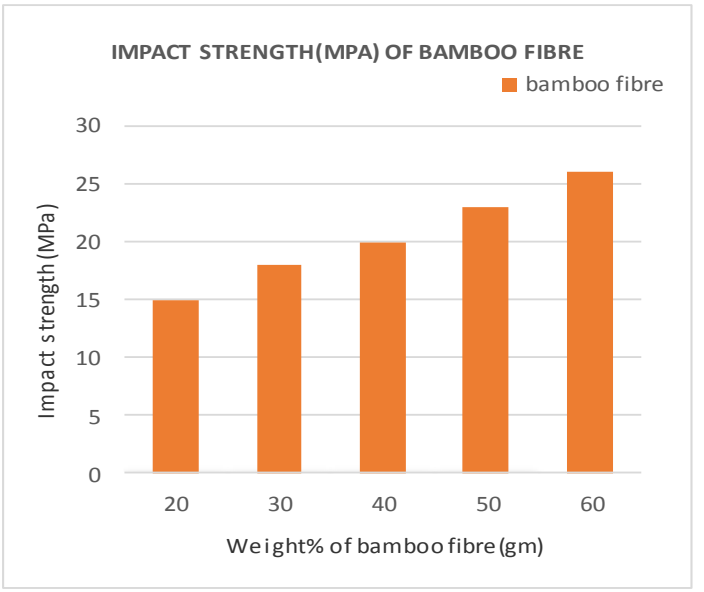


VI. HARDNESS TEST

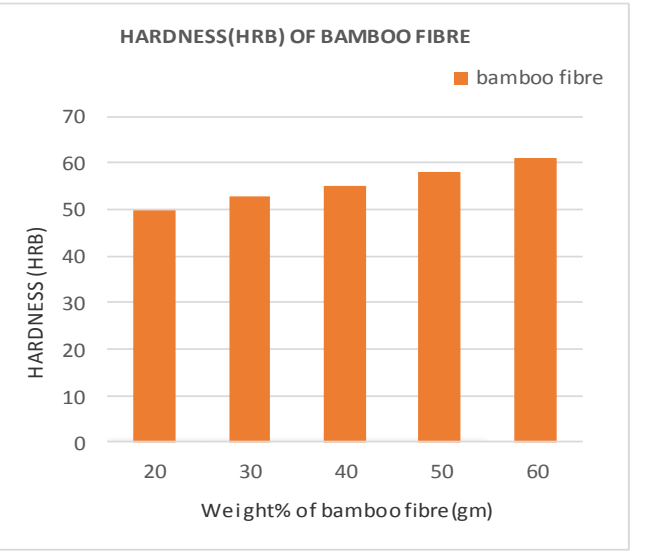
The Hardness test of Bamboo and wood fiber composites is presented in Table 3. It is observed that the laminate composite is exhibiting hardness.

Impact Properties of Bamboo fiber

S NO.	Weight of Bamboo fiber (gm)	Weight of PP (gm)	Impact Strength (KJ/m2)
1	20	250	15
2	30	250	18
3	40	250	20
4	50	250	23
5	60	250	26



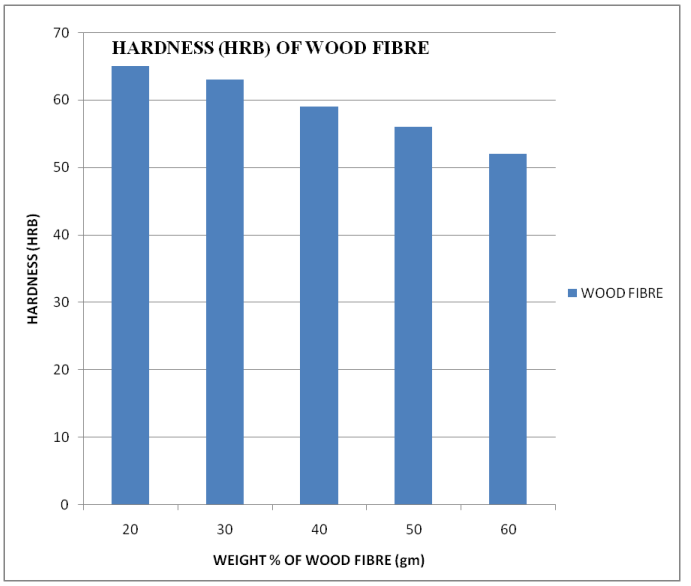
Hardness Properties of bamboo fiber



S NO.	Weight of Bamboo fiber (gm)	Weight of PP (gm)	Hardness (HRB)
1	20	250	50
2	30	250	53
3	40	250	55
4	50	250	58
5	60	250	61

Hardness Properties of wood fibre

S NO.	Weight of wood fibre (gm)	Weight of PP (gm)	Hardness (HRB)
1	20	250	65
2	30	250	63
3	40	250	59
4	50	250	56
5	60	250	62



Hardness Test with Specimen

VII. CONCLUSIONS

Bamboo fiber has several advantages over other plant natural fiber such as high growth rate, strength, and fixing the carbon dioxide. It also can be compared with glass fiber because of its light weight, biodegradability, and low cost. Therefore, there is a great interest in using bamboo fiber as a reinforced composite material in different applications. Several methods and adhesions have been used to improve the mechanical properties of bamboo fiber as reinforced composite. This can help to comprehend that bamboo fiber and bamboo fiber reinforced composite have ability to be used in more applications.

The future of FRPCs appears to be bright, because PP is a low-cost matrix. Future research should focus on the improvement of mechanical properties of FRCPs. Future research should also focus on the replacement of synthetic fibres by natural fibres considering the environmental fact. Increase in the strength of natural fibres reinforced polypropylene composites through various treatments of natural fibres to get best adhesion between natural fibres and PP will help to replace natural fibre reinforced polypropylene composites.

NFRPCs have received considerable attention over the past few decades. PP is a low-cost thermoplastic polymer, which has some excellent properties. Various fibres are reinforced with PP to prepare composites. Among natural fibers are mostly used as reinforcement with PP. Jute and wood with composites have very good mechanical properties. Among natural fibres, flax fibres are very strong and when reinforced with PP produce composites having good mechanical properties. Fibre modification can increase the mechanical properties of FRPCs satisfactorily. Surface of fibres can be modified by treatments like alkalization/mercerization, oxidation, and so on to improve fibre-PP adhesion which will result in greater mechanical strength. Incorporation of coupling agent like MAPP in appropriate amount in the fabrication of FRPCs will increase the mechanical properties of FRCPs.

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