Devlopment and Analysis of Natural Banana Fiber Composite

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***Abstract* —** This present work evaluated the effect of fiber orientation on mechanical properties of banana Fiber /epoxy composites. In this work banana fiber is used as reinforcement and epoxy is used as matrix material. Samples of different orientations of banana fiber reinforced composites were fabricated by Hand lay-up technique and investigated their mechanical properties like tensile strength and flexural Strength. The work of this experimental study has been carried out to determine the mechanical properties due to the effect of banana fiber orientations such as0degree, 45degree, 90degree orientation and volume fraction such as 30%, 40%, 50% .The results of this study indicate the orientation 0 and 40% Volume fraction shows the better mechanical properties compare than45&90 degree &30%&50% fiber volume fraction

Keywords*-*composite, synthetic, Fiber, Jute, Coir.

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I. INTRODUCTION

The use of composite materials in engineering field is increasing day by day. A composite material is materials system composed of a combination of two or more constituents that differ in form and chemical composition and which are essentially insoluble in each other. It consists of mainly two phases i.e. Matrix and Fiber. The fibers may be polymers, ceramics, metals such as nylon, glass, graphite, Aluminum oxide, boron, Aluminum etc. Now a day's Jute, Coir, Silk, Banana, Bamboo fibers and animal feathers are also utilized as a fiber. And matrix will be epoxy resin. Fiber reinforced composites offer varied advantages in various applications. Today fiber composites are used in such applications as automobiles, aircraft, space vehicles, offshore structures, container sand piping, sporting goods, electronics, and appliances.

II. MATERIAL AND METHOD

2.1 Material (fiber)

Banana is a natural fiber traditionally used in making twine and rope. Banana is fully biodegradable and highly renewable resource Banana fiber is exceptionally durable and a low maintenance with minimal wear and tear strength. The banana fiber is collected from banana plant. The extracted banana fibers were dried for 24 hours at 105° C to remove free water present in the fiber.

2.2 Epoxy

Epoxy resin 520 and Epoxy hardener-PAM. The epoxy resin and epoxy hardener were mixed in the ratio of 10:1 by the weight as suggested. The epoxy resin has the density of 1.22 g/cc.. Epoxy resin and hardener mixture was stirred thoroughly before fiber mats were introduced in the matrix material. Each laminate was cured under constant pressure near about 24hr in the mould and further cured at room temperature at least 12 hrs.The Epoxy resin(LY-556) is taken as matrix binder is supplied by Ciba Geigy India Ltd. Commonly epoxy resin has good mechanical and thermal properties air bubbles from it. It can press in a hydraulic press at the temperature of 120 C for 30 minutes. After this sample is post cured at atmosphere for three hours of time according to the manufacturer's guidance

2.3 Properties of Epoxy resin LY-556

1. Viscosity at 250 C – 10000-12000 MPa
2. Visual aspect – Clear, pale yellow liquid
3. Density at 250 C – 1.15-1.20 gm/cm3
4. Flash point – 1950 C

2.4 Properties of hardener HY-951:

1. Density = 0.95 gm/cm3
2. Melting point = 120 C (lit.)
3. Boiling point = 266-2670 C (lit.)
4. Water solubility= SOLUBLE
5. Flash point = 143.330C

2.5 Composite Preparation Mold is used for preparing the specimen which is made up of wood and having dimensions of 300x150x4 mm. First, the mould is cleaned and then a mould releasing agent is applied on the surface for easy removal of the composite from the mold. The epoxy resin LY556 and hardener (HY951) is mixed in a ratio of 10:1 by weight as used. The banana fiber is placed over the mold at required orient manually and then required amount of epoxy

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resin was poured over it. The process is continued until the required thickness and weight percentage fiber was obtained. For each time a roller was used to roll over the fiber in order To remove the air bubbles from it. It can press in a hydraulic press at the temperature of 120 C for 30 minutes. After this sample is post cured at atmosphere for three hours of time according to the manufacturer's guidance.

III. EXPERIMENTAL TESTS

3.1 Tensile Test

The tensile test specimen is prepared according to the ASTM D3039 standard and the machine specifications are also chosen according to the ASTM D3039. According to the ASTM D3039 standard the dimensions of Specimen used are200x20x3mm3. This test involves placing the specimen in a machine and subjecting it to the Tension according to specific load until it.

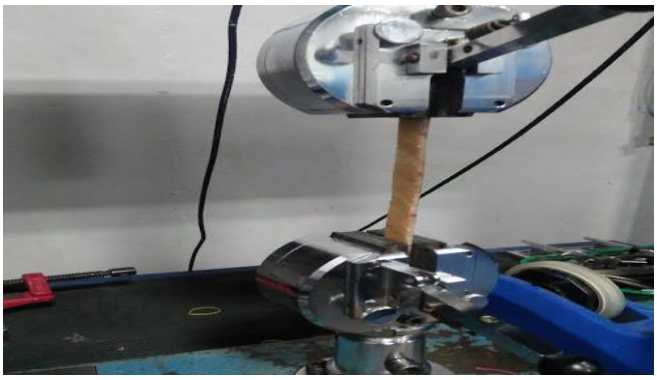

Fig1. Flexural Testing machine

Sr. No.	Comp-osition	Fiber Orientation (˚)	U.T.S. (N/mm2)		Average U.T.S. (N/mm2)
			Trial 1	Trial 2	
1	A (30/70)	0	15.336	15.093	15.21
		45	7.012	6.895	6.95
		90	5.903	4.322	5.11
2	B (40/60)	0	39.670	34.225	36.94
		45	9.835	5.593	7.71
		90	5.551	5.367	5.46
3	C (50/50)	0	18.015	13.925	15.97
		45	12.084	10.174	11.113
		90	8.537	3.086	5.81

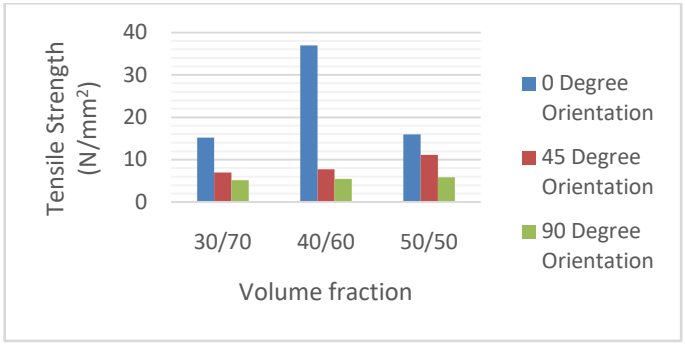

Fig .2 Tensile strength result

1.2 Flexural Tests

Flexural test is also known as bending test and consists in applying a point load at the centre of composite material specimen. The flexural tests were done on the universal testing machine according to ASTMD790. According to the ASTMD790 standard the dimensions of specimen used are 100x13x3mm3. Figure 3 shows the flexural testing

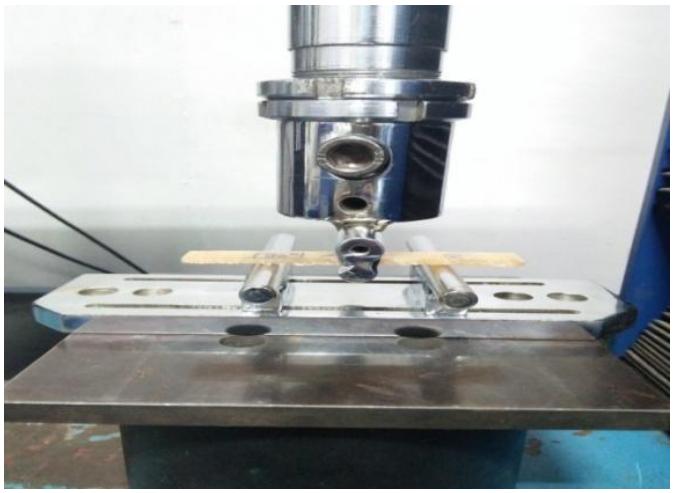

Fig.3 Flexural Testing machine

Sr. No.	compo sition	Fiber orientation (Degree)	Flexural Strength (N/mm2)		Average Flexural Strength (N/mm2)
			Trial 1	Trial 2	
1	A (30/70)	0	21.503	18.158	19.83
		45	15.556	13.878	14.72
		90	10.894	11.105	10.99
2	B (40/60)	0	43.247	47.203	45.23
		45	28.786	27.877	28.33
		90	15.700	11.805	13.75
3	C (50/50)	0	40.471	45.490	42.98
		45	37.941	35.495	36.71
		90	26.249	23.312	25.03

Table .2 Flexural testing results

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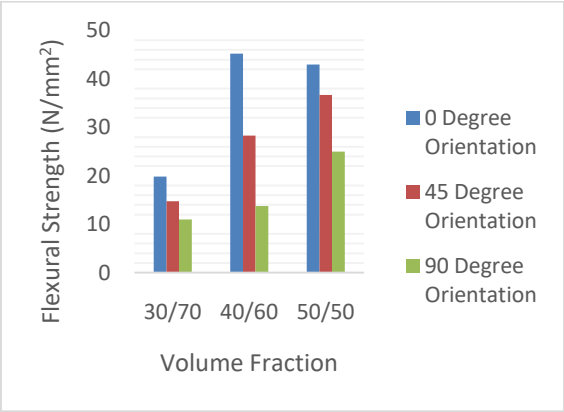

Fig .4 Flexural strength result

CONCLUSIONS

The experimental investigation on the effect of fiber orientation and fiber volume fraction on the banana fiber epoxy composites leads to following conclusion. The mechanical Properties such as tensile strength and flexural strength Shows the maximum value of 36.94 Mpa and45.23 Mpa in the 0 degree orientation compared to others

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