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Tensile and Impact Strength Evaluation of Developed Hybrid Hemp and Banana Fibre Composite Material

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Abstract: **-- Composite materials are being used in huge quantity in every walk of the life by almost every country throughout the world. At present, in India the conventional fibers such as carbon, glass and Kevlar are being imported from other countries, causing high cost of production and also the conventional fibers are not degradable.In recent years, the natural fiber reinforced composites have attracted substantial importance as a potential structural material. The attractive features of the natural fibers like jute, hemp, sisal, coir, and banana have been their low cost, light weight, high specific modulus, renews ability and biodegradability. Naturally, composites reinforced with such natural fibers have thus been a subject of intense study for low strength, low cost application in contrast to the synthetic fiber reinforced composites. Since the interfacial bond between the reinforcing fibers and the resin matrix is an important element to realize the mechanical properties of the composites.The proposed work is carried out on natural fibres as they widely available with less cost and excellent properties. We are carrying out this project by preparing the specimens of Hybrid hemp and Banana fibre and tests are to be conduct to analyze the behavior and to study their properties. With respect to that we used to find the application areas in the automobile field Banana fiber are acquired from the pseudo-stem of banana plant is a bast fiber with generally great mechanical properties. Plant filaments are schlerenchymatous cells with vigorously lignified cell dividers having a tight lumen in cross segment. Subsequently the present work we concentrating on to create hemp and banana fiber composite material and to play out a few tests to discover mechanical properties that is Tensile and Impact test lastly to recognize the application ranges of prepared examples.**

Key words**: Composites, Hemp, Banana fabric, Polyester resin, tensile strength, Charpy and Izod impact strength.**

I. INTRODUCTION

Composite materials, often shortened to composites or called composition materials, reengineered or naturally occurring materials made from two or more constituent materials with significantlydifferent physical or chemical properties which remain separate and distinct at the macroscopic or microscopic scale within the finished structure.

[1]Hemp is a standout amongst the most adaptable plants. It is exceptionally solid and sturdy. It can be developed in all most every one of the atmospheres, it is dry season safe, plant requires little manure, negligible pesticides or herbicides, and has was scope of employments. The hemp fiber solid, as well as holds its shape, extending not exactly whatever other normal fiber. The more hemp fiber is utilized, the milder it gets.

[2]Banana fibre has several advantages over synthetic fibers such as low density, appropriate stiffness and mechanical properties and also high disposability and renewability. Also, they are recyclable and biodegradable. banana filaments are lignocellulosic, comprising of helically twisted cellulose microfibrils in formless lattice of lignin and hemicelluloses. In this cellulose substance is the primary element which chooses the mechanical properties of removed banana fiber. High cellulose content expands the wanted mechanical properties

II OBJECTIVES OF PROPOSED STUDY

- To study about the composite materials commercially available in the market. to develop hybrid composite material using natural fiber Hemp and banana fiber.
- In the present work untreated hybrid hemp and banana fabric laminated composites has been take up.
- The commercially available hemp and banana is taken and fabric is prepared manually by using simple handloom machine.
- Hand layup technique was used to obtain test coupons. Test on composites were conducted by using Computerized Universal Testing Machine and impact testing machine.

III. EXPERIMENTAL PROCEDURE AND METHODOLOGY

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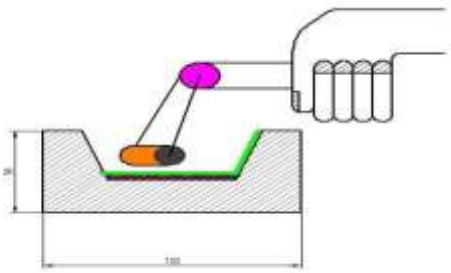

Fig 3.1: Hand Layup Technique

Each layer of fabric was pre-impregnated with matrix material which is prepared by mixing general purpose polyester resin, accelerator and catalyst in the weight ratio of 1:0.02:0.026 respectively and these layers were placed one over the other in the mould with care to maintain practically achieved tolerance on fabric alignment. Casting was cured under light pressure for 2 hours before removal from the mould. Hand lay-up technique is used to prepare specimen as shown in Fig. 3.1. The working surface was cleaned with thinner to remove dirt and a thin coat of wax is applied on the surface to get smooth finish. Then a thin coat of poly vinyl alcohol (PVA) is applied for easy removal of mould. Hemp and banana fabrics are cut to the required dimensions for test specimen pre-impregnated with matrix material and placed one over the other in the mould. Casting was cured under light pressure for 2 hours before removal of mould. All test specimens were moulded and prepared according to ASTM-D standard to avoid edge and cutting effect, thereby minimizing stress concentration effect.

Sl. No	Specimens Tested	ASTM-D Standard	Length (mm)	Gauge length (mm)
1	Tensile :Hemp-banana fabric composite	3039	250	25
2	Impact	256	86	--

Table 3.1: Standards, dimensions and configuration of hemp and banana composite test specimen

Fig 3.2: Tensile Test Specimen

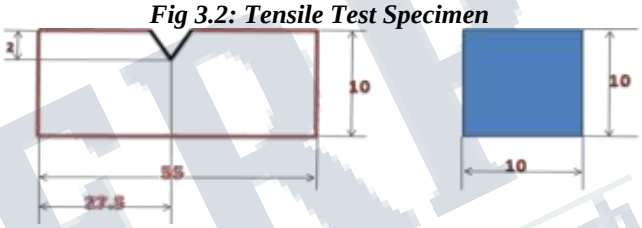

Fig 3.2: Charpy impact Test Specimen

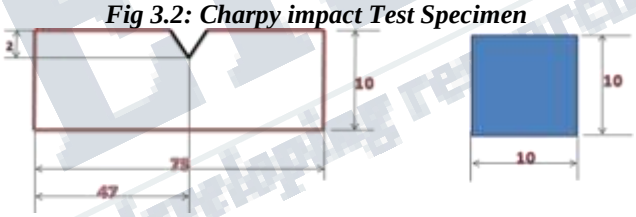

Fig 3.3: Izod Impact Testing Specimen

Tensile tests on composite specimens were carried out according to ASTM–D 3039 standard (shown in fig 3.2) to determine tensile strength and modulus of elasticity for jute-sisal FRP to observe the behavior of FRP under load. Tensile testing, also known as tension testing, is a fundamental materials science test in which a sample is subjected to uniaxial tension until failure.

Impact test is carried out according to ASTM-D 256 standard (shown in fig 3.3) to measure material ability to withstand shock loading. Impact tests are used in studying the toughness of material. A material's toughness is a factor of its ability to absorb energy during plastic deformation. Brittle materials have low toughness as a result of the small amount of plastic deformation that they can endure. The impact value of a material can also change with temperature.

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Fig 3.4: Prepared tensile and impact test Specimens

IV. RESULTS AND DISCUSSION

The results are evaluated as per the readings got from testing's conducted in universal testing machine and impact testing machine.

Tensile Test:Tensile stress-strain diagram of specimens tested for fabric reinforced polyester composites in warp direction shown in Figures 4.1 and 4.2. Strength and modulus of fiber as well as bonding strength between fibers and matrix are the prime factors, which accounts for the tensile strength of composite materials.

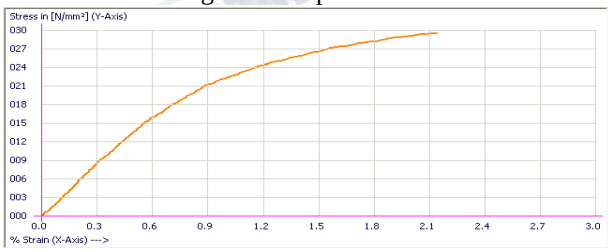

***Fig 4.1: Tensile stress v/s Strain response of specimen** 1*

The stress Vs strain curve of tensile specimen 1 is as shown in the Fig 4.1. The curve is linear up to certain load and it starts to take the load continuously and the layer of specimen will breaks at 18N/mm2 and finally it takes ultimate stress of 29 N/mm2.

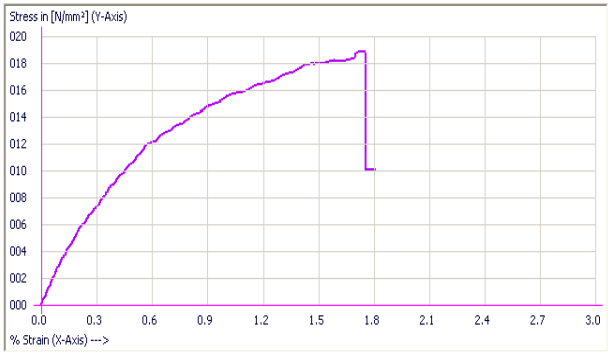

Fig 4.2: Tensile stress v/s Strain response of specimen 2

The stress Vs strain curve of tensile specimen 2 is as shown in the Fig 4.2. The Behavior of material is quite same till 18 N/mm2 and the finally breaks at a stress of 19 N/mm2.

Impact Test:

The obtained results of hybrid Hemp and banana fabric reinforced polyester composites as shown in Table 4.1

Impact a strength KJ/m²	Hybrid Hemp/banana laminate	
Charpy	Specimen 1	40
	Specimen 2	38.45
Izod	Specimen 1	35
	Specimen 2	39

Table 4.1: Results of impact test

Impact tests were conducted on hybrid Hemp/banana fabric reinforced polyester composites having with number of layers 20 and polyester resin using pendulum type impact tester. Impact strengths were obtained for both charpy and izod specimens (Table 4.1).

Charpy test were performed on hybrid Hemp/banana composite. The mode of fracture shows little pull out of fibres. The reason for this is poor bonding at the fibre matrix

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interfaces. The average impact strength values for hybrid Hemp/banana composite specimens are 40 KJ/m² for charpy, 35
KJ/m² for izod.

V. CONCLUSION

The main emphasis of the present work was on development and testing of hybrid hemp and banana fabric reinforced polyester composites to know their suitability and adaptability for various structural applications. From the tensile test it was found that the tensile strength and modulus of hybrid hemp and banana fabric reinforced polyester composite is
19Mpa and 29 Mpa, these are the shows that the prepared hybrid polymer composite is stronger and strengthen than the other fibers. An average Impact strength of the hybrid Hemp and banana fabric is 40
KJ/mm2 in charpy and 35 KJ/mm2 in Izod and which would a better impact strength for fibers be to resists
the loads.

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