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Experimental Investigations of Physical Properties on Chopped Flax and Sisal Fiber with Various Percentage Of Filler-Reinforced Epoxy Composite

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ABSTRACT: *The aim of this paperworkto investigate the various percentages of filler-Reinforced epoxy composite added to chopped flax and Sisalfibre with aneffect ofphysical properties are transformed. The hybrid Boron Carbide (B_4C or CB_4) filler used in nanopowder size(200µm) which added various percentage (0 to 10%) to test on different volume of Composites mixture which revealed the maximum strength of the composite at high percentage 10% hybrid filler Boron Carbide. The Improved Compression moulding techniques contribute superior bonding strength between the chopped fibre of 150mmand epoxy composites with filler. Past curing method is also calledrest curingtime, it's done after the compression moulding to get better sticking properties amid the mixed layers of composite of timing 3 hours and maintained pressure of 35 kg/cm^2 after past curing to prepare the hybrid composite laminate. The mechanical properties like Tensile, flexural, impact, water absorption testwere analysed as per ASTM Standard. The test results indicatethe improved the mechanical properties ratio of 40:50:10 compositionswhichare higher than other ordinary Composites.*

KEYWORDS: *Chopped Flax and Sisal Fiber, Filler, Nano powder, Compression Moulding Method, Mechanical Properties*

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I INTRODUCTION

More than thousand numbers of species of natural fibres are available and very limited of them are used in applications, because of their deciding properties. Recently the polymer composites use in new field products like jet ski, aircraft, missile, spacecraft, marine applications and automobile components, electrical and electronic equipment, water storage tanks. The physical properties of natural fibres such as density and diameter are the most important properties to make the composites lightweight. The tensile properties such as tensile strength, tensile modulus factor of natural fibres play an important role in deciding the properties of polymer composites

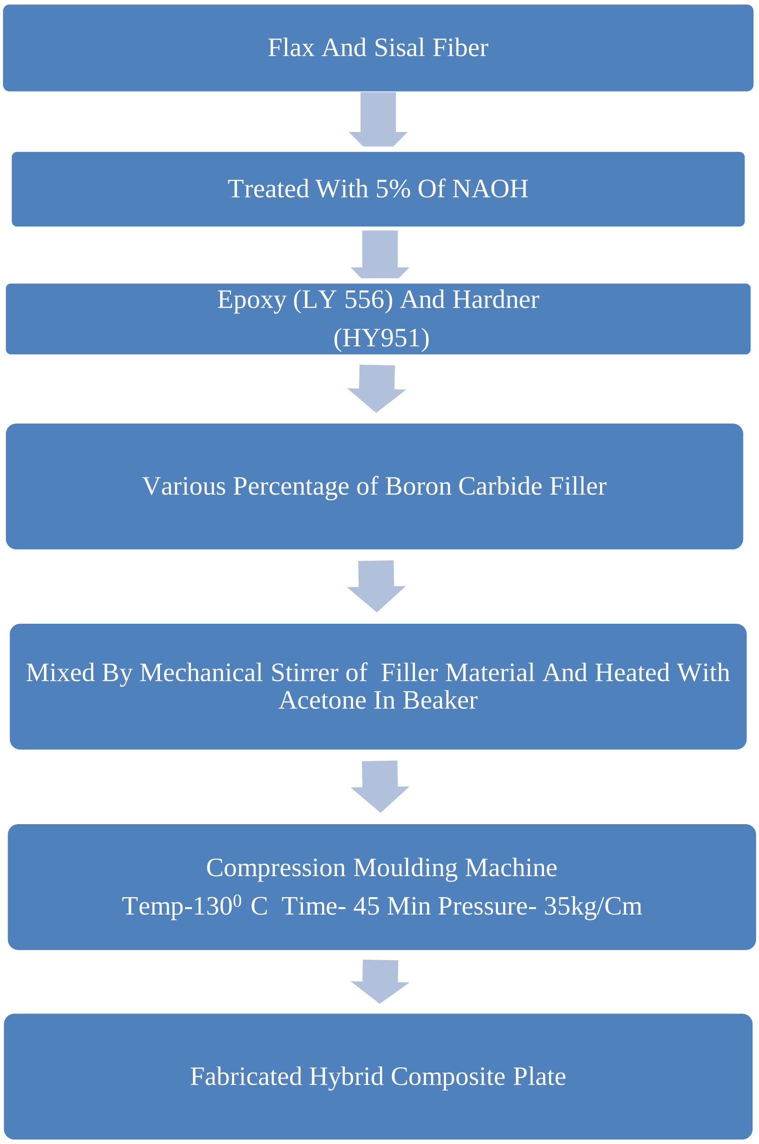
The researcher nowadays, newly identify to improve the properties of natural fiber with lesser weight. Natural fibres are cut down from plants which immersed in a water tank for three weeks. Fibres are stripped from the plants by using manual method then washed and dried in the sunlight. Natural fiber were cleaned and extracted by water retting process The unwanted substance like soft hemicellulose, lignin matrix was removed with the help of alkaline (NaOH) Solution. The epoxy Resign LY556 and Epoxy hardener were brought from Covai Seenu limited, Coimbatore, India. The Compression moulding Techniques were used to prepare the materials. Each layer of chopped flax and Sisalfibre of 150mm equally filled and arranged in composites for compression. Each layer in moulding is called laminate. The voids of air bubbles are trapped out by using hydraulic pressure pump. Here we fabricated 3 mm thicknessplate of composite material from the calculated percentage of the compositionby compression moulding techniques The total sizes of the fabricated plate are limited to 300*300*30 mm. After the fabrication process,the mechanical properties were analysed and concluded the result from the five tested samples from each fabricated plate, under ASTM Standard and tensile results**.** Generally, the main objective of this paper is to investigate the combined fibre of flax and Sisal with added filler material at severalpercentages which enhanced the maximum strength of mechanical properties of the composite materials.

II EXPERIMENTS PROCEDURE

2.1 Materials

The full length of Flax fibre rangesfrom 100cm t0150 cm purchased from Go green products, private company, Chennai, then chopped the fibre to 125mm with the help of tailor scissors. Epoxy grade LY550 mixed with hardener used as reinforcement with fibre, purchased from Covai seenu company, Coimbatore. The boron carbide nanopowders of 200 µm were purchased from Coimbatore metal mart trader, Coimbatore.The flax and sisal fiber had high strength of physical properties. The Improved Compression moulding method were used of Temperature of 130^0 C, timing 45 min with Pressure 35 Kg/Cm^2fabricated each plate. The past curing method are necessary to get better bonding strength of fixed timing 3 hours with pressure 35 Kg/cm^2.

2.2 Processing methods



III RESULTS AND DISCUSSION

3.1 Tensile and Flexural Test

In universal testing machine model DTRX -30KN, the tensile strength was calculated according to the ASTM standards D3039-92 and the dimensional size were length 250mm and width25 mm as shown in figure 1.Each fabricated specimen carries five samples to test tensile strength which helps ensure the results. The maximum tensile tested samples composition of 50: 10 which proved the filler material increased the mechanical properties by added maximum percentages of the composite materials. The flexural test conducts according to ASTM D790 from the Ultimate tensile testing machine. The samples with dimensions 125 mm and width 12.7 mm and the maximum flexural strength were obtained in the composition of 50:10 shown in table 1. The percentage was fixed (40 %) fiber and variation made between Reinforcement (60 %to 50%) and filler (0% to 10%) shown in table 1. In this present work proved the filler material improves both the Tensile Strength properties and Flexural strength properties of the fabricated material.

Figure 1. UTM with Tensile test specimen

Sample Number	Resin: Filler (%)	Tensile Strength Mpa	Flexural Strength N/mm^2
1	60:0	50.59	251.41
2	58:2	63.10	254.33
3	56:4	67.34	267.62
4	54:6	71.45	272.42
5	52:8	79.21	285.77
6	50:10	89.23	298.97

TABLE 1- TENSILE AND FLEXURAL TESTED VALUE

3.2 Water Absorption test

The water absorption test wascarried according to ASTM D570- 99 standards 64 mm x 12.7 mm × 3mm. The ovens are used to dry the specimen before water absorption test at 60^o C. The specimen was fully immersed in water for 4 days (96 hours), after 4 days the sample specimens were taken out and remove the excess amount of water using pure cloth. At last, the final amount of weight percentage can be calculated with the help the below equation. From the calculated test results of water absorption test shown in percentage (%), sample number 2 shows high water absorption of 14.23% which are gradually decreases by addition of boron carbide.

Water absorption (%)

$$= \frac{final\ weight - orginal\ weight}{orginal\ weight} x\ 100$$

Figure 3 – Measure after water absorption test

Sample Number	Fibre: Filler (%)	Before Immersion (Grams)	After Immersion (Grams)	Percentage of weight gain of material (%)
1	60:0	6.63	7.32	10.40
2	58:2	5.55	6.34	14.23
3	56:4	5.77	6.59	14.21
4	54:6	6.04	6.74	11.58
5	52:8	5.71	6.35	11.20
6	50:10	5.30	5.83	10

IV CONCLUSION

The compressed moulding done on different volume of filler boron carbide added to the combined fiber of flax and sisal with epoxy as reinforcement. After the addition of various percentages (2 to 10%) of filler boron carbide evidenced the improved tensile strength of 89.23 Mpaand maximum flexural strength of the material of 298.97 N/mm^2. The water absorption test showed the maximum in ratio of 58:2 and percentage of minimum of 50:10 which is minimum than without addition of boron carbide filler to form hybrid composite laminate. The natural fiber are not any harmful to our environments and its can easily obtained anywhere at low cost than other synthetic fibers. By comparing the tensile and Flexural properties with the hybrid composite material with weight ratio of epoxy resin to filler (nanopowder) as 50:10 shows the maximum results and better properties. The water absorption test results improve fiber- matrix blending and good fiber to matrix wettability.

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