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Abstract. Materials are indispensible but the supply is limited. In particularly, the supply of material is limited for specific applications. Light weight low strength applications are very wide. This investigation focuses the natural fibre hybrid with artificial fiber-based hybrid composite preparation. The banana fibre is used to prepare the composite with glass fibre. The banana fiber is here treated with specific concentration of sodium oxidanide in the distilled water. The composites synthesized with treated and untreated banana fibres. The alternate fashion of horizontal and vertical is followed for fibres' orientation. The bio epoxy is employed as matrix material with mix of hardener. The prepared composite are characterized by water absorbability, tensile properties, flexural properties and shock absorption capacities. The synthesized composites also characterized for dry and wet applications.

INTRODUCTION

Material consumptions are increased day by day drastically. The supply of material on conventional basis like metal is highly insufficient to meet those requirements. On another side the demand for materials which posses the high strength and low weight is preferred more than conventional material. So the researchers invent new materials to meet such demand. [1] Used almond shell powder and mix with resin to prepare the particulate composite panels by compression molding process. Similarly [2] suggested such composite fabrication with use of powder of skin removed tamarind seeds for fabricating the panels for commercial use. [3] Suggested the treated banana fibers will improves the mechanical properties. So they experimented and [3] suggested suitability of material by use of banana fibres treated with NaoH solution and selected jute fibre for hybrid composite laterally they suggested banana fiber treated by mallic acid with glass fiber for another kind of composite material [4]. [5] Suggested a methodology for Z-axis reinforcement that is prevention of de-lamination by stitching before compression for removing the excess rasin and air gaps and for ensuring predefined uniform thickness. This research focuses to examine the NaoH treated banana fibre and the artificial glass fiber with specific number of layers and pre defined best bonding orientation of fibers to obtain the composite material for both dry and wet applications. .

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MATERIALS AND METHODS

Composite Matrix

The matrix materials are mainly consists of selectively obtained and specially prepared high quality banana fiber (Figure 1a), the commercially available high quality glass fiber (Figure 1b) for reinforcement. The low cost, best match for banana fibre based composite's bonding agents, the cashew nut cell oil is employed as resin and also bought the suitable hardener for the same [6-22]. The poly vinyl acetate is employed as releasing agent [23-35]. The high quality banana fiber was prepared from the naturally harvested banana stems by rolling, combing and drying; further the fibre qualities were enhanced by chemical treatment [36-47].

.**TABLE 1.**Desirable properties of Preferred Fibres

Name of the Fibre	**Tensile Strength (MPa)**	**Density (kg/m^3)**	**Young's Modulus (MPa)**	**Flexural Modulus (MPa)**
Banana Fibre	54	1350	3487	2000 - 5000
Glass Fibre	2500-3500	2.5	70000	70000 - 73000

(a) (b)

FIGURE 1 (a) Treated Banana Fibre (b) Branded Glass Fibre

Refining Quality of Sisal and Banana Fiber

The low cost and appreciable enhancement was achieved through sodium oxidanide treatment [48-61]]. Here it was preferred that 1% of sodium oxidanide volume fraction with distilled water. The high quality banana fibers soaked in the solution for 240 minutes followed by drying on open space with normal sunrays (do not being at hot sunrays) for 120 minutes that is dried in the morning 8AM to 10 AM. After that the fibres cut to 5 cm long [62-70].

Synthesis of Hybrid Composite

The preferred selective sequence of layers and orientation of fibers on each layer are alternate fashion of horizontal and vertical. A chromium- plated MS, Square shaped molds (of side 30 cm) are placed n the molding table. The parting (Wax) agent applied on the mould which will facilitate release the finished. The planned layer details are furnished in the Table 2. Beadings at the corners of models are maintained the preplanned gap. The preplanned length of 50 mm followed for both banana fibre and glass fibres. The glass fibers used for extreme layers that top and bottom. In between layers banana but their fashions are alternate orientation of fibres in horizontal and vertical directions. The layers are bonded with just prepared paste of mix of 10 part of resin and one part of hardener. Finally entire composite panel was compressed in CTM and kept in the compressed position for 3 to 4 hours, by which the voids filled up, air bubbles removed and excess resin content also removed. Then panels allow drying in sun light with weight for avoiding bending due to shrinkage while drying. Hence the composite samples are prepared by the combination of compression mounding and manual layup technique.

CHARACTERIZATION

Investigation on Water Absorbability

According to ASTM D570, the prepared samples are preheated in the air over in the rage of 45 to 55 degree centigrade temperature settings. The composites samples are kept immersed in distilled water at room temperature around 25 to 35 degree centigrade of temperature. At every day and weighed after wiped out the water content on the surface of panels. On the first day the weight gain with the resolution of 0.01 mg is more and comparative decreases of weight gain day by day. Hence it was noted that the proposed hybrid composite absorbs the moisture. I was also found that the inflammation in tested hybrid composite samples. It was planned that better the proposed composite characterized in terms of its strength / property under wet condition than in term of water absorbability. So certain panels were allow immersing in water up to five days and used them to characterize its properties under wet condition.

TABLE 2. Water Absorbability of Treated and Untreated Banana Fibre based Hybrid Composite

Characterization Criteria	Composite Specimen	
	Treated	**Untreated**
Net Water Absorbed in grams	5.64	8.16

Characterization under Co-linear unlike Loads

TABLE 3: Characterization of Treated and Untreated, Dry and WetHybridComposite under Co-linear unlike load

Characterization Criteria	Dry Specimen		Wet Specimen	
	Treated	**Untreated**	**Treated**	**Untreated**
Tensile strength in MPa	59.2	49.4	60.4	52.4
Tensile Modulus in Mpa	271.06	214.16	273.18	244.12

FIGURE 2. Sample Specimen of Hybrid Compositefor Characterizing Properties under Co-linear unlike load

In the Co-linear type unlike loading investigation is for characterizing the material in terms of properties by tensile load by use of the specimen prepared to the standard of ASTM D3039 that is rectangular of size 1x10 sq. inches (Figure 2). The maker of FIE universal testing machine UTE-40 type 400 KN capacity was employed for this investigation. The loading speed is 1 mm per minute was set. As per standard the 150 millimeter of gauge length was set. The environment conditions are an average relative humidity of 50% and the temperature about 35ºC. The observations obtained for both dry and wet composite and presented them in the Table 3.

Characterization under Transverse or Orthogonal Load

In the Transverse or Orthogonal loading is used for characterizing by Flexural strength on is for the material in terms of properties by three point bending method. The specimen prepared to the standard of ASTM D790 that is 3 mm thick rectangular of size 157x 13sq. millimetres (Figure 2). The same FIE universal testing machine UTE-40 type 400 KN capacity was employed for this investigation. The loading speed is 1 mm per minute was set. As per standard the 150 millimeter of gauge length was set. The environment conditions are an average relative humidity of 50% and the temperature about 35ºC. The observations obtained for both dry and wet composite and presented them in the Table 4.

TABLE 4: Characterization of Dry and Wet(G-B-B-B-G) Hybrid Composite under Orthogonal load

Characterization Criteria	Dry Specimen		Wet Specimen	
	Treated	**Untreated**	**Treated**	**Untreated**
Flexural strength in MPa	12.52	8.34	13.02	9.44
Flexural Modulus in MPa	1325	946	1426	982

FIGURE 3. Sample Specimen of Hybrid Composite for Characterizing Properties under Orthogonal load

Characterization Hybrid Composite for Toughness

The Toughness of the materials is usually characterized by Impact Test Method. Charpy Test setup is employed in this investigation. The specimen prepared under the standard of ASTM D256 to the dimensions of 2½ x ½ x 1/8 Cubic Inches. The energy observed by the specimen is observed. And tabulate in Table 5. The specimen is shown in figure 4. The investigation ambient conditions are room temperature and 50% the average RH

TABLE 5: Characterization of Dry and WetHybrid Composite under Impact load

Characterization Criteria	Dry Specimen		Wet Specimen	
	Treated	Untreated	Treated	Untreated
Observed Energy in joules	12.48	7.95	12.79	8.24

FIGURE 3. Sample Specimen of Hybrid Composite for Characterizing Properties under Impact load

RESULTS AND DISCUSSIONS

Water Absorbability

The water absorbability was investigated in treated sisal and banana fibre and untreated banana fibre based specimens. It was found that the treated sisal and banana fibre based specimen absorbed less water than untreated sisal and banana fibre based composite specimens (Refer Figure 4).

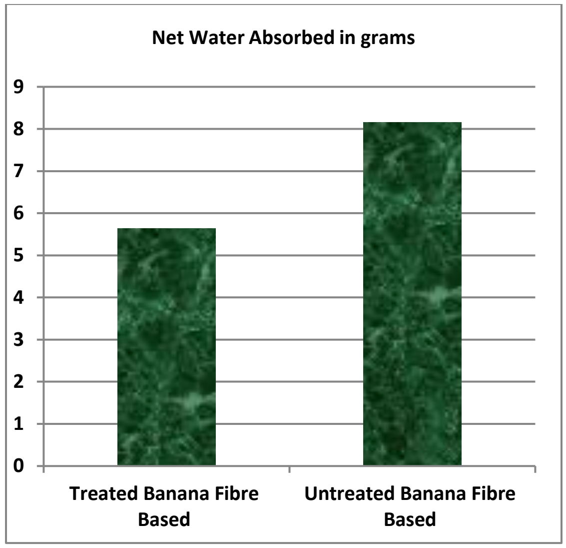


FIGURE 4. Water absorbability of Hybrid Composites

Tensile properties

The tensile properties like tensile strength and tensile modulus of the treated banana fibre based hybrid composites got improved (Refer Figure 5 and Figure 6). The wet composite is stronger in tension than dry specimen (Refer Figure 5 and Figure 6).

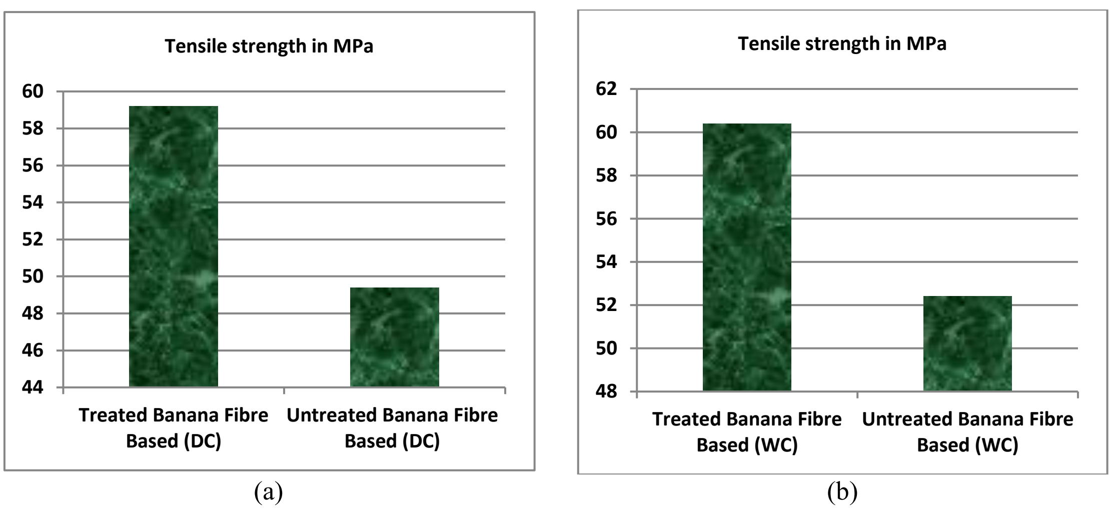
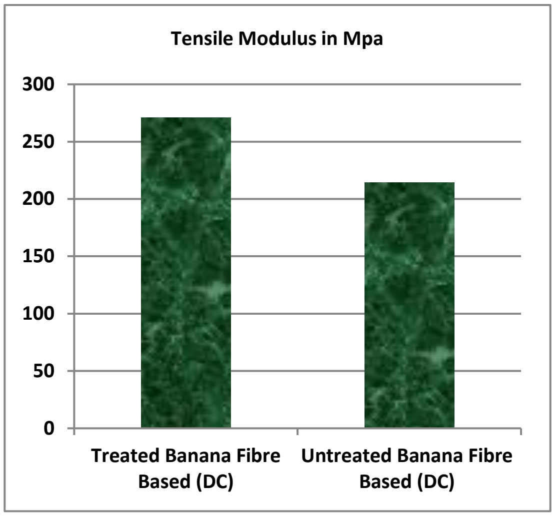
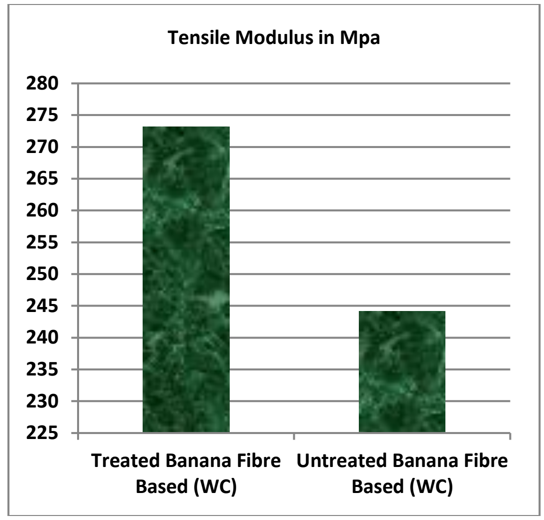


FIGURE 5. Tensile Strength of Treated and Untreated banana fibre based (a) Dry Composite (DC) (b) Wet Composite (WC)



(a)

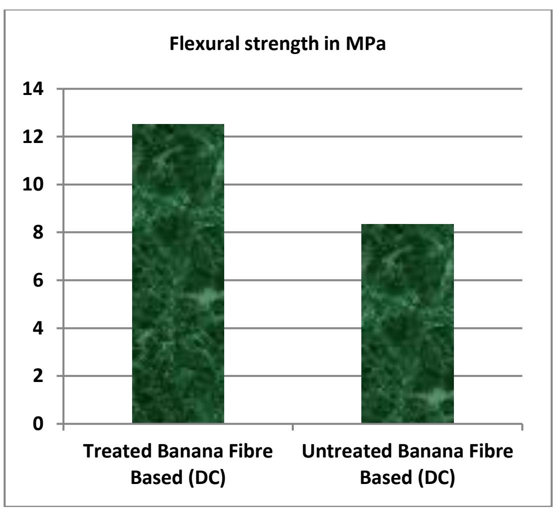


(b)

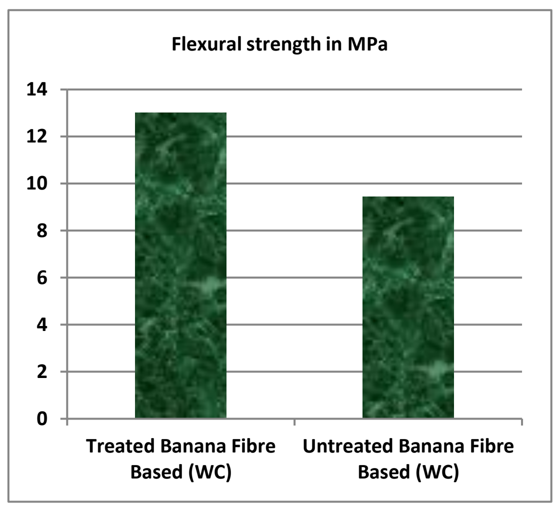
FIGURE 6. Tensile Modulus of Treated and Untreated banana fibre based (a) Dry Composite (DC) (b) Wet Composite (WC)

Flexural Properties

The Flexural Properties like flexural strength and flexural modulus of the treated banana fibre based hybrid composites got improved (Refer Figure 7 and Figure 8). The wet composite is stronger in bending than dry treated banana fibre based hybrid composite (Refer Figure 7 and Figure 8).



(a)



(b)

FIGURE 7. Flexural Strength of Treated and Untreated banana fibre based (a) Dry Composite (DC) (b)Wet Composite (WC)

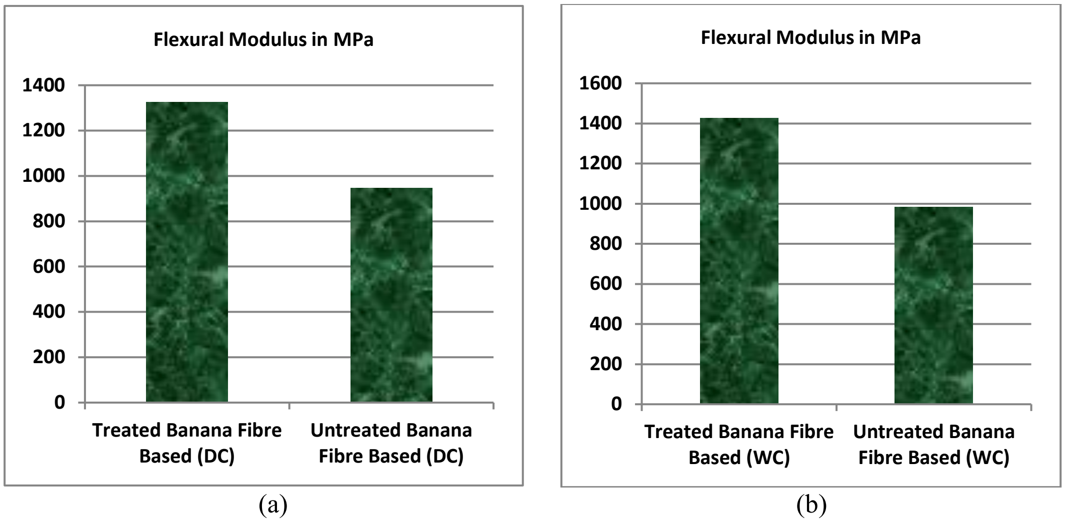


FIGURE 8. Flexural Modulus of Treated and Untreated banana fibre based (a) Dry Composite (DC) (b)Wet Composite (WC)

Shock Absorbability

The impact load or shock load based test namely charpy is employed for this investigation. The results reveal that impact strength of the treated banana fibre based hybrid composites got improved (Refer Figure 9). The wet treated banana fibre based hybrid composite is stronger in bending than dry treated banana fibre based hybrid composite (Refer Figure 9).

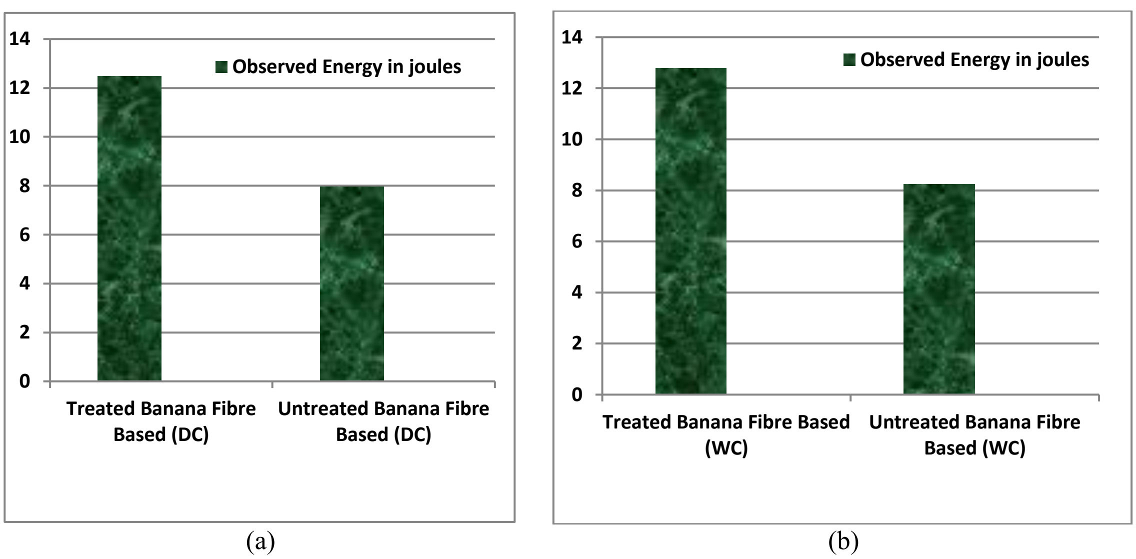


FIGURE 9 Impact Strength of Treated and Untreated banana fibre based (a) Dry Composite (DC) (b)Wet Composite (WC)

CONCLUSION

The natural abundant Banana fibre and one of the artificially strong glass fibre is hydride here with bio resin and hardener matrix to form the hybrid composite panels. In which the banana fiber is selectively processed and specially treated for enriching the proposed composite strength. It was experimentally proved that the proposed treated banana fibre based composite performed well than untreated banana fibre based hybrid composite. Suppose the composite subject to wet condition its performance significantly improved the same was also confirmed by experimental results. Hence the proposed composite is suitable for both dry and wet application. More preferably wet applications.

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