The Experimental Effect on Barium Sulphate on Mechanical Behavior of Natural Fibers as a Composite Material Matrix Made Aloevera Flax and Hemp Materials

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Abstract

This research work paper deals with the mechanical properties and dynamic mechanical analysis test of composite material with chemical treatment. Since the natural fibers are eco-friendly and no harm to the humans and nature. This is only the way we can change our lives in a smooth manner. This is also the very much cost effective method by using barium sulphate on different mechanical properties of the reinforced composite. The high-performance lingo-cellulosic composites have with uniform densities, durability and have very high strength when compared with other materials like glass, plastic etc. The different fibers with different combinations were tested for 1 week and 15% of barium sulphate solution at around a temperature of 25 ○C. The dynamic mechanical analysis was carried out and further they were analyzed by scanning electron microscopy. Therefore the proper proportion of chemical treatment improves the matrix adhesion and hence gives the maximum performance of the composites. Hence mixing the materials with 9% of NaOH solution increases the 77% in tensile strength when compared with untreated material. Once the concentration was increased, the unchanged observations were noticed.

Key words : Jute composite materials , hemp, Hardener, Flax fiber.

1. Introduction

In olden days the different fiber have different properties like low density, low cost in production, abundant availability and it can be recyclable and the synthetic fibers like Kevlar, glass are renewable in nature. The barium sulphate material combing with other natural fibers like aloevera, hem and flax gave very high strength for making composite material and this composite material should be chemically treated to have proper bonding. The products with different tough shapes can also be manufactured using flexible fiber in the shape of mat format. The materials will expand the current market and gives low cost material since they are made with waste and abundance material and also gives high performance composite material. The other fiber are flex, hemp are also have important properties, by considering their special properties comparable with that of E-glass fiber the properties like tensile strength, Young’s modulus and density are 1300 MPa, 55 GPa, and 1505 kg/m^3 respectively and also they have excellent sound absorbing capacity [1]. This kind of materials can be used in automobile industry mainly to develop different new components using flax fiber in order to obtain for better fuel consumption. The low composite fiber matrix compatibility reduces and in capable of to transfer pressure from reinforced matrix to different fiber. On the other hand, chemical methods such as mercerization [2] acetylation, [3] and silanization [4] increase fiber–matrix compatibility[13] In this analysis work, the new chemical treatment is employed with the aim of rising the mechanical homes of unifacial, flax-reinforced epoxy composites. For this cause, UD flax materials were proscribed in bicarbonate answers with five and ten w/w concentration, for five days at temperature[9,10,11] Quasi-static and dynamic mechanical exams were dead on composites artificial through vacuum infusion approach. The experimental results are as compared with those of composite laminated bolstered with untreated fiber. Fibers are shown in figure 1 and 2. The Scanning microscopy (SEM) analysis become applied on the tensile broken surfaces of the composites to analysis the exceptional of the fiber– matrix adhesion. Limitations of natural fiber reinforcement are mostly overcome by fiber surface treatment or by matrix modifications, usually by the removal of the carboxyl group[6]. The Flax is one of the interests to the branch of composite materialsbecause of the following main features: first it will have considerable tensile strength and stiffness, effective replacement for glass fiber, easy to process and recycle, can be customized to meet a variety of specifications and different manufacturing systems. because glass/carbon brings mechanical properties (e.g. high strength), whereas flax seems to better reduce vibrations that occur inside of the composite under load or impact [8, 9, 10]. The higher extensibility and stiffness of the fiber could be obtained with the help of proper chemical and thermal treatments of fibers like sisal ; and also the mechanical property also be upgraded with the help of by increasing the bonding between the bundles of fiber and matrix [12]. The proper proportion of sisal fibres with the help of NaOH solution, the reinforcement of the composite material gives the greater tensile strength and also the lower moisture absorption. However, there is still uncertainty on which type of manufacturing processes is suitable for producing these natural compos-its. the complexity of shape of a product also influences the type of manufacturing processes to be used. For example, filament winding is the most suitable method for manufacturing composite’s pressure vessels and cylinders. Pultrusion is mainly used for producing long and uniform cross-section parts.

Fig. 1 Barium Sulphate

(a) Woven Aloevera (b) Woven Hemp (c) Woven Flax

Fig.2 Woven Aloevera/hemp/flax fiber materials

2. Materials and Methods

The different materials like barium sulphate, Aloevera, hemp and flax fibers with different combination composite laminates were made and the shape of the panel was in the form of cured shape for 1 day and post cured shape for 18 hours at 48.5^{0}C. Flax fiber UD layers were soaked for 1 week at room temperature, then washed with H_2O and again dried in at a temperature about 45^{0}C. Then those fibers were further dried at 105^{0}C for 1 day.

3. Experimental characterization

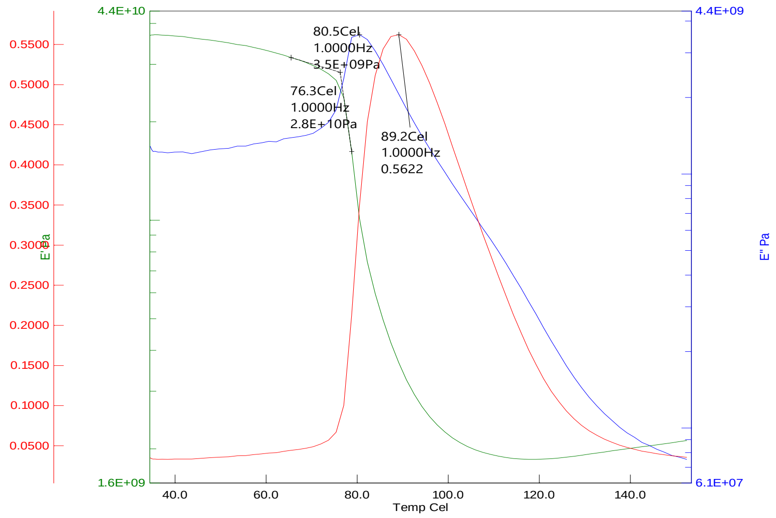

Fig.3 Woven Aloevera/hemp/flax fiber materials curves

The Quasi static tensile tests on 3sets of 4 prismatic samples of length 20 mm until 300 mm were performed in accordance to ASTM D 3039 widespread prepared with a load mobile of 50 kN. The strain of the specimens changed into evaluated through a YYU-10/50 extensometer with gauge period of 50 mm and a full- scale price identical to 30% coupled to the checking out device. Tensile exams had been completed in displacement manipulate mode at a crosshead velocity of zero. The beam setup called 3-point bending setup had completed consistent with ASTM D790 trendy, the use of a regular trying out gadget setting the span period identical to forty-eight mm and the crosshead speed to 4 mm/min. Dynamic mechanical analysis checks had been executed at B.S Abdur Rahman University, Chennai, India. By the usage of an SEM version. Specifically, the fracture surfaces of samples examined beneath quasi-static tensile condition were observed. Before the analysis, each and every sample was sputter coated initially with a thin film of gold color to eliminate electrostatic charging. The different properties of raw material are shown in table 1

Table 1. Raw material properties

Unidirectional flax fabric		SX8 EVO epoxy resin system	
Areal weight (g/m^2)	180	Density (g/cm^2)	1.5

Areal volume (m^3/m^2)	0.2	Viscosity at 25°C (mPa s)	560
Thickness (mm)	0.1	Gel time at 25°C (h)	4
Warp weight (%)	96	Tensile modulus (GPa)	2.9
Weft weight (%)	4.99	Tensile strength (MPa)	80

4. Dynamic Mechanical Test

The following figure 6 represents the typical tan (d) versus temperature curves obtained through DMTA characterization for untreated and treated composite flax fiber. Results shows calculated as the loss of different storage modulus values, from all these values the fiber matrix adhesion affect the curve shape. Therefore it is observed that the weak fiber matrix adhesion resulted in higher values of tan (d). But in case of good fiber matrix adhesion values reduce the mobility of the polymer therefore reduced the damping values [12, 13]. The following figure 3 shows the different experimental work data at different temperatures are shown in x axis and tan values are shown in y axis the result is shown by curves.

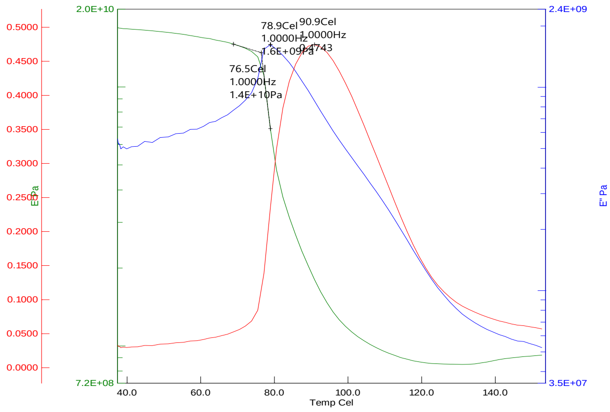

Fig 4. Typical tan (d) versus temperature curves

5. SEM analysis

The morphology of the fractured surfaces of untreated composites and treated fiber reinforced composites was fully analyzed. The following figure 4 shows the SEM images of untreated samples shows the SEM images belongs to samples treated in NaoH solution with concentration at 6% and 20% of weights.

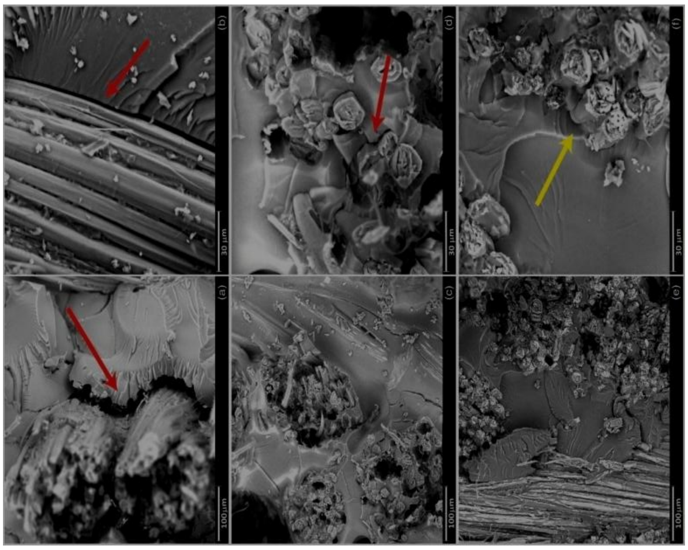

Fig 5. Typical tan (d) versus temperature curves

6. Results and discussions

All the composites prepared in this research study are presented in following Table 2. The chemical treatment influences the thickness (t) and the weight of the fiber fraction P_f. On the other side, the resulting composites values had noticed that the decrement of their void content after the bicarbonate method. Therefore it is important that all the setup laminates are working as best composite material. Since their voids content are less than 5%.

Table 2. Flax/epoxy laminates experimental values.

Sample	Untreated fiber	6% treated fiber	20% treated fiber
Thickness (mm)	1.535	1.399	1.44
P_f (%)	30.21	31.59	30.45
Theoretical density (g/cm^3)	1.323	1.27	1.345
Real density (g/cm^3)	1.113	1.53	1.34
Voids content (%)	5.3	2.81	2.9

Table 3. Dynamic Mechanical analysis experimental values

Time	Temp	Freq	E'
min	Cel	Hz	Pa

0.366667	37.44284	1	1.69E+10
1.266667	37.57875	1	1.69E+10
2.166667	37.68092	1	1.69E+10
3.083333	37.79901	1	1.69E+10
3.983333	37.98834	1	1.69E+10
4.883333	38.32389	1	1.69E+10
5.8	38.95998	1	1.68E+10
6.7	39.92007	1	1.68E+10
7.6	41.24538	1	1.67E+10
8.516667	42.88623	1	1.67E+10
9.416667	44.81203	1	1.66E+10
10.31667	46.8881	1	1.65E+10
11.23333	49.04289	1	1.64E+10
12.13333	51.1969	1	1.62E+10
13.03333	53.28735	1	1.61E+10
13.95	55.28827	1	1.6E+10
14.85	57.19363	1	1.58E+10
15.76667	58.99902	1	1.56E+10
16.65	60.60907	1	3.29E+10
17.55	62.24318	1	3.24E+10
18.46667	63.86828	1	3.2E+10
19.36667	65.49207	1	3.14E+10
20.26667	67.10753	1	3.09E+10
21.16667	68.73384	1	3.03E+10
22.06667	70.35372	1	2.97E+10
22.98333	72.02748	1	2.9E+10
23.88333	73.69609	1	2.8E+10
24.78333	75.39232	1	2.68E+10

Fig.5 The stress versus strain values curve and tangent modulus versus strain curve.

The comparison between the stress and strain curves were related and drawn based on the experimental values for different composites reinforced with treated fibers and untreated fibers. The different characteristics like yield slope and failure conditions were noted and results were tabulated and drawn graph.

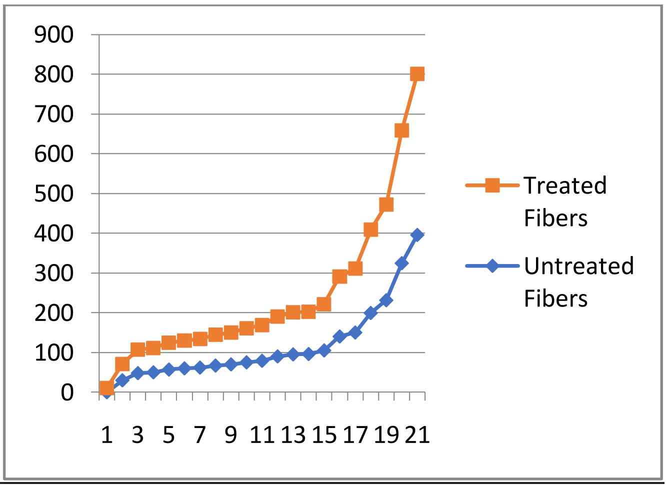

Figure 6. Stress curves and Strain curves for untreated and treated samples

7. Conclusions

In this research work, an eco-friendly treatment and analysis was proposed to have better improve the mechanical properties. The mechanical properties different changes were analyzed and noticed after a treatment of the reinforcement fabric with a 6% and 20% in weight solution of NaoH for 7 days at temperature of 30^0C and the results were compared carefully with prepared composites with the help of untreated fabrics. Therefore the eco- friendly chemical treatment for natural materials gives best results.

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