WATER ABSORPTION EFFECT ON HEMP BAGASSE FIBER REINFORCED WITH EPOXY HYBRID COMPOSITE

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Abstract - Composite are new development in material science enterprises. Presently a days in car businesses weight of the vehicle is steadily decreases in light of the fact that to expand effectiveness of the vehicle. For lessening the heaviness of the vehicle material with higher weight ought to be decreased with low weight of material so that, the aggregate weight of the vehicle can be diminishes. Composite material is taken consideration because of its light weight, ease and low thickness with having of high quality to weight proportion and biodegradability. The significant unmistakable quality among the basic materials has been worried by the characteristic filaments. The filaments were treated with 5% NaoH and 5% Nacl answers for take away the lignin content and to advance the grip property. The strands were fortified into the epoxy with reasonable straightforward hand layup procedure. The treated bagasse fiber and hemp fiber fortified with epoxy half and half composites at various weight parts (10% and 20%) are created and assessed by their submersion in typical water and refined water at room temperature. The outcomes demonstrated that the rate of water assimilation increments with expanding of fiber weight portions and natural temperature. The procedure of retention of water was found to approach the fickian dissemination conduct.

Keywords: Bagasse fibre, Hemp fibre, E-glass fiber, moisture absorption, Hand layup method.

1. INTRODUCTION

Normal strands to fortify composite materials expanded significantly amid the most recent couple of years. The essential favorable circumstances of utilizing characteristic fillers in thermoplastics can be recorded as low densities, minimal effort, nonabrasive nature probability of high filling levels, low vitality utilization, high particular properties, biodegradability, accessibility of a wide assortment of strands all through the world, and era of a provincial/farming based economy. Characteristic strands are subdivided in light of their roots, into four sorts: seed hairs (cotton, kapok), bast-filaments (flax, hemp, jute, and ramie), leaf-filaments (sisal, henequen, coir, and abaca) and wood flour (wheat husk, rice husk). Half breed composites are materials made by consolidating at least two unique sorts of strands in a typical framework. Hybridization of two sorts of short strands having diverse length and distance across can offer a few points of interest over using each of the filaments alone in a solitary polymer grid. Be that as it may, mixture composites utilizing characteristic filaments are less considered. In this kind of studies, the mixture composite of-ten comprises of one common fiber and one non-characteristic fiber. The mechanical properties of plant filaments are to a great extent identified with the measure of cellulose, which is nearly connected with the crystallinity of the fiber and the microfibril edge as for the fundamental fiber pivot. Filaments with high crystallinity as well as cellulose content have been found to have unrivaled mechanical properties. These composites have gotten consideration because of the thermoplastic idea of common filler thermoplastic composites, which permits handling of the composites utilizing customary preparing strategies and reusing of the resultant items or squanders toward the finish of their valuable life. Fiber-fortified composite materials offer a blend of quality and modulus that are either equivalent to or superior to numerous unadulterated materials[1]. Common strands are hydrophilic in nature as they are lignocellulosic, which contain emphatically spellbound hydroxyl gatherings. However, thermoplastic show hydrophobic nature. Characteristic filaments demonstrate an abnormal state of dampness retention and in-adequate grip between untreated strands and the thermoplastics polymer network, for example, polyolefin's. Because of high water assimilation and less interfacial holding qualities, the use of these composites are limited. Change in the mechanical properties of such composites requires solid grip between the regular fiber and polymer framework. The similarity between composite segments was enhanced utilizing either physical or compound change of the polymer or filler or by utilizing coupling agents[2]. Synthetic treatment of the fiber, help to stop the dampness ingestion prepare, synthetically alter fiber surfaces and increment the surface unpleasantness to expand the interfacial bond between the fiber and network, bringing about enhanced mechanical execution of fiber Reinforced composites.

2. MATERIALS USED

2.1 Hemp Fibers

Hemp is one of the relatives of cannabacia plant. It is a tremendously valuable plant and it gives filaments, oil likewise a hardwood[4]. These sorts of filaments are likewise utilized as a part of making of rope, angling nets, papers, fire protecting funnels and material fiber. Hemp develops to a normal of 4572 mm and its fiber can be between 914 mm to 3962 mm. It is removed from the bark of stalk. It is twice solid as wood, bio-degradable and its fiber contain low measure of lignin. However for our necessity the hemp is removed from the bark of the stalk by utilizing certain procedure and these strands were extricated utilizing appropriate process

Fig. 1 Hemp fiber separated from cannabacia plant

2.2 BAGASSE FIBERS

The bagasse is a sugarcane deposit having dim yellow to light green in shading. The stalks are non-uniform and furthermore cumbersome in measure. The strands were separated by pulverizing the sugarcane utilizing appropriate machine the acquired buildup were taken and dried in daylight for one week[3]. The dried buildup were drenched in water for quite a while and afterward kept in the climate by uncovering for daylight for one week. The stalks which are available in a buildup were dried. The acquired buildup is called as Bagasse. In that the filaments were separated conveniently and kept securely in a specific holder.

Fig. 2 Bagasse Fiber Extracted from Sugarcane stalk

2.3 E-GLASS FABRIC

The E-glass filaments are regularly utilized for polymer lattice composites because of its thermoplastic nature and furthermore it can without much of a stretch mix with any sort of the materials. It has great quality, minimal effort and consumption resistance thus it likewise carries on like electrical protector.

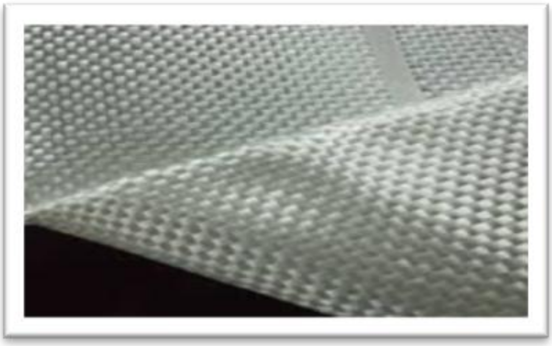

Fig. 3 E-Glass Fiber

2.4 EPOXY RESIN

Softener (Araldite LY 556) purchased from zenith industries the out-standing properties has been utilized as lattice material.

- It displays great grip property to various materials.
- Exhibit's insignificant shrinkages.
- Better electrical and mechanical properties.
- Odourless and non-toxic.

2.5 HARDENER (HY951)

For the most part hardener is blended with resin because of its low consistency and furthermore it is extremely helps amid the cementing of the composites and it have great mechanical quality, great imperviousness to environmental and substance corruption. As the name demonstrates that it will be get hard when blended with the gum materials and gives great holding quality to the tar and trim examples. Relies on upon the curing time, quality and arrangement of the composites the hardener rate will contrasts. Here we are utilizing the hardener proportion of 1:10 with epoxy gum material to make a composite overlay. The hardener which is utilized here is HY 951.

3. EXPERIMENTAL METHOD

3.1 HAND LAYUP PROCESS

Hand lay-up strategy is utilized to set up a cover of two filaments (i.e, bagasse and hemp strands) were taken for various lengths and additionally extraordinary volume portion (20% and 30%). For 20% and 30% volume division filaments the strands were cleaved upto to 2mm and 3mm length. At first the premould is set up as per the measurement of 300×300×3 mm. The base and top layer of the form a glass texture is put and in the middle of the glass textures the slashed strands were kept and tar will be connected on each layer of the procedure. After that an aluminum piece is kept keeping in mind the end goal to maintain a strategic distance from air rises amid curing process and kept for 24 hours for curing then the overlay were kept in broiler at 1000C upto 60 minutes. The cover were sliced by the ASTM models

3.2 WATER ABSORPTION TEST

Water ingestion test were done by ASTM D570-81. The examples with measurements of (127, 12.7, 3.2mm) were chosen and dried in a broiler for 1 hr at 100^0C. The weight was measured to an accuracy of 0.0001g utilizing four digit adjusts. The examples were then set in ordinary and refined water at room temperature. For estimation, examples were expelled from the water, the surface water was wiped of utilizing a delicate dry fabric, and the examples were weighed. After weight estimation the specimen were submerged in typical water and refined water for 12 hrs and 24 hrs. The estimations of the water assimilation were figured utilizing the accompanying equation.

$$W\% = (W_{(f)} - W_{(i)})/\ W_{(f)}$$

Where, $W_{(f)}$ – Final reading , $W_{(i)}$ – Initial reading with time respectively.

3.3 Determination of Density of Hemp, Bagasse and E-Glass Fibers

The density of the fiber can be find out by water removal strategy. In this strategy, at first a little amount of fiber is weighed by utilizing computerized measuring machine. The heaviness of the fiber must be noted down. The test tube is utilized for testing right off the bat the water is topped in the tube off to certain level and it is taken as beginning perusing, the measured filaments are included into the test tube thus there is an adjustment in the water level. Following couple of second the last level of dilute is noted as definite perusing. The difference between initial and final readings gives the difference in water level from the test tube. Hence by dividing the weight of the fibers weighed with the difference in the water level will gives the density of the fibers. The below tables show the density calculations of hemp, bagasse and E-glass fibers.

Table 1 Density test of Hemp fiber

Mass of fiber (gms)	Initial reading (mm)	Final reading (mm)	Difference in volume (mm)	Density (g/cm^3)
2	50	51.41	1.41	1.42
2.2	53	54.5	1.5	1.46
2.4	56	57.52	1.52	1.57

Average of Density = (1.42 + 1.46 +1.57) / 3
Average of Hemp Fiber density = 1.48 g/cm^3

Table 2 Density test of Bagasse fiber

Mass of fiber (gms)	Initial reading (mm)	Final reading (mm)	Difference in volume (mm)	Density (g/cm^3)
2	40	41.6	1.6	1.25
2.2	42	43.7	1.7	1.28
2.5	44	46.1	2.1	1.22

Average of Density = (1.25 + 1.28 +1.22) / 3
Average of Bagasse Density = 1.25 g/cm^3.

Table 3 Density test of E-glass fiber.

Mass of fiber (gms)	Initial reading (mm)	Final reading (mm)	Difference in volume (mm)	Density (g/cm^3)
2.8	64	65.16	1.16	2.41
3.2	67	68.24	1.24	2.58
3.5	71	72.32	1.32	2.65

Average of Density = (2.41 + 2.58 +2.65) / 3
Average of Bagasse Density = 2.55 g/cm^3.

The density of 20% and 30% volume fraction of the composite laminate is 1.242 gm/cm^3 and 1.26 gm/cm^3 is obtained from the calculation.

4. RESULTS AND DISCUSSIONS

4.1 Absorption Behavior

The rate of water ingestion in the composites relied on upon two parameters, fiber substance and condition temperatures. The outcomes demonstrate that the water ingestion increments with additions of fiber content and encompassing temperature. The composites retain water quickly at the underlying stage, and later it will achieve immersion level was accomplished with no further increment in water assimilation. The outcomes were appeared in underneath tables for 20% and 30% volume fraction.

Table 4 Water Absorption in 24 hrs.

Type of immersion	Volume fraction of specimen	Wt. of specimen before (gm)	Wt. of specimen after(gm)
Normal water	20%	16.75	18.03
	30%	17.05	18.37
Distilled water	20%	16.65	18.21
	30%	18.27	20.26

Table 5 Water Absorption in 48 hrs.

Type of immersion	Volume fraction of specimen	Wt. of specimen before (gm)	Wt. of specimen after(gm)
Normal water	20%	16.72	20.32
	30%	17.15	20.36
Distilled water	20%	16.24	19.89
	30%	18.12	20.12

5. CONCLUSION

The specimen were cut according to ASTM standard and calculated the Weight percentage of both the samples (20%&30%) in normal and distilled water by varying a time. For 24 hrs normal water, the weight percentage is increased and it is calculated by using the formulae, we get 6.99% for 20% volume fraction and 7.18% for 30% volume fraction. From distilled water, 8.56% of weight increased in 20% and 9.82% of weight increased in 30% volume fraction. For 48 hrs normal water, the weight percentage is increased and it is calculated by using the formulae, we get 17.72% for 20% volume fraction and 15.76% for 30% volume fraction. From distilled water, 18.35% of weight increased in 20% and 9.94% of weight increased in 30% volume fraction.

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