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Effect of Ultraviolet Radiation on Jute/E-glass fiber Reinforced Polymer composites

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Abstract : This work investigates the mechanical and aging properties of E-glass fiber reinforced by jute fiber hybrid composites. The Harmful effects of weather conditions are simulated and they are utilized to predict the durability of materials used outdoors. The damaging effects of sunlight are simulated by UV-fluorescent lamps. UVB lamp ranges from 280-315 nm are deployed to expose in hybrid composite and variations in tensile tests are determined for 50, 75 and 100 hrs. The mechanical properties as a function of reinforcement content are affected which are reflected in the values of the tensile modulus and strength as well as impact resistance and hardness.
Key Words: E-glass, Jute fiber, UVB lamp, tensile test.

I Introduction:

Polymers of composite substances have initiated massive pastime in exclusive designing fields, particularly in aviation bundles when you consider that they find over the top precise great and flexibility in distinction with strong steel mixtures. A polymer composite fabric reveals their extended purposes below instances in which they are going to main issue to strong molecule disintegration. Case of such bundles are funnel line wearing sand slurries in petroleum refining, helicopter rotor slicing edges pump impeller sharp edges, severe rhythm autos and flying desktop working in fruitless field situations, water factories, and aircraft motor edges not withstanding, polymer composite elements exhibit horrendous disintegration resistance contrasted with metal components. Robust molecule disintegration of Jute/E-glass fiber composite has not been explored to the quantity. Numerous gurus have assessed the resistance of unique kinds of polymers and their composites to stable molecule disintegration. Jute/E-glass fibers are exposed to gentle throughout storage and on the construction website online but are covered in service. Degradation in the course of exposure to light is as a result of the ultraviolet (UV) aspect of sun radiation, whether direct daylight or diffuse light, and aided through warmness and moisture. Some weathering results are due to the alternation of day and night or of moist and dry periods. It is thus endorsed that every one Jute/E-glass fibers should be verified for his or her resistance to weathering. UV irradiation will purpose a major degradation of the Jute/E-glass fiber and for this reason weaken its force when it's uncovered straight below sunlight. The wavelength of the sun radiation extends from the infrared (>700 nm) to the UV (< 400 nm) with a cut-off at around 300 nm relying on atmospheric stipulations. When solar radiation strikes the polymer surface (uncovered Jute/E-glass fiber surface), photons with vigor an identical or better than the chemical bond force of the polymer causes a series of reactions that can lead to polymer chain scission and eventual degradation of polymer properties. The UV vigor of the daylight is ample to break chemical bonds of polymers. Out of doors ordinary publicity method is essentially the most easy publicity assuming that time allows for. Because of the variability of the local weather from website online-tosite, experiment information are simplest relevant for that exact web site. However, laboratory weatherometers accelerate sunlight degradation in controlled environment so that extra regular results can be

generated in evaluation to outdoor publicity methods. Laboratory weatherometers are valuable in assessing suitable antioxidants and stabilizers for the Jute/E-glass fiber as well as to verify the formula for first-class manipulate or fine assurance functions.

II. Experimental:

2.1 Raw Materials: The material is Jute fiber reinforced with the aid of E-glass fiber composite. Those are subjected atUV-B Lamp for 100hrs and tensile tests are done at 50 hrs, 75 hrs and 100 hrs. The materials are obtained from Ram composites Private Limited, Hyderabad.

2.2 Testing :

The Jute/E-glass fiber were subjected to accelerated weathering in a UV weatherometer (QUV Weatherometer, Q-Lab Products & Services) equipped with UVB-313 nm lamps. The test cycle in UVB-weatherometer comprised of 8 hours UVB simulation at 60^0C followed by 4 h of condensation (UVB-lights off during condensation) at 50^0C as per accordance of ASTM G-154. The polymer was exposed for 100 hours in the weatherometer. The coatings uncovered in UVB weatherometer were portrayed for shading change (dE) utilizing a spectrometer (BYK-Gardener Spectrometer) furnished with Color-Lab Quality Control programming. The information was accounted for on L, a, b scales and general shading difference was given in the following equation:

$dE = [\Delta L^2 + \Delta a^2 + \Delta b^2]^{½}$

where; $\Delta L = L_2 - L_1$, $\Delta a = a_2 - a_1$, and $\Delta b = b_2 - b_1$ Respective numbers 1 and 2 are denoted to samples before and after the exposure test.

III. Results d Discussion:

3.1 Mechanical Properties:

Checks are carried out for the composite material and its mechanical residences are shown in table 1.

Table 1: Mechanical residences of Jute/E-glass fiber:

S.no	Material	Density(gm/cc)	Shore Hardness	Tensile Strength Mpa	Impact strength (Kg/cm^2)
1	Jute with E-glass fiber	1.31	80	58.8	28.4

3.2. UV weathering for Photo degradation:

The photo degradation of Jute/E-glass fiber were studied using an accelerated weatherometer at a Light source of 154 : Fluorescent lamp - (UV-B) @ 313 nm in irradiance of 0.63 Wm^2 for 100 hrs. The photo-degradation of Jute/E-glass fiber is due propagation of depolymerization initiated from jute polymer radical by Hydrogen abstracting mechanism. The percentage reduction in the material loss gives the life it losses.

Table 2. Tensile strength and Elongation at break before and after UV Accelerated weathering

S.no	properties	unit	Tensile Strength Mpa	% Reduction
1	Tensile strength Before UV	Mpa	58.8	0
2	Tensile strength after UV at 50 hrs	Mpa	57.5	2.21
3	Tensile strength after UV at 75 hrs	Mpa	48.6	17.3
4	Tensile strength after UV at 100 hrs	Mpa	48.5	17.5

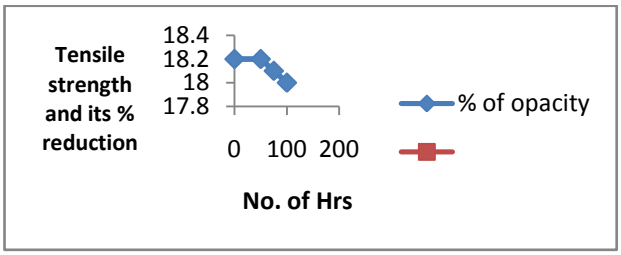

Fig 1:Graph showing change in Tensile strength and its % percentage reduction when exposing to UV

Table 3.Percentage of opacity change before and after UV Accelerated weathering

S.no	properties	% of opacity
1	Before UV	18.2
2	After UV at 50 hrs	18.2
3	After UV at 75 hrs	18.1
4	After UV at 100 hrs	18

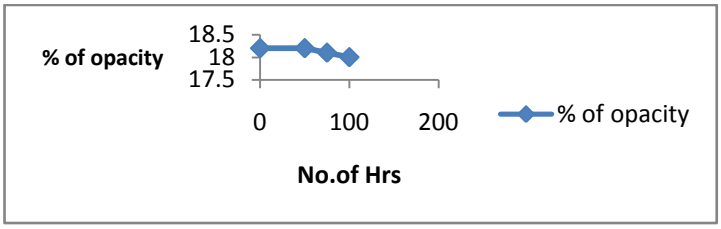

Fig 2: Graph showing % of opacity

Table4.Change in hardness of the sheet before and after UV Accelerated weathering

S.no	Properties	Hardness	% of Reduction
1	Before UV	80	0
2	After UV at 50 hrs	78.8	2.25
3	After UV at 75 hrs	78	2.5
4	After UV at 100 hrs	75	3.75

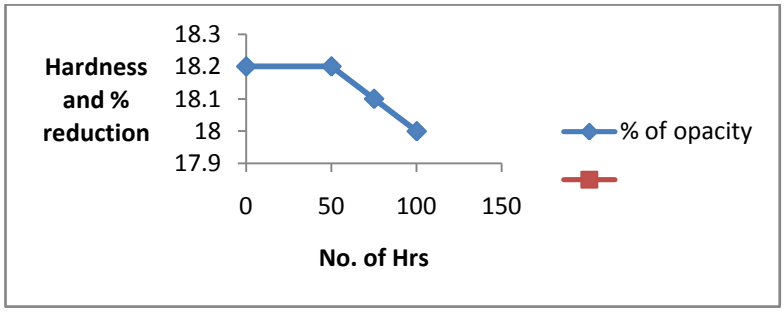

Fig 3: Graph showing change in hardness and its % percentage reduction when exposing to UV.

3.3 Surface morphology:The specimens subjected to various conditions have been observed for their micrographs by Scanning electron microscope (SEM). Specimens exposing to UV and after exposing to UV rays are shown in fig 4 and 5 respectively.

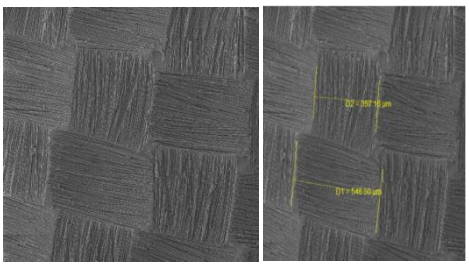

Fig 4: Before exposing to uvFig 5: After exposing to uv

4. Conclusion:

As the experiment is carried for Uv-weatherometer on Jute fiber reinforced by E-glass fiber, it should have arrived at the accompanying conclusions on:

The tensile strength of composite material is evaluated after exposing to UV test. It is informed that the strength is reduced with the increase of uv exposure period as shown in fig 1.

Similarly % of opacity and hardness are also reduced with the increase of UV exposure as shown in fig 3 and 5 due to loss of binding property between them.

While coming to the weathering resistance of UV-B lamp according to ASTM G 154 show significant differences in retained strengths during water spray. The ASTM G 154 shows the closer retained strength to combination UV under light on during water spray and proves the polymer has long life.

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