Tensile and Impact Ananlysis of Coated and Uncoated Kenaf Fiber Reinforced Composite

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ABSTRACT

The fiber reinforced composites are increasingly getting used in the aerospace, vehicle, plastic and mineral processing industries, as a result of their stepped forward strength, stiffness and tensile residences. The broadly used reinforcing fibers are kenaf, jute, kemp and many others inside the form of strips. The main purpose of this paper is to design and analyze the mechanical homes of the kenaf fiber reinforced composite. The composition of the fiber and resin is various and tested for the various mechanical houses like impact strength, flexural power, tensile strength etc. The composite is manufactured by using changing the orientation of the fibers and growing the impact energy. The composite is tested manually through various checking out apparatus and additionally analyzed through the design software program like Ansys. On this paper it's far aimed to enhance the effect electricity of the composite via varying the fiber length. The composite is also lined with the hydrogen peroxide solution and the tests are performed. The experimental consequences of the coated and uncoated composites are compared.

KEY WORDS: Composite materials, Kenaf fiber, Impact testing, Hydrogen peroxide.

1. INTRODUCION

A fiber-reinforced composite (FRC) is a composite building material that consists of three additives: (i) the fibers because the discontinuous or dispersed segment, (ii) the matrix because the continuous phase, and (iii) the first-class interphase region, additionally referred to as the interface (Gopinath, 2016). This is a form of advanced composite organization, which makes use of rice husk, rice hull, and plastic as components. This generation entails a way of refining, mixing, and compounding herbal fibers from cellulosic waste streams to shape a excessive-strength fiber composite material in a polymer matrix (Ishak, 2010). The particular waste or base raw substances used on this instance are those of waste thermoplastics and various categories of cellulosic waste along with rice husk and noticed dirt (Kotresh Sardar, 2014).

FRC is high-performance fiber composite done and made viable with the aid of move linking cellulosic fiber molecules with resins within the FRC fabric matrix through a proprietary molecular re-engineering process, yielding a manufactured from first rate structural homes (Mohd Yuhazri, 2011).

This feat of molecular re-engineering selected physical and structural homes of wood are efficaciously cloned and vested inside the FRC product, similarly to other essential attributes to yield overall performance properties advanced to contemporary wood (Jeyanthi and Jancirani, 2012). This material, unlike other composites, can be recycled up to 20 instances, permitting scrap FRC to be reused time and again. The kenaf fiber and jute fiber with epoxy improves the tensile, flexural and effect strength of the substances (Jong Sung Won, 2015). Herbal fibers are chosen as reinforcement because they are able to reduce the device wear when processing, breathing irritation and serving as options for artificial fiber composites in the growing worldwide power crisis and ecological risks (Mohd Suhairil Meona, 2012).

2. MATERIALS AND METHODOLOGY

Kenaf: Kenaf-*Hibiscus cannabinus*, is a plant inside the Malvaceae own family. *Hibiscus cannabinus* is within the genus Hibiscus and is mostly originate to south region of Asia, even though its original foundation is unknown. The name additionally applies to the fiber received from this plant. Kenaf is one of the joined fibers of jute and exhibits same properties.

The fibers in kenaf are found inside the bast (bark) and center (wood). The bast constitutes 40% of the plant. "Crude fiber" separated from the bast is multi-mobile, inclusive of numerous man or woman cells caught collectively. The individual fiber cells are about 2–6 mm lengthy and slender. The cell wall is thick (6.3 µm).

The core is about 60% of the plant and has thick (˜38 µm) however brief (0.5 mm) and skinny-walled (3 µm) fiber cells. Paper pulp is constituted of the entire stem, and consequently includes sorts of fibers, from the bast and from the middle. The pulp high-quality is just like hardwood (Saiful Izwan Abd Razak, 2013).

The kenaf fibers are bast fibers extracted from the plant and smashed hard to get moisture out from the fiber after which dried inside the daytime at better temperatures for 2 three weeks. The fibers were separated from their stalks with the aid of using water retting for approximately 20 days. After the water retting process is finished, the fibers were then cleaned with water and making from moisture underneath the sunlight. Then the fibers are passed thru the alkali treatment (Saba, 2015).

Alkali Treatment: Fibers are treated with the 6% NaOH solution. Fibers were immersed in the 6% NaOH solution for one complete day at the room temperature. Fibers were then making into free moisture in the absence of sunlight until the fibers are dried completely. The fibers are then separated and used for the manufacturing of the composite (Naveenkumar, 2015).

Preparation of Composite: The composite is manufactured by way of the hand lay-up method. A solid iron die of three hundred mm x 300 mm x 4 mm is made. After the moulds of required dimensions had been organised, wax become carried out to the internal sides of the moulds for easy release of the composite without sticking to the mold partitions. Then hardner combined with epoxy. So matrix become prepared. The epoxy and the hardener ratio have been maintained at 10:1 (Olusegun David Samuel, 2012). The suitable amount of fibers turned into located such that epoxy mixture absolutely spread over the fibers after initial layer of the mold become full of the epoxy resin and hardener aggregate over again, epoxy combination turned into poured at the fiber. As a result, the beginning and ending of the layers had been of epoxy resin. (Seong Ok Han, 2012)

A plastic releasing company was located at the top of the uncured mixture. Earlier than application of compression, efforts were made to avoid form bubbles using curler. Then the compression strain of 0.05 MPa became carried out and cured for whole day at room temperature evenly. On this, specimens containing 40% vol. fractions of fiber had been organized. The job is prepared in line with ASTM D 3039-seventy six is applied for carrying out checks (Suhad Salman, 2015) and shown in Figure.1.

Coating: After the specimens have been made in line with the assessments. Some of the specimens are covered with the Hydrogen Peroxide method to evaluate the outcomes of the mechanical testing of the composites among the covered and the uncoated composites.

Mechanical Tests: Test specimens were drawn from the composite plates as according to the ASTM general for Tensile take a look at, Flexural check and Impact check are shown in Figure.2, Figure.3 and Figure.4 respectively.

Tensile Test: Tensile testing becomes performed in a time-honoured checking out gadget UTE-60 with a 600 kN capability as in step with ASTM D 3039. For ASTM D3039 the test pace may be determined with the aid of the material specification or time to failure (1 to 10 mins). A standard check speed for trendy test specimens is two mm/min (0.05 in/min).

Flexural Test: Training of the flexural check specimens as in keeping with the ASTM D790 standards and 3-point flexure check is used for trying out. The deflection of the specimen is measured and the assessments are performed at a mean relative humidity of 50% and the temperature about 35ºC. From the testing device the flexural hundreds also the displacements are monitored for all of the test samples.

Impact Test: The effect take a look at specimens are prepared in step with the required size following the ASTM-A370 preferred. For the duration of the checking out manner, the specimen must be loaded inside the trying out machine and let's in the pendulum until it fractures or breaks. At some point of impact test, the impact force wanted to break the fabric may be measured easily and may be used to degree the durability of the fabric and the yield electricity. The final results of strain price on fracture and ductility of the cloth may be analyzed using the impact take a look at.

3. EXPERIMENTAL RESULTS

In this take a look at the composites are fabricated and their effect on tensile, effect and flexural homes are evaluated and in comparison. The effects are compared among the lined and uncoated composites.

Tensile Graphs: The Tensile properties of the composite samples are examined with UTM and the strain-stress curve is plotted. The typical graph generated immediately from the system for tensile check for kenaf fiber strengthened composites are shown in Figure 5, Figure 6 and Figure 7.

Analysis Result: The composite is also designed the use of the modelling software CATIA v5 with the various orientations of the fiber inside the composite. It's far then analysed the use of the evaluation software program ANSYS with the use of the loads for the numerous tests and the effects are acquired. The analytical consequences of the composites are in comparison with the experimental effects.

Figure.1. Kenaf fiber composite material

Figure.2. Tensile test specimen

Figure.3. Flexural test specimen

Figure.4. Impact test specimen

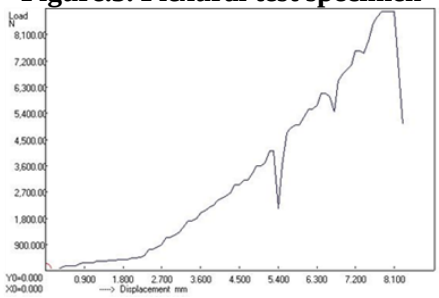
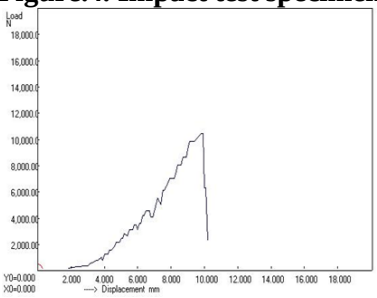
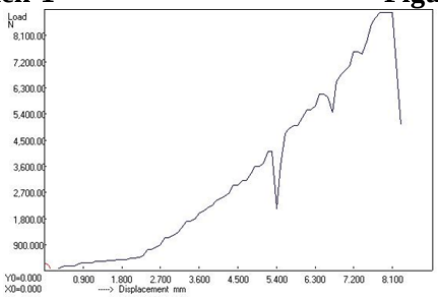


Figure.5. coated specimen-1



Tensile strength = 116 N/mm²

Figure.6. coated specimen-2



Tensile strength = 131.62 N/mm²

Figure.7. uncoated specimen-1

Table.1. Experimental Results

Test Parameters	Coated	Coated	Uncoated
Tensile Strength, N/mm²	116	131.62	81.845
Flexural Strength, N/mm²	132.24	142.42	103.4
Impact, J/m	9.0	9.25	8.1

4. CONCLUSIONS

The kenaf fiber strengthened epoxy composites are prepared through hand layup method. The herbal fiber composites are subjected to mechanical testing like tensile, flexural and impact take a look at. Relies upon at the obtained outcomes, the subsequent conclusions are derived. The consequences are derived for both coated and uncoated composites.

It is seen that the coated composites have extra strengths than uncoated composites. The effects imply that the hydrogen peroxide covered kenaf fiber strengthened epoxy composite substances display most tensile strength 131.62 N/mm^2. The coated kenaf fiber bolstered epoxy composites are successful of having most flexural energy of 142.42 N/mm^2.

The most effect power is received for the coated kenaf fiber beef up epoxy composite and has the value of 9.3 J/m. The composite is also designed and analyzed the usage of the design and the analysis software program, the consequences are acquired. The experimental effects and the analytical results of the kenaf fiber reinforced epoxy composite are verified and as compared.

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