Crash Test Analysis on Natural Fiber Composite Materials for Head Gear

B. Murali1*, B. Vijaya Ramnath2 and D. Chandramohan3

1Department of Mechanical Engineering, Vel Tech, Avadi, Chennai - 600062, Tamil Nadu, India
2Department of Mechanical Engineering, Sri Sairam Engineering College, Chennai-600044, Tamil Nadu, India
3Department of Mechanical Engineering, Hindustan Institute of Technology and Science, Chennai-603103, Tamil Nadu, India

Keywords: Ansys, Bio Polymers, Hemp, Jute, Kenaf, SEM

Abstract

Objectives: In this analysis, natural fibers like, Jute, Kenaf and hemp; Jute and Hemp (mixture) Hemp and Kenaf (mixture), Jute and Kenaf (mixture) are invented with bio epoxy stick abuse forming system. This work, affects quality of Hemp and Kenaf (mixture), Jute and Kenaf (mixture) and Jute and Hemp (mixture) composite at dry and wet conditions were examined. Affect check were directed Izod affect testing machine and the little structure of the examples are checked by the Scanning magnifying instrument and contrast the leads with Ansys. Methods/Statistical Analysis: A synthetic check could be a subjective or quantitative strategy intended to demonstrate the presence of, measure, a substance or unit with the assistance of a chose compound specialist. The synthetic testing was performed in both sulphuric. The bits of the fiber strengthened polymer composite were initially weighed and after that drenched in the corrosive for around 24 hours. The pieces were then were made to a temperature of around 105°C and again weighed. The outcome uncovers the erosion resistance of the mixture polymer composites. Findings: Fiber-strengthened compound composites have contend a predominant parent for an extended time in an exceedingly style of uses for high particulate quality and modulus. The fabricate, utilize and expulsion of antiquated fiber-reinforced plastic, now and again made of glass, carbon or aramide fibers-reinforced thermoplastic and thermo-setting gums zone unit considered fundamentally on account of ecological issues. By characteristic fiber composites we tend to mean a material that is reinforced with strands, particles or platelets from regular or renewable assets, in refinement to for instance carbon or aramide filaments that should be integrated. The aftereffect of strands on effect quality for the examples prepared for each dry and wetness conditions. This check are regularly utilized as quick and basic inner control look at to work if a texture meets particular effect properties or to match materials for general sturdiness. Application/Improvements: Mixture fiber composites show halfway weak nature of break in view of the nearness of hemp strands. So by examining the protective cap display, and Experimental Results, it’s demonstrated that common fiber supported stuff of jute and hemp Hybrid material elements a property quality for the apparatus of Motor cycle Safety head protectors.

1. Introduction

These days, the normal filaments like Hemp, Kenaf and hemp; Jute can possibly be utilized as a trade for glass or diverse old support materials in composites. Distinctive advantages grasp thickness, high sturdiness, tantamount particular quality properties, lessening in device were, simple detachment, little vitality of creation. Composites square measure materials that contain heavy load conveying material (known as reinforcement) embedded in weaker material (known as matrix) one. Fortification gives quality and unbending nature, serving to bolster
auxiliary load. The framework, or fastener (natural or in-natural) keeps up the position and introduction of the support two. They require high particulate properties like solidness, effect resistance, adaptability, and modulus. Moreover, they’re open in gigantic sums, and square measure renewable and perishable. Distinctive intriguing properties grasp low esteem, thickness. Employments of those filaments fulfill each monetarily and biological interests. The present commitment reports use of untreated Hemp, Kenaf and hemp; Jute filaments as strengthening fillers for bio epoxy stick as network for the essential time. The Jute and Hemp (mixture) Hemp and Kenaf (mixture) and Jute and Kenaf (mixture) fiber-fortified compound composites were prepared exploitation hand shaping procedure.

2. Materials and Methods

2.1 Chemical Treatment

The strands are little grained. At that point the filaments are clean usually in clean running water and dried. Once sufficient drying of the filaments in conventional shading for a few hours, the strands are taken and splashed inside the prepared NaOH solution. Dousing is dole out for different time interim’s depending upon the quality of fiber required. Amid this review, the filaments are splashed inside the determination for 3 hours. Once the filaments are taken out and washed in running water, these are dried for one more two hours. The filaments are then taken for resulting manufacture strategy particularize the Pro-casting technique. And furthermore the materials are gathered from various divisions as appeared in table one.

2.2 Moisture Absorption Test Procedure

Affect examples according to ASTM principles were cut from the made-up plate. Edges of the specimens were fixed with polyester rosin and subjected to wet ingestion. The composite examples to be utilized for wet ingestion investigate were first dried in partner degree air kitchen apparatus at fifty ºC. At that point these adopted composite examples were inundated in water at thirty ºC for concerning five days. At normal interim’s, the examples were off from water and wiped with paper to dispose of surface water and weighed utilizing an advanced adjust of 0.01mg resolution. The specimens were inundated in water to permit the continuation of regular activity till immersion point of confinement was come to Impact Test.

Un-indent Izod affect investigate per ISO method is taken after to seek out the vitality consumed by each molecule inside the composites. The consequence of strands on effect quality for the examples prepared for each dry and wet conditions. Effect might be a solitary reason investigate that measures a materials imperiousness to affect from a swinging mechanical assembly. Effect is delineated on the grounds that the mechanical vitality required to stare break and proceed with the crack till the example is broken. This investigate is utilized as quick and basic inward control verify whether a texture meets particular effect properties or to check materials for general sturdiness as appeared in figure one.

3. Results and Discussions

The effect of filaments on effect quality for the examples prepared for each dry and wet conditions are indicated figures. Hemp and Kenaf (mixture) and Jute and Kenaf (half and half) ingest a great deal of vitality on effect stacking conditions each inside the dry also as wet conditions. The half and half composites demonstrated generally higher execution, as demonstrated by the micro-graphs taken for the broken Hemp, Kenaf, Jute, and mixture composites as appeared in beneath figures. The ascent inside the effect quality may well be found for Kenaf, Hemp, Jute, and mixture fiber composites. The greater level of fiber fall back, which is found inside the example made-up by half and half fortification, brings about prevalent effect quality. The clarification may well be the decreased fiber crossing over effect resulting from lower fiber fallback. The whole breaking of the fiber rather than fallback is found through SEM examination. What’s more, along these lines the effect quality outcome for crossover composite fiber as appeared in table two.

Figure-2 demonstrates that filaments are all around tied down inside the grid and a truly bit of particulate are compel out. The broken surfaces are smooth and clear.
This is regularly decided due to the weak way of the bio epoxy grid. It might be over that the break in the principle occurs inside the network due to next to no void arrangement inside the center of the half and half example and wetness nearness inside the material.

**Figure-3** indicates quality and modulus happened for the composites in wetness assimilation conditions. It's conjointly important to notice that the effect of wetness ingestion on the mechanical properties of the composites depends capably on the temperature, fiber substance and time of introduction.

**Figure-4** indicates fiber uncovering enter bound spot, once load is connected on the example, owing to less holding vitality between Hemp/jute and furthermore the network. It pushes the particulate-out while stacking, though it is enhanced once treating with salt answer.

**Figure-5 and 6** demonstrates the nearness of next to no pits between material implies that at the surface holding between the filler and grid compound is poor and frail. Since the filler substance will build, the ineffectively ensured interfaces and firmness of the filler affect the malleable property (decreased quality and overstated modulus). Improved surface holding winds up in enhanced elastic correctly infer-able from appropriate inter-mixture size connection of Kenaf and red tawny and also wet condition. It enhances higher surface trustworthiness.

**Figure-7** demonstrates fiber or molecule haul out from the network inside the nearness of a heap is a pointer of absence of grip among fiber and grid and will expand surface hardness of break surface. These perceptions were conjointly affirmed by effect investigate comes about.

3.1 The Crash Flow Analysis of Helmet

The head protector show that has planned inside the CATIA v5 bundle is to configure and later it's exchanged to the ansys bundle and work the cap display. The entire a piece of head protector is fit with space work with quadrilateral segment frame as show inside the figure.

The crash investigation of the engine cycle protective cap sculptural inside the catia bundle is outside to ansys and tetrahedral Meshing is connected. Fine work of the article offers remedy prompt to the investigation half. An inflexible question is made over a stature of 2500 mts separated frame the cap that is demonstration to be as a protest be conceived on the protective cap. Along these
lines the texture properties of the fiber fortify composite fiber is connected for the different investigate examination of AS4/Polyphylethelyn plastic material acquired from the writing review. The most extreme anxiety levels got inside the protective cap crash stream examination is arranged. What's more, subsequently the outcome from LS dyna investigate examination for fiber composite materials is appeared in figure 8,9,10.

Figure 8. Kenaf and Hemp Hybrid composite material crash test analysis on helmet.

Figure 9. Jute and Hemp Hybrid composite material crash test analysis on helmet.

Figure 10. Jute and Kenaf Hybrid composite material crash test analysis on helmet.

Figure 8-10. Result from LS Dyna Crash test Analysis for Natural fiber Composite Materials.

Systematic Result it’s demonstrated that engine cycle protective cap displayed inside the CATIA has given a most heap of 2500 N stack affect at fifty km/h speed crashes the head protector show. The crash stream investigation of the engine cycle head protector sculptural inside the CATIA bundle is remote to ansys and tetrahedral Meshing is connected. Fine work of the article offers rectify prompt to the examination half. Furthermore, finally result got in LS dyna crash examination is appeared in table three.

| Table 1. Materials |
|---------------------|
| **Materials** | **Type** | **Supplied by** |
| Matrix | Bio epoxy resin Grade 3554A | Lab chemicals, Chennai. |
| Catalyst | Hardener Grade 3554B | Lab chemicals, Chennai. |
| Releasing agent | Poly vinyl acetate | Lab chemicals, Chennai. |
| Reinforcement Hemp & Jute (hybrid) | Particle natural fibers | India especially in South India regions |

| Table 2. Impact Strength Result for Composite Fiber |
|---------------------|
| **CONDITION** | **IMPACT STRENGTH (joules/mm²)** |
| | HYBRID OF JUTE AND KENAF | HYBRID OF HEMP AND KENAF | HYBRID OF HEMP AND JUTE |
| without moisture | 0.23125 | 0.258333 | 0.17604 |
| without moisture) | 0.244792 | 0.266667 | 0.19375 |

| Table 3. Result obtained in LS Dyna Crash Analysis |
|---------------------|
| **Applied for crash test** |
| **Materials** | **Stress** |
| Kenaf and Jute (Hybrid) | 6.40MPa |
| Hemp and Jute (Hybrid) | 6.67 MPa |
| Kenaf and Hemp (Hybrid) | 6.37 Mpa |
| As4 polyphenylene sulphide | 4.36 MPa |

4. Conclusion

Un-scored Izod affect check according to ISO methodology is taken after to seek out the vitality consumed by each molecule inside the composites. The aftereffect of strands on effect quality for the examples prepared for each dry and wet conditions. Hemp and Kenaf (half and half) and Jute and Kenaf (mixture) ingest extra vitality
on effect stacking conditions each inside the dry furthermore as wet condition it demonstrates their fragile nature however Hemp and Jute (mixture) that demonstrates its malleable nature by assimilate less vitality on effect stacking conditions. At that point from the test investigation of Hybrid composite materials, Jute and Hemp half and half stuff fuses a higher quality and trademark properties to trade the As4/polyphenylene sulfide Plastic Helmets. At last this paper ended that one in everything about least complex materials is Hemp and Jute (mixture) is utilized for make the top apparatus.

5. References

1. ASTM D 695 – 02: Standard Test Method for Compressive Properties of Rigid Plastics. Annual Book of ASTM Standards. ASTM International, West Conshohocken; 2013 Apr.
2. Ramnath BV and Manickavasagam VM. Determination of mechanical properties of intra-layer abaca-jute-glass fiber reinforced composite. Materials and Design. 2014; 60:643–52. Crossref
3. Roe PJ and Ansell MP. Jute reinforced polyester composites. Journal of Materials Science. 1985; 20:4015–20. Crossref
4. Saheb D. Nabi JP and Jop. Natural fiber Polymer composites: A review. Advances in Polymer Technology. 2007; 18:351–63. Crossref, Crossref
5. Sebe G, Cetin NS, Hill CAS and Hughes M. RTM hemp fibre-reinforced polyester composites. Applied Composite Materials. 2000; 7:341–9. Crossref
6. Shah AN and Lakkad SC. Mechanical properties of jute reinforced plastics. Fibre Science and Technology. 1995; 15:41–6. Crossref
7. Murali B and Mohan DC. Chemical treatment on hemp/polymer composites. Journal of Chemical and Pharamaceutical Researcch. 2014; 6(9):419–23.
8. Kalita BB and Gogoi N. Properties of ramie and its blends. International Journal of Engineering Research and General Science. 2013; 1(4).
9. ASTM D 638 – 03: Standard Test Method for Tensile Properties of Plastics. Annual Book of ASTM Standards. ASTM International, West Conshohocken; 2007.
10. Chakravarety AC, Sen SK and Dasgupta PC. Studies on ramie-fiber the effect of gum content on the physical properties of Ramie fiber. Journal of Textiles Association. 1991; 33:73–79.