EXPERIMENTAL INVESTIGATION OF E-GLASS AND KENAF FIBRE WITH EPOXY RESIN

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Abstract - *The use of natural fibers in composites has exaggerated in recent years because of their light-weight, non-abrasive, flammable, non-toxic, low value and perishable properties. However, compared to synthetic fibers, the mechanical properties of natural fibers are lower. The inclusion of synthetic fibers could therefore improve the performance of natural fiber-based composites. The demand for hybrid composites (natural + synthetic fiber) is increasing due to recent advances in construction, automotive, household, military and other industries. In this job, hybrid composite is prepared with Bisphenol unsaturated polyester resin polymer matrix using untreated Kenaf fiber and E-glass fiber reinforcement. Kenaf / fiber glass hybrid composites were manufactured using a mixture of hand-laying techniques. Prepared composites were evaluated for compression, flexural and impact strength (Izod test) as per ASTM D3410, ASTM D790 and ASTM D256, respectively. Harness (Brinell) and water absorption tests were also carried out. Water absorption tests were conducted in two environmental conditions including sea water and distilled water. Results stated that the mechanical characteristics of kenaf fiber were reduced after the moisture had penetrated the composite.*

Key Words: **Kenaf fiber, E-Glass Fiber, Epoxy resin, Natural fibers.**

1. INTRODUCTION

Now-a-days, the world is focusing on the new class of materials that are biodegradable in nature. Natural fiber composites attract the attention of many researchers and engineers because they offer low density, low cost, low environmental impact and improved mechanical properties. They are used in the fields of automotive, ship building, food packaging, aerospace and construction, etc. The most frequently used in composites are natural fibers such as flax, cotton, hemp, jute, kenaf, sisal, banana, ramie, etc. These natural fibers, despite their benefits, have poor resistance to moisture resulting in fiber swelling. However, this can be overcome by hybridizing natural fibers with synthetic fibers. This approach not only enhances the mechanical properties but also improves the moisture resistance of the hybrid composite.

The natural fiber used in this study is Hibiscus cannabinus. This plant belongs to the Malvaceae family and is popularly known as Kenaf. They are mostly grown in Asian countries. Kenaf has a single, straight, branchless stalk. It is extracted from the outer fibrous bark. Due to their low cost and better flexural strength, they are used to make ropes, bags, rugs and paper. E-Glass is the synthetic fiber used. This fiber is a material made of extremely fine glass fibers. They provide advantages such as light weight, high tensile strength and excellent insulating properties, which have a wide range of applications in the fiber reinforcement industry. Current work is directed towards the manufacture of kenaf and glass fiber hybrid composites using an epoxy matrix. The variations in mechanical properties (Compression, Flexural, hardness, impact and water absorption) are studied.

The study of mechanical properties of Kenaf and Fiber glass Hybrid Composite laminates by Hand layup method was investigated by

Z. Salleh, et al. [1]. Short, Long fiber and powder fiber are used. Variation of the tensile strength of distinct kinds of fibers has been researched. Test findings show that the greatest tensile strength and tensile modulus is discovered for lengthy hybrid fiber composites. From the SEM assessment, the surface failure is due to the fracture of the matrix, the pull out of the fiber, the debonding of the matrix and the fracture of the fiber.

MohdSuhairilMeon, et al. [2]used high density Polyethylene (PE) and polypropylene (PP) separately to prepare two sets of short kenaf composite. The kenaf fibers were treated with 3%, 6% & 9% of NaOH for a day and then dried for 24 hours at 80o C. The tensile properties of treated kenaf were improved when compared with the untreated kenaf fibers. Further coupling agents like MAPP, MAPE have amplified the tensile properties of both treated and untreated cases.

S Sivasaravanan, et al. [3] made an investigation on glass fiber/epoxy/nano clay composite by varying Nano clay from 1 to 5 wt% by hand layup process. E- Glass fiber is of bi-directional: 45o orientation is used. The average value of

5% wt of nano clay showed good impact results when compared to the other combinations used.

A. Atiqah, et al. [4] developed kenaf –glass reinforced unsaturated polyester hybrid composite. Kenaf and glass fibers are used in mat form. The kenaf fiber was treated with 6% NaOH using Mercerization method for 3 hours. The test results showed that high tensile, flexural and impact strength were obtained using treated kenaf with 15/15 v/v kenaf/glass fibers. The adhesion between the matrix and surface of fiber was enhanced, which plays key role in improving the mechanical properties of KG- UPE hybrid composites. The development of hybrid composite using jute and E- glass mats reinforced with epoxy (LY-556) resin and HY951 hardener is carried out by M. R. Sanjay, et al. [5]. Laminates were prepared by varying the both mat layers. The test results show that hybrid composite has better mechanical properties and leads to increase of utilization of natural fibers in various applications.

2. EXPERIMENTAL PROCEDURE

Materials: The reinforcing materials used are E-Glass fiber and Kenaf fibers. Epoxy resin (LY 556) and Hardener (HY 951) is used as the matrix material.

Fabrication: Hand layup technique is used for the preparation of the composite. The mold is produced of wood in sizes as specified in the ASTM Standards for Specimen Pre-Parathione. The OHP sheet is removed and the release agent is applied over it and is equipped with the inside of the mold and permitted to dry. A glass beaker and a glass rod or stirrer shall be removed and well washed with running water and then with hot water. The calculated amount of epoxy resin and the measured amount of hardener (ratio 10:1) are then added to the breaker and the blend is stirred for almost 25 min. The reason behind this stirring is to produce a homogeneous mixture. After the mixture is finished, the calculated quantity of fibers (ratio 1:1) is added and the stirring process is continued for the next 45 min. Then the mixture is poured into the mold and gently rammed for a standardized settlement.

Fig -1: Fabrication plate

3. CHARACTERIZATIONS OF COMPOSITE MATERIALS

3.1 Compressive test

The ductile experiments were conducted by the ASTM D 3039 standard of the Mechanized Universal Testing Machine. The stacking course of action for the instance and the picture of the device used were shown in the figure. Examples with length measurements of 300 mm and width of 25 mm have been used. The experiment was carried out at a crosshead velocity of 5 mm/min using a load cell of 10 kg. For each situation, 3 examples were used and the normal quality was taken into account. The compressive quality is usually obtained through the use of UTM compressive test techniques.

3.2 Flexural and Impact Test

The flexural quality of the composites was determined by the three-point twisting technique. It tends to be finished in the adapted UTM machine as per ASTM D790. The stacking course of action for the instance and the picture of the device used were shown in the figure. All the composite examples were of a rectangular shape with a length of 80 mm x 15 mm x 5 mm. Trials were conducted at a crosshead velocity of 0.5mm / min. At that stage, the flexural quality was determined to use a straight forward minute outline of the fundamentally bolstered bar at the primary problem load. Effect quality was determined by the Izod Effect Test using examples of measurements.

4. RESULT AND DISCUSSION

4.1 Impact strength

The variety of effect quality with the fiber content, if there should be an occurrence of Prosopis juliflora composite is displayed in the figure. For this situation, the E-Glass and Kenaf fiber composites displayed better sway properties. The effect quality increments with the expanding volume part of filaments, arriving at a most extreme incentive at 30%. Past 30%, the effect quality demonstrates a diminishing pattern. The most extreme effect quality of the composites fluctuates between 1.75 Joules to 2.3 Joules. Antacid treated E-Glass and Kenaf fiber indicated improved effect quality.

4.2 Compressive strength

The variety of compressive quality with the fiber content on the antacid treated composites has appeared in the figure. The E-Glass and Kenaf fiber composite material were tried and the compressive quality was determined. Three examples were tried, the normal compressive quality was accounted for. The compressive quality was expanding relentlessly up to 30% and past that, the change was negligible. The compressive quality of the E-Glass and Kenaf fiber from 19.77 MPa to 35.63 MPa.

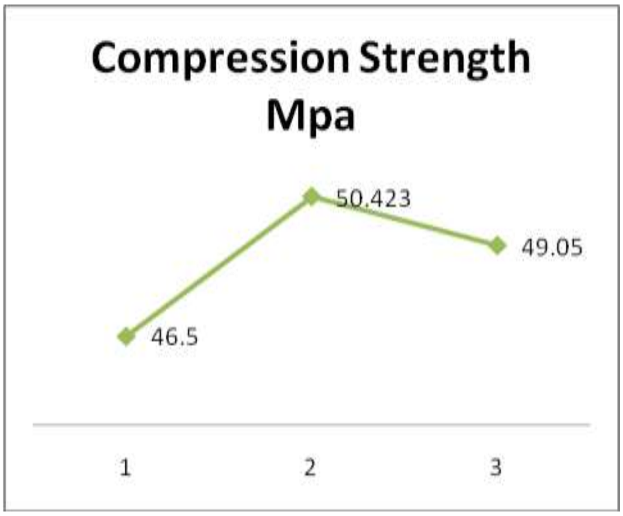

Chart – 1: Compressive Strength

4.3 Flexural strength

Fiber substance and fiber quality are affecting parameters for the quality-related properties of the composite. Subsequently, the quality variety of fiber stacking demonstrated in an unexpected way. This variety in ductile and flexural quality of the composites with 60%,65% and 70 of fiber substance has appeared in figures. These figures obviously show rigidity and flexural quality for half and 60% fiber content. Anyway, there is a decline in both pliable and flexural quality of the composite with 70% fiber content.

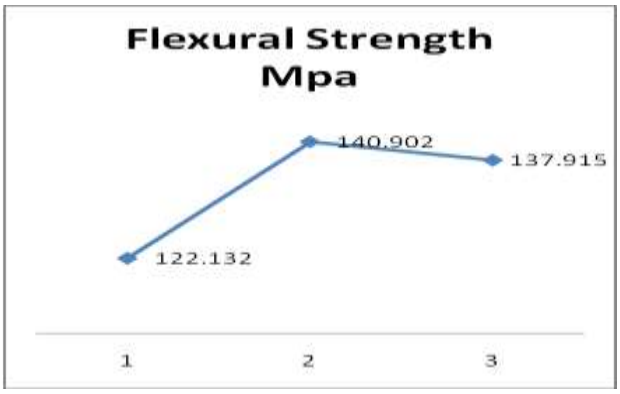

Chart -2 : Flexural strength

5. CONCLUSIONS

The results achieved from PMC of the current work were better in terms of compression strength and hardness than the comparison between kenaf, E-glass and kenaf / E-glass hybrid composites.

The results showed that the addition of E-glass fiber resulted in brittle failure and a greater quantity of kenaf fiber with a small percentage of E-glass fiber resulting in low strength, high ductility and toughness.

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