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Experiment Work on the Effect of Hygrothermal Environment on the Mechanical Behaviour of Natural Fiber Reinforced Epoxy Composites

C.M. Meenakshi, Jeeva Bharathi, S Karthikeyan

Abstract*: *In todays industrial scenario the need for bio degradable matreials in all the fields including automobile and mechanical field is increasing . To satisfy this needs we need to find an alternative natural sorce based materials with similar properties. These natural products attribute can be enhanced using some processing techniques and by adding suitable chemicals. Composite materials are the one which is ruling our world and the need for them is high due ton their high srength to weight ratio. Thus composite research is happening in large number throughout the world, in which the hybrid composite manufacturing has been wide range of investigations. The composites have superior properties like light weight, low density, stiffness, and better mechanical properties. The present work aims on mechanical and thermal behaviours of GKG, GAG, and KGA fibre reinforced epoxy composites. Hand layup method used for fabricate hybrid composite laminates. Work has been carried out to explore the tensile strength, Hygrothermal exposure. For testing and analysis, the specimens are cut as per ASTM standards.

Keyword*: *Composite materials, Hypothermal Exposure

I. INTRODUCTION

Regular fiber fortified composites are as a rule progressively utilized in many building applications like sliding boards, orientation, linkages, bushings. Polymer composite materials regularly have mechanical and physical properties that improve them appropriate for a wide scope of uses than the individual composite parts[1],[3],[5]. The utilization of normal fiber advancement of polymeric materials that are created from manageable and naturally composites ordinarily have a fiber or molecule stage that is stiffer and more grounded than the constant framework stage and serve "composites are multifunctional material frameworks that give qualities not realistic from any discrete material. The NFC removed flax FIBERs have been found to have quality 20% higher than those extricated precisely. The Fabrication Reinforced Composites (FRC) is expanding quickly in the car, aviation and wind vitality parts due to their high explicit quality and modulus. This project work aimed at the usages of Natural plant fibres such as flax, sisal and producing a natural based material composite laminate made from renewable agricultural and forestry feedstock. The natural fibre used will be chemically treated to improves its performance and the laminate will be prepared with this treated fibres. Then it will be subjected to mechanical characterization and analysed[2],[4],[6].

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***** Correspondence Author (s)
CM Meenakshi, Department of Mechanical Engineering, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India. Email: cmmeenakshidhanush@gmail.com
Jeeva Bharathi, Department of Mechanical Engineering, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India. Email: jeevabharathi013@gmail.com
S. Karthikeyan, Department of Mechanical Engineering, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India. Email: karthi.keyan5@yahoo.co.in

II. RELATED WORKS

In 2002, V.P. Della, I. Kuhn, D. Hotza contemplated on Rice husk fiery remains as a substitute hotspot for dynamic silica generation. The investigation was about portrayal of dynamic silica with high explicit surface territory from rice husk fiery debris. They finished up result as rice husk fiery remains in the wake of wearing out at 700 °C for 6 hours will give high measure of silica.

In 2012, A. Gowthami K. Ramanaiah A.V. Ratna Prasad, K. Hema Chandra Reddy, K. Mohana Rao, G. Sridhar Babu considered on Effect of Silica on Thermal and Mechanical Properties of Sisal Fiber Rein-constrained Polyester Composites they directed ductile test, sway test, explicit warmth limit test. They finished up result as expansion of silica with the composite shows great in elasticity, tractable modulus, sway quality and explicit warmth limit than composite without silica content.

In 2014, Elammaran Jayamania, SininHamdanb, MdRezaurRahmanb, MdKhusairy Bin Bakri made near investigation of dielectric properties of half breed normal fiber composites. The investigation was about the jute fiber, and bamboo fiber fortified with polypropylene and polyester on hot press strategy. They directed elastic test, flexural test, and effect test. Jute, bamboo strengthened unsaturated polyester cross breed composites have higher dielectric properties than jute, bamboo fortified polypropylene composites. Henceforth the previous composite is favored than the last mentioned[7],[9],[11].

III. SAMPLES FOR MECHANICAL CHARACTERIZATION

Composite overlays arranged are cut into littler examples of ASTM gauges, for different test methodology and the measured examples are appeared in the approaching figures.

A. Tensile Strength

The ductile test is performed in the widespread testing machine. Numerous composite materials are solid in hub pressure, and pliable test examples must, by their temperament, be grasped in some way for testing. The elastic test is for the most part performed on level examples. The regularly utilized examples for tractable test are the pooch bone sort, i.e., the example has a steady width focal (gage) district, yet is broadened at the finishes to decrease the worries there, by expanding the cross sectional territory (ASTM D 638, 1996).Thus, if neighborhood harm is instigated it ideally won't be sufficient to cause disappointment in these low pressure areas[8],[10],[12].

During the test a uni-hub burden is applied through both the parts of the bargains. The setup of elastic test example appeared in figure 1

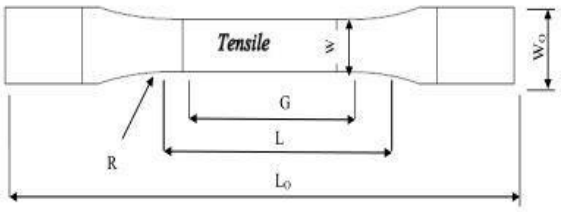


Figure 1- Tensile test Specimen

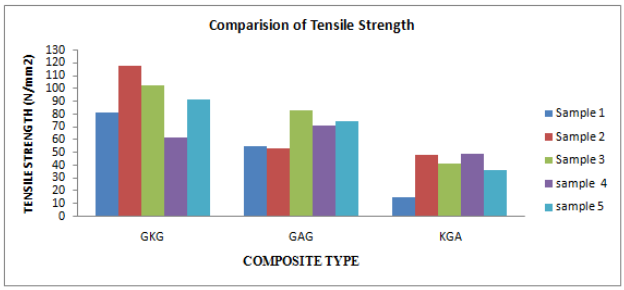
B. Hygrothermal Test

Tests are cut into the size of (165mm × 19 mm × 3 mm) in concurring with ASTM benchmarks D-638. The examples were tried by utilizing hygrothermal testing gear, it comprise of the compartment loaded up with demineralized water of pH worth is 7 and TDS worth is under 300. Thinking about the climate conditions in India, the test temperature for hygrothermal test was fixed as 60 ºC. The examples were weighed independently by utilizing an electronic parity to maintain a strategic distance from abrupt effect on examples we place examples at 44 ºC and when the temperature arrived at 60 ºC the example were screened to the hygrothermal molding for 72 h. After the hygrothermal introduction, the examples were expelled from the compartment and the abundance dampness superficially were evacuated after that weighed again and the measure of dampness consumed are determined. The examples were encased in aluminum foil to stay away from dampness misfortune (or) dampness gain[13],[15],[17].

IV. RESULT AND DISCUSSION

A. Tensile Strength

Composite Type	TENSILE STRENGTH (N/MM2)					
	1	2	3	4	5	Average
GKG	81.78	118.52	102.54	62.44	91.77	91.41
GAG	54.89	53.81	83.12	71.14	74.48	67.48
KGA	14.97	48.38	41.52	49.59	36.79	38.25



B. Hygrothermal Analysis:

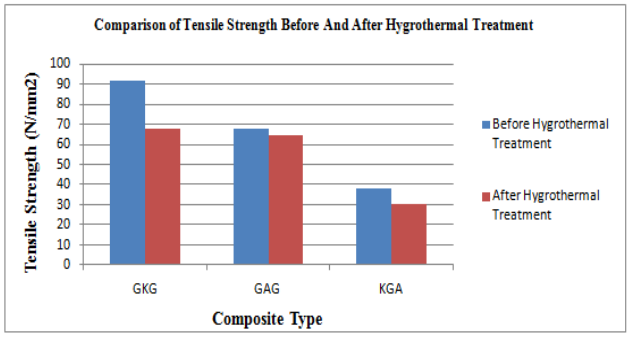
The after Hygrothermal treated tensile test result shows that the hybrid composite is showing equally good performance to glass fiber reinforced composite and natural fiber reinforced composite is also showing positive result. The maximum strength obtained by GKG and GAG when compare to KGA.

Composite type	Tensile Strength N/mm²			
	Sample 1	Sample 2	Sample 3	Average
GKG	68.97	70.37	63.62	67.65
GAG	69.86	63.95	58.92	64.24
KGA	29.88	32.08	28.89	30.28

C. Comparison of Tensile Strength Before and After Hygrothermal Treatment

The Tensile test was carried out before and after Hygrothermal treatment. By comparing both values, we found that the tensile strength decreases lightly after hygrothermal treatment as compare to before hygrothermal treatment in GKG, GAG and KGA[14],[16],[18]. The before and after Hygrothermal treatment tensile strength decrement range very less in GAG, when compare to others. It is inferred that GKG and GAG can be act as promising replacement in structural application demanding nominal tensile strength than KGA[19],[21],[22]. The results are shown in table.

Composite Type	Before Hygrothermal Treatment Tensile Strength(N/MM2)	After Hygrothermal Treatment Tensile Strength(N/MM2)
GKG	91.41	67.65
GAG	67.48	64.24
KGA	38.25	30.28



V. CONCLUSION

Three types of composite laminates are fabricated using hand layup method with Glass, Kenaf and Aloe vera fibers in Epoxy Resins and their mechanical and thermal properties are studied. From the results the following conclusions are made.

- From the tensile strength test it is understood that GKG (Glass/Alovera laminate) is having higher tensile strength compare to GAG and KGA.
- From hygrothermal results, and by comparing the before and after hygrothermal treatment tensile strength , GAG and KGA hybrid laminates shows less strength Reduction.

The overall results shows, the hybridization of natural fiber along with the glass fiber has good impact on the thermal capacity of the composites. Also we found that, if the proportion of natural fibre increased then the thermal ability will be increased.

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AUTHORS PROFILE

C.M. Meenakshi Assistant Professor, Department of Mechanical Engineering, Bharath Institute of Higher Education and Research, Chennai, India.

Jeeva Bharathi Assistant Professor, Department of Mechanical Engineering, Bharath Institute of Higher Education and Research, Chennai, India.

S Karthikeyan Assistant Professor, Department of Mechanical Engineering, Bharath Institute of Higher Education and Research, Chennai, India.