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MECHANICAL PROPERTIES CHARACTERIZATION AND TESTING OF BASALT KENAF CAMEL HAIR WITH GLASS POWDER USING HAND LAY UP TECHNIQUE

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ABSTRACT: Fiber reinforced polymer composites are replacing conventional materials because of its better properties which can be effectively used in various applications. Owing to the lower density of fiber reinforced material compared to metals which lead to the higher strength to weight ratio for the composites. Present day material advancement is assuming a significant part for the development of the items in different fields. Various specialists are looking for primary materials of strength, minimal weight and minimal expense. To achieve more strength and lesser weight, we choose composite materials. The aim of the project is to have camel hair and their hybrids developed by hand lay-up strategy using an epoxy and a hardener. Using above these combinations Basalt+15% Glass Powder, Kenaf + 15% Glass Powder , Camel Hair + 15% Glass Powder, Basalt + Kenaf + 15% Glass Powder, Kenaf + Camel Hair + 15% Glass Powder, Camel hair + Basalt + 15% Glass Powder, Basalt + Kenaf + Camel Hair+15% Glass Powder Testing such as tensile, flexural, impact, and hardness determine the properties of these composite was made the crossover material which are assessed tentatively as per ASTM norms. After which material is best concluded that material design the helmet using the catia software and perform the static analysis using ansys software here observed Von-mises stress, Total deformation, shear stress, strain.

Keywords*:* Basalt, Kenaf, camel fiber, 15% Glass Powder, Fabrication, Testing, ASTM

INTRODUCTION

A composite refers to a material formed by combining two or more distinct materials. A common example of such a composite is a fiber-reinforced polymer (FRP). In the context of FRP, the polymer functions as the matrix while the fibers serve as the reinforcement. The matrix maintains the cohesion of the fibers, enhancing the composite's resistance to damage. Meanwhile, the fibers contribute strength and stiffness to the composite. Composite properties often exhibit anisotropy, implying that they vary based on the measurement direction. For instance, a unidirectional composite will exhibit superior characteristics in the fiber direction compared to the perpendicular orientation. By arranging fibers in a random manner, it's possible to attain nearly isotropic properties within a composite. Polymer matrix composites are referred to as PMCs, while there are also MMCs and CMCs are metal-matrix composites and ceramic-matrix composites, respectively. Composites are a type of material. frequently employed as substitutes for metals due to their reduced weight and comparable or improved strength and stiffness. This proposal focuses solely on the investigation of PMCs.

BASALT FIBER

Basalt fiber is a type of fiber made from basalt rock, which is a hard, dense volcanic rock that can be found in most countries across the globe. It is made by melting the crushed and washed basalt rock at about 1,500 °C (2,730 °F) and then extruding the molten rock through small nozzles to produce continuous filaments of basalt fiber.

Aspects of basalt fiber:

- It is strong and durable. Basalt fiber is stronger than glass fiber and has a higher tensile strength than steel. It is also very durable and can withstand high temperatures and harsh environments.
- It is lightweight. Basalt fiber is lightweight, making it a good choice for applications where weight is a major consideration, such as in aerospace and automotive applications.

Figure: 1 Basalt

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KENAF FIBER:

Kenaf fiber content can vary depending on the variety of kenaf plant, the growing conditions, and the processing method. However, the average kenaf fiber content is about 40%-60%. The bast fibers, which are the long, strong fibers that are used for making textiles and composites, make up about 35% of the total fiber content. The core fibers, which are shorter and weaker fibers, make up the remaining 25%-35% of the fiber content.

Aspects of kenaf fiber:

- High fiber content: Kenaf has a high fiber content, which makes it a valuable resource for making a variety of products.
- Versatility: Kenaf fiber can be used to make a variety of products, including textiles, composites, paper, biofuel, bioplastics, animal bedding, soundproofing materials, and thermal insulation materials.
- Sustainability: Kenaf is a sustainable crop that can be grown without the use of pesticides or herbicides.
- Biodegradable: Kenaf fiber is biodegradable, which means that it will break down naturally in the environment.

Figure 2 camel hair fiber

GLASS POWDER:

Glass powder is not commonly used in fibers, but it can be used in a few specific applications where its unique properties are desired.

Unique properties of glass powder:

- Strong and durable: Glass powder is a very strong and durable material. It is resistant to corrosion and chemicals, and it is also a very lightweight material.
- Good insulator: Glass powder is a very good insulator. It is used in applications such as glass wool insulation and glass beads for noise control.

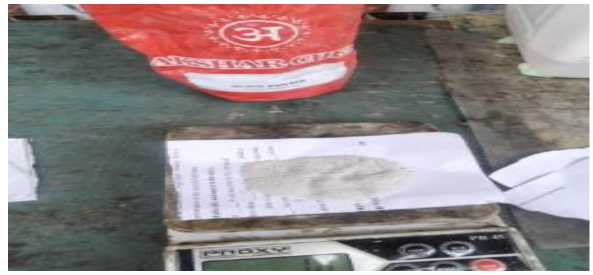

Figure 3: Glass fiber powder

BASIC CLASSIFICATION OF RESINS

1. Examples of thermo sets include Epoxies, polyesters, phenolics, and polyamide.
2. Thermoplastics, such as polyethylene, polystyrene, and polyether–ether Ketone, serve as instances.

When thermo sets undergo restoration, they experience an irreversible chemical transformation. They chemically crosslink and form a structural framework to maintain their shape. Following curing, they do not melt upon heating. Their form remains intact until they begin to degrade at elevated temperatures. In contrast, thermoplastics melt and solidify reversibly with heating and cooling.

EPOXY RESIN:

Epoxy exhibits excellent additive characteristics, along with high mechanical strength, minimal contraction, chemical resilience, high permeation density, low viscosity, and enhanced electrical resistance capacity. Carbon fiber, jute flax, kenaf, and hybrid fibers can all serve as reinforcement options for it.

Figure 4 EPOXY RESIN LY556

LITERATURE REVIEW

1) **Oblisamy Lakshminarayanan, Sanoj Pawar, Basithrahman A, Harshal Diwate, Yash Mane, Omkar Yadav, and Shivtej Rajeshirke** conducted experimental testing on carbon/basalt interwoven fabric to determine its mechanical properties.The interwoven fabric was made by hand-weaving method.Various

mechanical tests, such as tensile, flexural, impact, and hardness, were carried out on the polymer matrix composite according to ASTM standards. Scanning Electron Microscope (SEM) was used to examine the morphology of the fractured surface of the hybrid composite during testing.

2) **M. Ramesha and S. Niranjan** conducted a mechanical property analysis of kenaf–glass fiber reinforced polymer composites using finite element analysis (FEA). The experimental results were compared with the predicted values and a high correlation was observed. The morphology of the fractured surfaces of the composites was analyzed using scanning electron microscopy (SEM). The results indicated that the properties of the hybrid composites were in the increasing trend and comparable with pure synthetic fiber reinforced composites. This shows the potential for hybridization of kenaf fiber with glass fiber.

3) **M. Umashankaran, S. Gopalakrishnan, and S. Sathish** conducted a study on the preparation and characterization of tensile and bending properties of basalt-kenaf reinforced hybrid polymer composites. They used a hand layup technique to fabricate the composites with four different sequence combinations. The results showed that the hybrid composites had improved tensile and bending properties compared to the individual basalt and kenaf composites.

4) **S. Vigneshkannan, R. Neethika, R. Revathy, R. Vetri Selvi, and D. Veera Arthi** conducted an experimental investigation and comparison on the mechanical properties of RCC columns with kenaf and basalt fiber wrapping. The results showed that the fabric fiber provided better strength to the structure. The authors concluded that the use of fabric fiber in RCC columns is a promising technique that can improve the strength and durability of structures.

5) They also noted that the use of fabric fiber is not yet widely implemented in the construction industry, but they believe that this will change in the future as the benefits of this technology become more widely known.

6) **Patthem Chandu and T. Pavan Kumar** conducted a study on the mechanical and water absorption characteristics of jute/basalt reinforced laminate. They performed tensile and hardness tests on the laminates with different fiber orientations. They also performed water absorption tests to study the water absorption percentage of the jute and basalt fibers. SEM analysis was used to study the fiber intactness and surface morphology of the optimum sample. The results showed that the hybridization of basalt fiber and jute epoxy showed greater tolerance to strength. The tensile strength and hardness of the laminates were improved with the addition of basalt fibers. The water absorption percentage of the jute fibers was higher than the basalt fibers. SEM analysis showed that the basalt fibers were more intact than the jute fibers after the water absorption tests.

7) **Ganesh Rajendran and Anand Palaniselvam** conducted a study on the enhancement of mechanical behavior through hybridization of kenaf with basalt fiber in reinforced vacuum bagged polymer composites. They found that basalt fiber reinforced laminates had better properties than kenaf fiber-reinforced laminates and kenaf and basalt fiber hybrids. Laminates with basalt fiber as the outermost layer showed good hardness and impact strength results. Scanning electron microscopy was used to study the failure modes of the fractured composite samples.

8) **K. Mohan Kumar, Venkatesh Naik, Vijayanand Kaup, Sunil Waddar, N. Santhosh , and H. V. Harish** Nontraditional Natural Filler-Based Biocomposites for Sustainable Structures The review paper has made an attempt to present the summary of various works carried out by researchers on the use of nontraditional natural fibers in green composite materials while keeping different engineering applications in the perspective.

9) **Mohd Yuhazri, Y., Phongsakorn, P. T., and Haeryip Sihombing** conducted a study to compare the vacuum infusion and hand lay-up methods for manufacturing kenaf/polyester composites. They found that the vacuum infusion process produced composites with higher strength and lower void content than the hand lay-up process. This makes the vacuum infusion process a more promising method for manufacturing kenaf/polyester composites, as it can produce composites with better properties and is more environmentally friendly.

10)**T. Rohith Kumar, U. Venkata Ramana, A. Arun, and Md. Rameez Rizwan** investigated the tensile and flexural behavior of hybrid fiber composites based on basalt and kenaf fibers. They found that the hybrid composites had improved mechanical properties compared to the conventional single fiber composites. This is because the basalt fibers provide high strength and

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stiffness, while the kenaf fibers provide good toughness and impact resistance. The authors concluded that the basalt and kenaf reinforced hybrid fiber composites have the potential to become a future alternative for the conventional single fiber composites.

11) **Amber Jaiswal, Nehal Akhtar, and Md. Ziaur Haq** investigated the development and mechanical testing of natural hybrid composite materials. They found that the hybrid composite material GKFHC had a lower water absorption rate than the individually woven composite material. This is because the GKFHC composite has a lower cellulosic and hemicellulosic content, which are the components of natural fibers that absorb water. The GKFHC composite absorbed water up to its saturation point, after which no further water absorption occurred.

PROJECT OVER VIEW: OBJECTIVE OF THE PROJECT

1. Specimens preparation using hand layup technique.
2. Cutting specimens according to ASTM standards for tensile, impact, flexural and hardness tests.
3. Conducting the testing for all specimens.
4. Illustrate the better fiber combination from testing results.
5. Obtaining design of Helmet using Catia v5 and then imported in Ansys 16.0 with the better combination.
6. Meshing of design model using ANSYS 16.0.
7. Static analysis performed.
8. Comparing the performance of Basalt+15% Glass Powder, Kenaf+ 15% Glass Powder , Camel Hair+ 15% Glass Powder, Basalt + Kenaf + 15% Glass Powder, Kenaf +Camel Hair+ 15% Glass Powder, Camel hair+ Basalt + 15% Glass Powder, Basalt + Kenaf + Camel Hair+15% Glass Powder.
9. Identification of the suitable material for manufacturing of the helmet and better combination among all specimens.

METHODOLOGY:

Step1: Collecting information and data related to camel fiber, KENAF fiber, basalt and synthetic fibers.

Step 2: preparation of specimens using hand layup technique

Step 3: Conducting tensile, impact, hardness and flexural tests.

Step 4: Plot charts for the results and manual calculations are conducted.

Step 5: Identify better combination among 7 combinations.

Step 6: A fully parametric model of car bumper is created in CATIA software.

Step 7: Model obtained in igs. Analyzed using ANSYS 16.0(workbench), to obtain stress, strain and deformations

Step 8: Taking boundary conditions static analysis.

Step 9: Finally, we compare Basalt+15% Glass Powder, Kenaf+ 15% Glass Powder , Camel Hair+ 15% Glass Powder, Basalt + Kenaf + 15% Glass Powder, Kenaf +Camel Hair+ 15% Glass Powder, Camel hair+ Basalt + 15% Glass Powder, Basalt + Kenaf + Camel Hair+15% Glass Powder with better combination with the results obtained from ANSYS and compared different materials.

PROCESS OF HAND LAY UP TECHNIQUE

- Hand lay-up is the simplest composites molding method, offering low cost tooling, simple processing, and a wide range of part sizes.
- Gel coat is first applied to the mold using a spray gun for a high quality surface.
- When the gel coat has cured sufficiently, roll stock fiberglass reinforcement is manually placed on the mold.
- The laminating resin is applied by pouring, brushing, spraying, or using a paint roller.
- Paint rollers, or squeegees are used to consolidate the laminate, thoroughly wetting the reinforcement and removing entrapped air.

Subsequent layers of fiberglass reinforcement are added to build laminate thickness.

Low density core materials such as end-grain balsa, foam, and honeycomb, are commonly used to stiffen the laminate.

FABRICATION OF COMPOSITE SPECIMENS (HAND LAYUP)

Hand lay-up procedure is the straightforward and least expensive strategy for composite handling. The infrastructural need for this strategy is additionally insignificant .The standard test method for Mechanical properties of fiber-sap composites; ASTM-D790M-86 is used to as per the estimations. The shape is ready on smooth clear film with 2 way tape to the necessary estimation. At that surface form is arranged keeping the 2 way tape on the unmistakable film.

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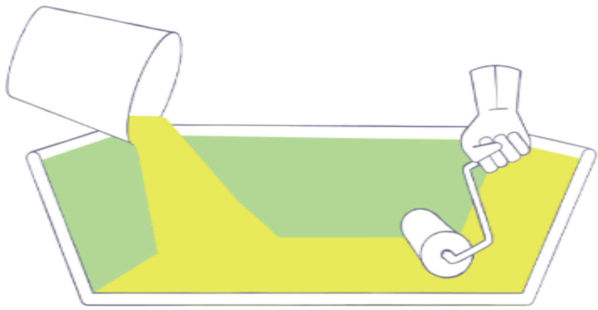

Fig5: FABRICATIONS OF COMPOSITE SPECIMENS

Long fiber support is cut to the shape size and placed on the outside of a thin plastic sheet. The thermosetting polymer in fluid structure is then modified to the appropriate extent with a specified hardener (restoring expert) and poured over the outside of transparent. With the help of a brush, the polymer is evenly distributed. Then second layer of fiber is placed on the polymer surface and another layer of polymer is applied after this is closed with another thin plastic sheet after squeezer is moved with a gentle pressure on the thin plastic sheet to remove air .The consequential mold is cured for 24 hours at room temperature.

After fabrication specimens are cut form sheets according to the ASTM statndards175mm long, 25mm in width and 4.5 mm in thick are fabricated for tensile testing. 100mm long, 13mm width and 4.5 mm in thick are fabricated for flexural testing. 66 mm long, 13 mm width and 3mm thick are fabricated for impact testing.

FABRICATIONS AND EXPERIMENTAL SETUPS

In our nation India, there are sweeping specific mixed bunches of regenerative plants and trees with some fiber content. In them, some are made from the occasions and some are wild plants, creepers, and trees that make in forests and woods. It's obviously true that any material which is in tacky construction is more grounded than in the mass design. Subsequently, these solid fibers are utilized. Pineapple and Agave Americana are vivaciously open in our country that has been utilized as a piece of their restorative construction. Regardless, same business related to this fiber is all that plentifully obliged when stood apart from different fibers. This assessment fuses to investigate the conceivable utilization of fibers in making of new mixed sack of composites for weight passing on structures. The propose of brand name fibers is to broaden the quality. An immense piece of the standard composites are less expensive than the delivered fiber composites.

EPOXY

In present work epoxy LY556 is utilized as framework material displayed in figure.3.1 to manufacture half and half fiber epoxy composites. Epoxy LY556 is picked in light of the fact that it is a one such lattice which is broadly utilized on the grounds that it show low shrinkage, higher mechanical properties, simple creation, great synthetic and dampness opposition, great wet capacity. Epoxy tars are the most generally utilized thermoset plastic in polymer framework composites. Epoxy tars are a group of thermoset plastic materials which don't radiate response items when they fix thus have low fix shrinkage. They likewise have great grip to different materials, great synthetic and natural obstruction and great protecting properties.

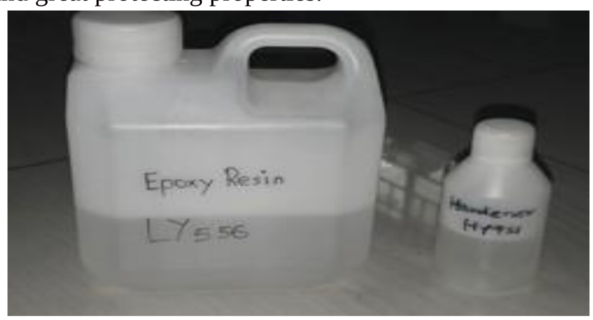

Fig 6: EPOXY RESIN LY556

HARDENER

Hardener utilized for present examination for starting gel development is hardener HY951 which is displayed in figure.3.2. The mix of epoxy LY556 and hardener which fixes at room temperature, astounding glue strength, great mechanical and electrical properties. The proportion of the epoxy and hardener are taken 10:1 that is 10 grams of epoxy and 1 gram of hardener gram of hardener.

Fig7: HARDENER HY 951

SPECIMEN PREPARATION & TESTINGS

FABRICATION OF COMPOSITE SPECIMENS (HAND LAYUP)

Hand lay-up is the most basic and cost-effective form of composite processing. This approach also has a

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low infrastructure need. According to the data, the ASTM-D790M-86 standard test protocol for Mechanical characteristics of fiber-resin composites is used. The mould is cut out of smooth clear film using two-way tape to the appropriate size. The two-way tape on the clear film is used to prepare the mould on that surface.

Long fiber reinforcement is cut to fit the mould size and inserted on the surface of a thin plastic sheet. After that, the thermosetting polymer in liquid form is properly mixed with a prescribed hardener (curing agent) and poured onto the transparent surface. With the help of a brush, the polymer is spread evenly. The second layer of fibre is then put to the polymer surface, followed by another layer of polymer, which is then sealed with another thin plastic sheet after the squeezer is gently pressed against the thin plastic sheet to eliminate air. At normal temperature, the resulting mould is cured for 24 hours.

GLASS POWDER: powder is mixed with epoxy resin and stirred uniformly half an hour and same process is follow to produce GLASS POWDER powder. After fabrication specimens are cut form sheets according to the ASTM statndards175mm long, 25mm in width and 4.5 mm in thick are fabricated for tensile testing. 100mm long, 13mm width and 4.5mm in thick are fabricated for flexural testing. 66mm long, 13mm width and 3mm thick are fabricated for impact testing.

Fig8: COMPLETE SEQUENCE OF PECIMEN MAKING PROCESS

STEPS INVOLVED IN THE FABRICATION OF SPECIMEN:

KENAF fiber supported Epoxy Composite example was created by utilizing hand layup procedure. In this interaction 6 sheets of 300GSM KENAF fiber (230/300 mm) are utilized to get the 4mm thickness. What's more, 10 grams of hardener (HY951) is blended in with 100 grams of Epoxy (LY556) which is utilized as grid in the composite. The thickness of example for tensile, flexural test is 4.5 mm to acquire this thickness a 6 sheets of 15% glass powder and 300GSM KENAF fiber are utilized.

BASALT Fiber supported Epoxy Composite example was created by utilizing hand layup procedure. In this interaction 6 sheets of 300GSM BASALT fiber (230/300 mm) are utilized to get the 4mm thickness. What's more, 10 grams of hardener (HY951) is blended in with 100 grams of Epoxy (LY556) which is utilized as grid in the composite. The thickness of example for tensile, flexural test is 4.5 mm to acquire this thickness a 6 sheets of 15% glass powder and 300GSM BASALT fiber are utilized.

CAMEL HAIR fiber supported Epoxy Composite example was created by utilizing hand layup procedure. In this interaction 6 sheets of 300GSM CAMEL HAIR fiber (230/300 mm) are utilized to get the 4mm thickness. What's more, 10 grams of hardener (HY951) is blended in with 100 grams of Epoxy (LY556) which is utilized as grid in the composite. The thickness of example for tensile, flexural test is 4.5mm to acquire this thickness a 6 sheets of 15% glass powder and 300GSM CAMEL HAIR fiber are utilized.

THE HYBRID BASALT/KENAF WITH 10% OF GLASS POWDERPOWDER

This fiber sheet generated by using of all three main compositions taken in this thesis work that is KENAF/BASALT with 10% of GLASS POWDER commonly used in each layer of a fiber sheet. Totally 6 sheets are required make our desired thickness for testing machinery. Totally 6 layers of 3 layers of KENAF fiber and 3 layers of BASALT fiber are used to make this hybrid composition. Also, 10 % of hardener (HY951) is blended in with 100 grams of Epoxy (LY556) and 15% glass powder which is utilized as framework in the composite. The thickness of the example for tensile test and flexural test is 4.5 mm which is used for testing machinery.

THE HYBRID BASALT/CAMEL HAIR FIBER WITH 10% OF GLASS POWDERPOWDER

This fiber sheet generated by using of all three main compositions taken in this thesis work that is BASALT/CAMEL HAIR with 10% of GLASS POWDER commonly used in each layer of a fiber sheet. Totally 6 sheets are required make our desired thickness for testing machinery. Totally 6 layers of 3 layers of BASALT fiber and 3 layers of CAMEL HAIR fiber are used to make this hybrid composition. Also, 10 % of hardener (HY951) is blended in with 100 grams of Epoxy (LY556) and 15% glass powder which is utilized as framework in the composite. The thickness of the example for tensile test and flexural test is 4.5 mm which is used for testing machinery.

THE HYBRID KENAF/CAMEL HAIR FIBER WITH 10% OF GLASS POWDERPOWDER

This fiber sheet generated by using of all three main compositions taken in this thesis work that is KENAF/CAMEL HAIR with 10% of GLASS POWDERcommonly used in each layer of a fiber sheet. Totally 6 sheets are required make our desired thickness for testing machinery. Totally 6 layers of 3 layers of KENAF fiber and 3 layers of CAMEL HAIR fiber are used to make this hybrid composition. Also, 10 % of hardener (HY951) is blended in with 100 grams of Epoxy (LY556) and 15% glass powder and utilized as framework in the composite. The thickness of the example for tensile test and flexural test is 4.5 mm which is used for testing machinery.

THE MIXED BASALT/CAMEL HAIR/KENAF FIBER WITH 10% OF GLASS POWDERPOWDER

This fiber sheet generated by using of all three main compositions taken in this thesis work that is KENAF/BASALT/CAMEL HAIR with 10% of GLASS POWDER commonly used in each layer of a fiber sheet. Totally 6 sheets are required make our desired thickness for testing machinery. Totally 6 layers of BASALT fiber, 2 layers of KENAF fiber and 2 layers of CAMEL HAIR fiber are used to make this hybrid composition. Also, 10 % of hardener (HY951) is blended in with 100 grams of Epoxy (LY556) and 15% glass powder which is utilized as framework in the composite. The thickness of the example for tensile test and flexural test is 4.5 mm which is used for testing machinery.

DESIGN PROCEDURE IN CATIA:

Go to the sketcher work bench create the point using profile tool bar dimensions is 50x50 after go to the after apply revolve option after go to the Partdesign workbench.After using wire frame and surface design apply the split and trim option after use extract option apply thickness of surface as shown below figures

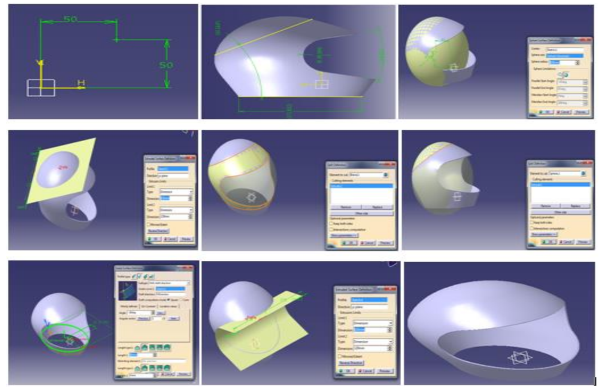

Fig9: STEP BY STEP DESIGN PROCEDURE HELMET IN CATIA.

RESULTS AND DISCUSSIONS

MECHANICAL CHARACTERISTICS OF COMPOSITES

The overall composites of the this project are,

1. **BASALT+15%GLASS POWDER POWDER**
2. **KENAF+ 15%GLASS POWDER POWDER**
3. **CAMEL HAIR+ 15%GLASS POWDERPOWDER**
4. **BASALT+KENAF+ 15%GLASS POWDER POWDER**
5. **KENAF+CAMEL HAIR+ 15%GLASS POWDER POWDER**
6. **CAMEL HAIR+BASALT+ 15%GLASS POWDER POWDER**
7. **BASALT+KENAF+CAMEL HAIR+15%GLASS POWDER POWDER**

Reinforced epoxy hybrid composites with of fiber under this investigations. I have taken each composite for each test. Details of processing of these composites and the tests conducted on them have been described in the previous chapter. The mechanical properties of Synthetic fiber reinforced composites are largely depends on the chemical, structural composition, fiber type and soil conditions and also on atmospheric conditions at the time of fabrication of the specimens. All experimental tests were repeated three times to generate the data. In this project carried out 7 different compositions using the KENAF, Camel hair and BASALT fiber materials with 15% glass powder.

The results are used to predict how the material will react under tensile loading. Some of the mechanical properties that are directly measured by tensile test are tensile strength, Young's modulus, and yield strength. The results of various characterization tests are reported here. This includes evaluation of tensile strength, flexural strength, impact strength, Hardness Has been studied and discussed.

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TESTING SPECIMENS:

Fig10: All 7 compositions of Tensile, Flexural, Hardness and Impact specimens after cutting into ASTM standards

TESTING RESULTS:

FINAL RESULT							
S.no	Composite	Tensile test(MPa)		Flexural test(MPa)		Impact test	Hardness
		load(N)	Elogation(mm)	load(N)	Elogation(mm)	(J)	Number
1	KENAF	7725	12.3	135	9.6	1.4	59
2	BASALT	9130	10.7	520	9.2	5.8	54
3	CAMEL HAIR	8125	8.4	156	8.5	1.2	64
4	KENAF+CAMEL HAIR	10405	10.8	591	8.4	4.3	71
5	KENAF+BASALT	9445	9	198	8.1	1.5	58
6	BASALT+CAMEL HAIR	10655	11.3	613	9.1	5.0	51
7	BASALT+CAMEL HAIR+KENAF	10910	6.9	631	7.3	5.7	78
15% GLASS POWDER COMMONLY USED IN ALL ABOVE COMPOSITIONS							

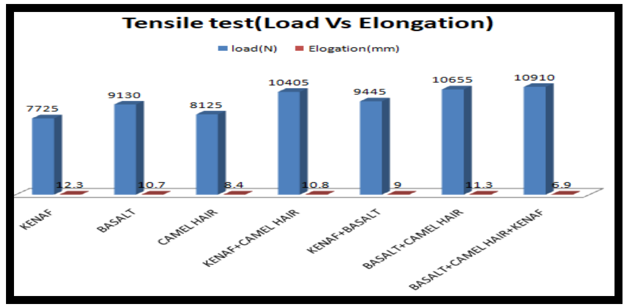
TABLE 1 FINAL TESTING RESULTS

The results of various characterization tests are reported here. This includes evaluation of tensile strength, flexural strength and impact strength and hardness test. Has been studied and discussed. Based on the tabulated results, various graphs are plotted and presented in figures for composites.

S.no	Composite	Tensile test(MPa)			
		load(N)	Elogation(mm)	Tensile stress(MPa)	% of Elogation
1	KENAF	7725	12.3	1.76	7.02
2	BASALT	9130	10.7	2.08	6.11
3	CAMEL HAIR	8125	8.4	1.85	4.8
4	KENAF+CAMEL HAIR	10405	10.8	2.37	6.17
5	KENAF+BASALT	9445	9	2.15	5.14
6	BASALT+CAMEL HAIR	10655	11.3	2.43	6.4
7	BASALT+CAMEL HAIR+KENAF	10910	6.9	2.49	3.94

TABLE 2 TENSILE TEST RESULTS

After successful completion of the tensile strength we are getting maximum values for the HYBRID MIXED COMPOSITION OF BASALT+KENAF+CAMEL HAIR WITH 15% GLASS POWDER10910N at elongation is 6.9 mm



GRAPH 1: TENSILE TEST RESULT GRAPH

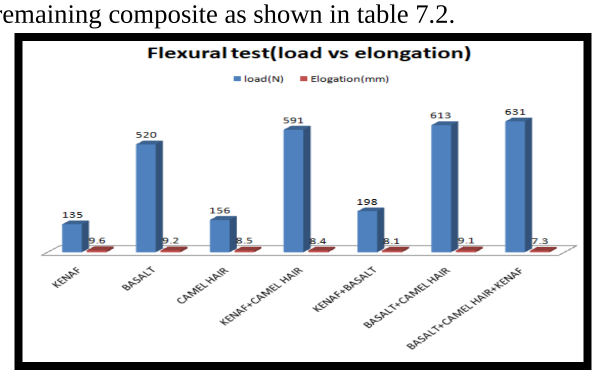
FLEXURAL STRENGTH

Fabrication and testing successfully completed in this project the flexural strength of BASALT, KENAF, CAMEL HAIR, BASALT /CAMEL HAIR, CAMEL HAIR/ KENAF, KENAF /BASALT and KENAF /BASALT and CAMEL HAIR fibers with commonly 15% glass powder are fabricated by using hand lay-up method. The flexural strength was calculated based the following relation

S.no	Composite	Flexural test(MPa)			
		load(N)	Elogation(mm)	Flexural stress(MPa)	% of Elogation
1	KENAF	135	9.6	76.81	9.6
2	BASALT	520	9.2	295.88	9.2
3	CAMEL HAIR	156	8.5	88.76	8.5
4	KENAF+CAMEL HAIR	591	8.4	336.27	8.4
5	KENAF+BASALT	198	8.1	112.66	8.1
6	BASALT+CAMEL HAIR	613	9.1	348.79	9.1
7	BASALT+CAMEL HAIR+KENAF	631	7.3	359.03	7.3

TABLE 3 FLEXURAL TEST RESULTS

Based on the flexural strength finally concluded that KENAF /BASALT and CAMEL HAIR fibers With 15% glass powder possess high flexural strength compared to remaining composite as shown in table 7.2.



GRAPH 2: FLEXURAL TEST RESULT GRAPH

IMPACT STRENGTH

Fabrication and testing successfully completed in this project I also focused on impact strength of BASALT, KENAF, CAMEL HAIR, BASALT /CAMEL HAIR,

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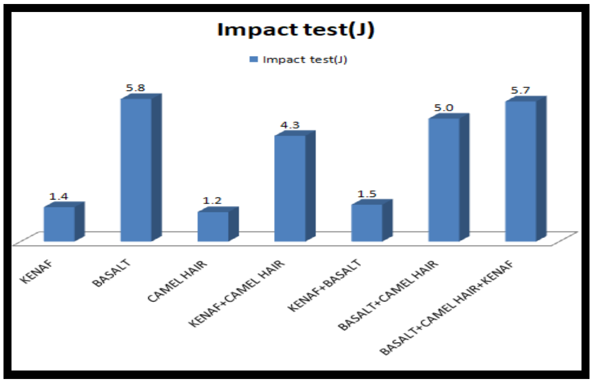
CAMEL HAIR/ KENAF, KENAF /BASALT and KENAF /BASALT and CAMEL HAIR with 15% glass powder fibers fabricated by using hand lay-up method.

S.no	Composite	Impact test (J)
1	KENAF	1.4
2	BASALT	5.8
3	CAMEL HAIR	1.2
4	KENAF+CAMEL HAIR	4.3
5	KENAF+BASALT	1.5
6	BASALT+CAMEL HAIR	5.0
7	BASALT+CAMEL HAIR+KENAF	5.7

TABLE 4 IMPACT TEST RESULTS



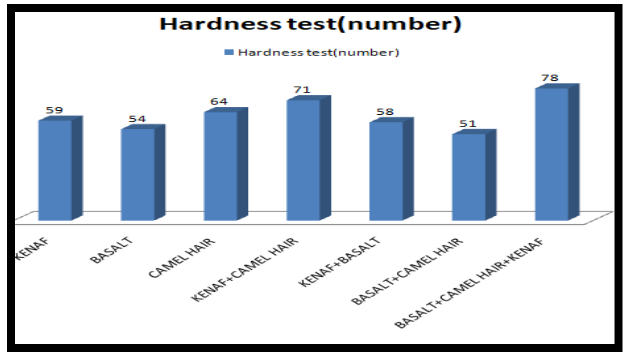
GRAPH 3: IMPACT STRENGTH RESULT GRAPH

HARDNESS NUMBER:

Brinell hardness values of these natural composites. Experiment gives the KENAF /BASALT and CAMEL HAIR fibers having maximum Brinell hardness value 78, where Wt% ratio of resin &hardener.

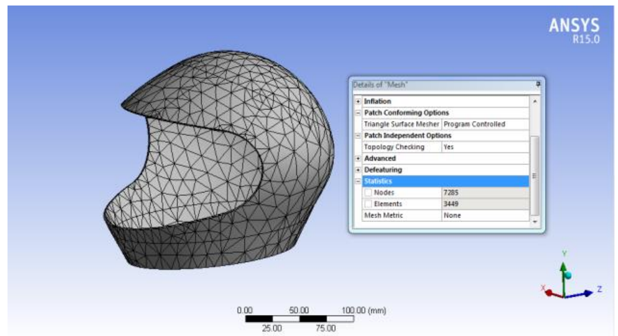
S.no	Composite	Hardness test (number)
1	KENAF	59
2	BASALT	54
3	CAMEL HAIR	64
4	KENAF+CAMEL HAIR	71
5	KENAF+BASALT	58
6	BASALT+CAMEL HAIR	51
7	BASALT+CAMEL HAIR+KENAF	78

TABLE 5 HARDNESS TESTING RESULTS

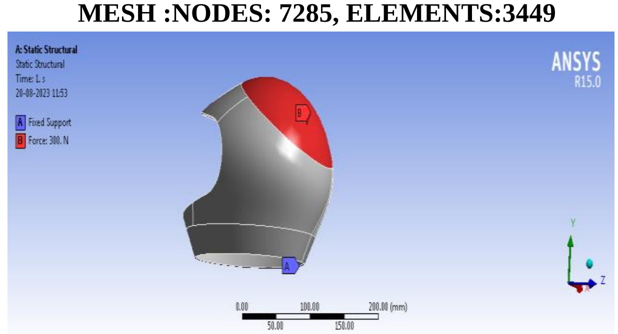


GRAPH 4: HARDNESS NUMBER RESULT GRAPH

MESH AND BOUNDARY CONDITIONS:



MESH :NODES: 7285, ELEMENTS:3449



BOUNDARY CONDITIONS: 300N

STEPS INVOLVED IN ANSYS

The design and analysis procedure involves conducting a static analysis of Helmet using the existing material PET and present new material is KBC With 15% Glass powder. Finally find out the Von-misses stress, Total deformation, Shear stress, Strain, using ANSYS 15.0 software, as outlined in the discussion below.

ANALYSIS PROCEDURE IN ANSYS:

After designing a component in CATIA workbench and importing it into ANSYS workbench, proceed to choose the steady-state thermal analysis.

1. Define engineering materials (material properties).
2. Generate or import geometry.

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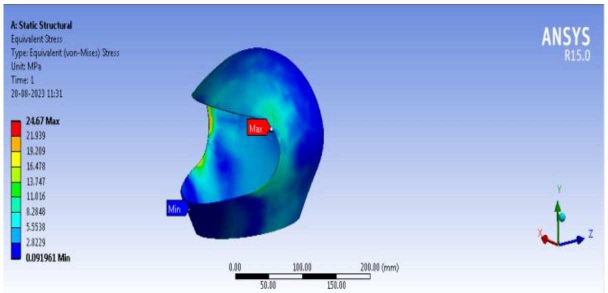
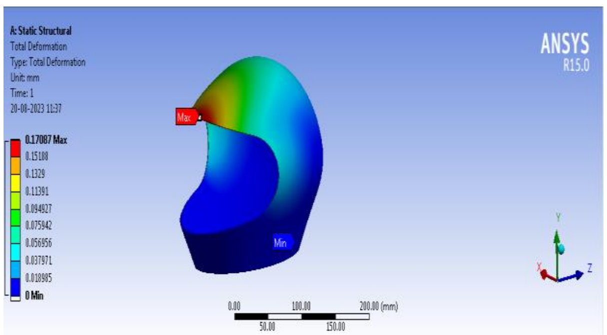
3. Create a mesh for modeling.
4. Set up boundary conditions.
5. Perform the solution.
6. Analyze and interpret the results.

KBC WITH 15% GLASS POWDER MATERIAL



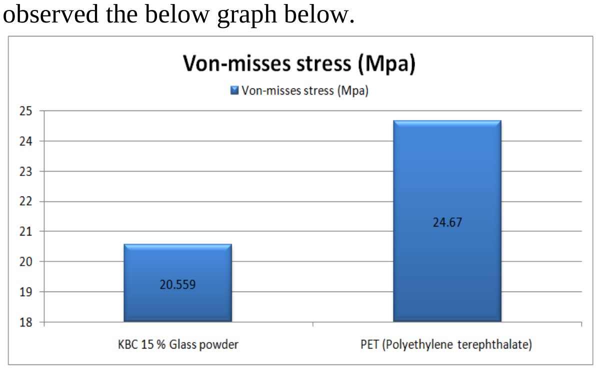
Von-misses stress of KBC With 15% Glass powder material



Total deformation of KBC With 15% Glass powder material

VON-MISSES STRESS GRAPH:

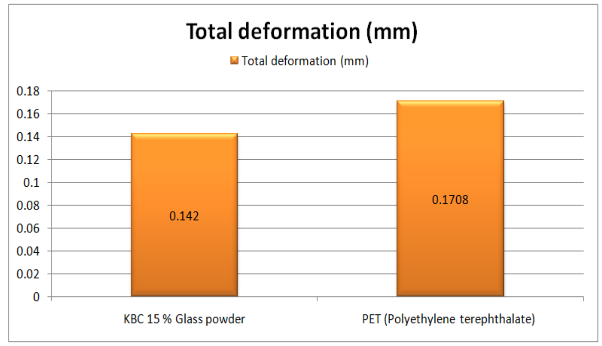
The graph below illustrates the von misses stresses of two different materials KBC With 15% Glass powder material and PET (Polyethylene terephthalate). The von misses stress is observed to be 20.559Mpa least value KBC With 15% Glass powder material and Highest is PET(Polyethylene terephthalate) 24.67 Mpa as observed the below graph below.



Von-misses stress of two Materials

TOTAL DEFORMATION GRAPH:

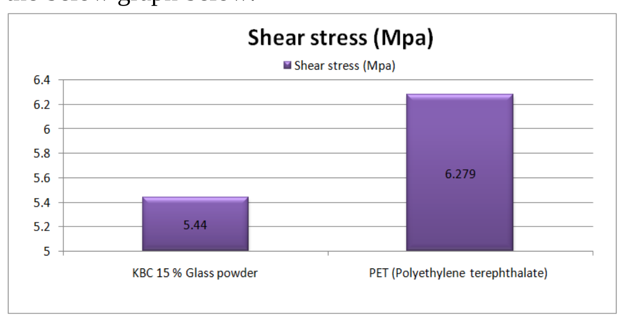
The graph below illustrates the Total deformation of two different materials KBC With 15% Glass powder material and PET(Polyethylene Terephthalate). The Total deformation is observed to be 0.142mm least value KBC With 15% Glass powder material and Highest value is PET(Polyethylene Terephthalate) 0.1708mm as observed the below graph below.



Total deformation of two Materials

SHEAR STRESS GRAPH:

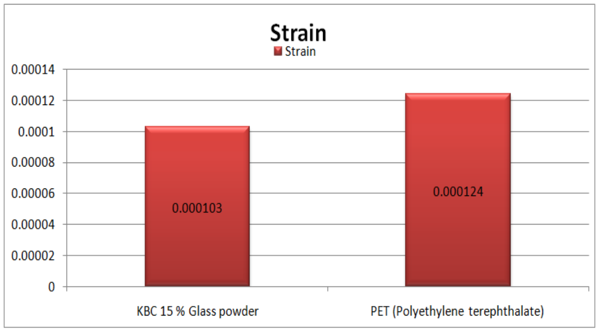
The graph below illustrates the von misses stresses of two different materials KBC With 15% Glass powder material and PET(Polyethylene terephthalate). The von misses stress is observed to be 5.44Mpa least value KBC With 15% Glass powder material and Highest is PET(Polyethylene terephthalate) 6.279 Mpa as observed the below graph below.



Shear stress of two Materials

STRAIN GRAPH:

The graph below illustrates the Strain of two different materials KBC With 15% Glass powder material and PET(Polyethylene terephthalate). The Strain is observed to be 0.000103 least value KBC With 15% Glass powder material and Highest is PET(Polyethylene terephthalate) 0.000124 as observed the below graph below.



Strain of two Materials

CONCLUSIONS & FUTURE SCOPE

CONCLUSION

The present work has been done with an objective to explore the use of BASALT, KENAF, CAMEL HAIR, BASALT /CAMEL HAIR, CAMEL HAIR/ KENAF, KENAF /BASALT and KENAF /BASALT and CAMEL HAIR fibres are manufactured using hand lay-up method. Epoxy is used as matrix in the reinforced composite and investigated the mechanical properties like tensile, flexure, impact and hardness number of composites.

This work is focused to find the best composite among the seven combinations. After all the tests has performed on the specimens the KENAF /BASALT and CAMEL HAIR fibres shows a best result in the tensile strength impact strength, hardness test and as well as flexural strength . For the above investigations we are proposed the KENAF /BASALT AND CAMEL HAIR FIBERS WITH 15% GLASS POWDER having good mechanical properties when comparing with other results.

After Testing the all specimens with 3 trails KENAF /BASALT AND CAMEL HAIR FIBERS With 15% GLASS Powder is the best material compared to remaining material Human helmet is design using the catia software and perform the static analysis using two different materials existing material is PET(Polyethylene terephthalate) and new material is KBC with 15% Glass powder finally von-misses stress, Total deformation, Shear stress, Strain KBC with 15% Glass powder have least values so it is suitable for the manufacturing purpose.

FUTURE SCOPE

The extension of this thesis work can be done by considering the following points:

The fiber can also take in the form of powder to fabricate the specimen which may increases the strength.

Different type reins can be used to find the mechanical properties like strength, wear resistance

By considering different process parameter and different composites which improves the properties of composites.

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2) M. Ramesh and S. Niranjan conducted a mechanical property analysis of kenaf–glass fiber reinforced polymer composites using finite element analysis (FEA). The study was published in the Bulletin of Materials Science in February 2016.

3) M. Umashankaran, S. Gopalakrishnan, and S. Sathish prepared and characterized the tensile and bending properties of basalt-kenaf reinforced hybrid polymer composites. The study was published in the International Journal of Polymer Analysis and Characterization in 2020.

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the mechanical properties of RCC columns with kenaf and basalt fiber wrapping. The study was published in the International Research Journal of Engineering and Technology in 2023.

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6) IRJET was founded in 2014 and is indexed in Google Scholar, Academia.edu, and other major academic databases. The journal has an impact factor of 8.226 for the year 2023. The journal publishes articles in all areas of engineering, technology, and related sciences. The articles are subjected to a rigorous peer-review process before they are accepted for publication. IRJET is a valuable resource for engineers, scientists, and researchers who are looking to publish their work in a high-quality journal.

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