FABRICATION AND TESTING OF ABACA, BANANA AND PINEAPLLE FIBER REINFORCED WITH 10 GRAMS TITANIUMM OXIDE USING IN RECREATIONAL ACTIVITIES AND SPORTS

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ABSTRACT

Natural fiber materials have been widely used for several years and their market share is continuously growing. Natural fiber polymer composites are lightweight and environmentally friendly as well as low cost compared to traditional engineering materials. Banana fiber +10 grams titanium oxide, Abaca fiber +10 grams titanium oxide, Pineapple fiber +10 grams titanium oxide, Banana fiber +Abaca fiber +10 grams titanium oxide, Banana fiber+ Pineapple fiber +10 grams titanium oxide, Pineapple fiber+ Abaca fiber +10 grams titanium oxide, Banana fiber+ Abaca fiber+ Pineapple fiber +10 grams titanium oxide. By using the above mentioned seven reinforcements with epoxy resin we will be provided with combinations. In all compositions commonly 10 grams of Titanium oxide powder used. 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.Helmets are used for recreational activities and sports (e.g., jockeys in horse racing, American football, ice hockey, cricket, baseball, camogie, hurling and rock climbing); dangerous work activities such as construction, mining, riot police, military aviation, and in transportation .The bio-composite are prepared with fibers such as banana fiber, abaca fiber, pine apple fiber with Titanium oxide powder using hand lay-up method with epoxy resin and hardener appropriate proportions to result in helmet shell structure Prepared in Catia. The Design helmet are planned to evaluate its mechanical strength while apply the load at top side find out the best one using analysis Existing ABS Material and Proposed Banana fiber+ Abaca fiber+ Pineapple fiber +10 grams titanium oxide materials after IGS File using performed static analysis find out the von-misses stress, Total deformation, Shear stress, Strain.

INTRODUCTION TO NATURAL FIBER REINFORCED COMPOSITES (NFRC)

Composite materials are a significant type of materials which are presently accessible to humankind in huge amount. Lately, many glass reinforced by fiber composite materials are broadly utilized in the aviation and car businesses. Composite materials are significant for mechanical, chemistry and structural architects, material researchers for utilizing them on a lot of building and different applications. These materials have turned into the option of customary basic materials, for example, steel, wood or metals in numerous applications. Natural fibers are renewable, and biodegradable. Low in thickness, renewability, cost, accessibility and effective mechanical properties make natural fibers as alternative option for carbon, glass, and man-made fibers used in production of composites. Polymers are categorized into two categories; they are thermoplastics and thermosets. However, structure of thermoplastic matrix materials consists of one or more dimensional molecular, so these polymers have a tendency to make softer at an increased heat range and roll back their properties throughout cooling. This increases the flexibility of the composite.

BANANA FIBER

Banana fiber is a natural fiber extracted from the stem of the banana plant. It's known for its strength, flexibility, and eco-friendliness. The process of extracting banana fiber involves separating the usable fibers from the rest of the plant's material through a process of scraping, soaking, and drying.

Figure 1 banana fiber

ABACA FIBER

Abaca fiber, also known as Manila hemp, is a natural fiber derived from the leaves of the abaca plant (Musa textilis), which is native to the Philippines and other parts of Southeast Asia. It's valued for its strength, durability, and versatility, making it suitable for various applications.

Figure 2 Abaca fiber

PINEAPPLE FIBER

Pineapple fiber, also known as piña, is a natural fiber derived from the leaves of the pineapple plant (Ananas comosus). It's a sustainable and eco-friendly material used in various textile applications. The extraction process involves separating the long fibers from the leaves, which are then cleaned, spun, and woven into fabric.

Figure 3 Pine apple fiber

LITERATURE REVIEW

[1] K. N. SHIVA, S. UMA, M. MAYIL VAGANAN, P. SURESH KUMAR AND V. KUMAR et.al By virtue of gigantic growth, banana plant produces large amount of biomass. More than two-thirds of the total biomass produced during banana cultivation consisted of pseudostem, leaves, mid rib, peduncle and corm. Banana pseudostem is a waste material after the harvest. In pseudostem, only 9-10 layers of sheath of the plant yield fibre. The fresh pseudostem yields about 1-1.5% of fibre. It is estimated that annually 30 million tons of biomass is produced through banana cultivation, from which there is scope to produce 1.5 million tons of banana fibre across the country as byproduct, which otherwise recycled into soil for enrichment or goes as a waste. The biomass production varies from 54.60 t/ha (Poovan, AAB) to 94.10 t/ha (Saba, ABB). Utilization of banana fibre is an underexploited area due to the lack of awareness and lack of systematic research on structural and physical properties of the fibre. As banana is cultivated round the year, supply of raw materials is ensured round the year for production of a wide array of products. From outer sheath, coarse fibre is extracted while fine fibre is extracted from inner sheath. Both the fibres are utilized for making many handicrafts.

[2] ASIM, M.; JAWAID, M.; ABDAN, K.; NASIR, M. et.al Effect of Alkali treatments on physical and Mechanical strength of Pineapple leaf fibers NASA Astrophysics Data System (ADS) Pineapple leaf fibre (PALF) is a waste material of pineapple plants. PALF is abundant in amount for industrial purpose, cheap, easily available, high specific strength and stiffness. PALF is contributing a sustainable development in bio-composites as reinforcement material. However, natural fibres are not fully compatible with matrix due to hydrophilic in nature. To enhance the compatibility with matrix, fibres are modified its surface to make good interfacial bonding with matrix. In this research, PALF is treated with 3% and 6% concentration of NaOH for 3h, 6h 9h, and 12h soaking time. Surface modification of fibres was investigated by using scanning electron microscopy. Single fibre test and diameter of PALF fibres were evaluated the effects of NaOH treatments.

[3] HANAFEE, Z. M.; KHALINA, A.; NORKHAIRUNNISA, M.; SYAMS, Z. EDI; LIEW, K. E et.al The effect of different fibre volume fraction on mechanical properties of banana/pineapple leaf (PaLF)/glass hybrid composite This paper investigates the effect of fibre volume fraction on mechanical properties of banana-pineapple leaf (PaLF)-glass reinforced epoxy resin under tensile loading. Uniaxial tensile tests were carried out on specimens with different fibre contents (30%, 40%, 50% in weight). The composite specimens consists of 13 different combinations. The effect of hybridisation between synthetic and natural fibre onto tensile properties was determined and the optimum fibre volume fraction was obtained at 50% for both banana and PaLF composites. Additional 1 layer of woven glass fibre increased the tensile strength of banana-PaLF composite up to 85%.

[4] YOGESH, M.; RAO, A. N. HARI et.al Natural fibre based composites are under intensive study due to their eco friendly nature and peculiar properties. The advantage of natural fibres is their continuous supply, easy and safe handling, and biodegradable nature. Although natural fibres exhibit admirable physical and mechanical properties, it varies with the plant source, species, geography, and so forth. Pineapple leave fibre (PALF) is one of the abundantly available waste materials in India and has not been studied yet. The work has been carried out to fabrication and study the mechanical characterization of Pineapple Leaf fiber reinforced Vinylester composites filled with different particulate fillers. These results are compared with those of a similar set of glass fiber reinforced Vinylester composites filled with same particulate fillers. It is evident that the density values for Pineapple leaf fiber (PALF) - Vinylester composites increase with the particulate filler content and void fractions in these composites also increase. The test results show that with the presence of particulate fillers, micro hardness of the PALF-Vinylester composites has improved. Among all the composites under this investigation, the maximum hardness value is recorded for PALF-Vinylester composite filled with 20 wt% alumina. In this investigation the maximum value of ILSS has been recorded for the PALF-Vinylester composite with 20 wt% of Flyash.

[5] K. Z. M. ABDUL MOTALEB, ABDUL AHAD, GINTA LAURECKIENE AND RIMVYDAS MILASIUS et.al Thereafter, Fluorinated and Oxy fluorinated Short Banana fiber Fiber-Reinforced Ethylene Propylene Polymer This paper examines raw Banana fiber and surface treated Banana fiber. Examination on its thermal properties showed an increase in thermal stability and storage modulus due to gradual reinforcement of fibers. It is also noted that it continues to increase in the case of ox fluorinated and fluorinated Banana fiber fiber-reinforced EP.

[6] MADHUMITA MUKHERJEE **UNIVERSITY OF CALCUTTA AND INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH KOLKATA** C. K. DAS ALEXANDER P. KHARITONOV **et.al** Fluorinated and oxy fluorinated Banana fiber fiber's tensile strength increased substantially. This concludes that fluorination and oxy fluorination had an impact on the surface morphology giving better adhesion of fibers and the matrix. Moreover, comparison of properties like crystalline, thermal, mechanical of syndiotatic polystyrene composites with surface modified abaca fiber. In comparison to oxi-fluorinated abaca fiber reinforced fiber, fluorinated abaca fiber reaches higher crystallization temperature. There is a significant increase in thermal conductivity in case of modified abaca fiber reinforcement. It also shifts to a higher value shown by differential scanning calorimeter and dynamic mechanical analysis. A strong adhesion between sPS matrix and oxy-fluorinated abaca fiber was found and it seems to be better than other composites shown by atomic free microscopy. From this research it was found that it boosts up the thermal stability and storage modulus of the composite

[7] AYU NATASYA KASIM TECHNICAL UNIVERSITY OF MALAYSIA MALACCA MOHD ZULKEFLI SELAMAT **et.al** However, the properties of pineapple fiber, polypropylene based on composite material under high strain rate loading using Split Hopkinson Pressure bar (SHPB). Flat laminated pineapple fiber composite of 16, 24 and 30 layer where comparison molded and laser machined to obtain cylindrical specimen of desired shape based on SHPB experiment. To report compressive material behavior as expansion of growing strain rate, the stress strain plots were obtain and analyzed. The studies suggest that for better performance of composite

[8] ANDREA DORIGATO UNIVERSITÀ DEGLI STUDI DI TRENTO ALESSANDRO PEGORETTI et.al Laminates apply thin laminates. The 90% of thickness composite depend on the peak stress, strain and toughness. On the basis of high strain rate testing of 16, 24, 30 layered pineapple fiber polypropylene composite SHPB testing was done and the following conclusion was made. At low strain rates the growth pattern of stress and strain are linear and further continue the same nature even at high strain rates. As per research the thin specimen are more useful than the thick specimen

[9] MOHD KHAIRUL RABANI HASHIM UNIVERSITI MALAYSIA PERLIS M.S. ABDUL MAJID UNIVERSITI MALAYSIA PERLIS MOHD RIDZUAN MOHD JAMIR UNIVERSITI MALAYSIA PERLIS FARIZUL KASIM UNIVERSITI MALAYSIA PERLIS et.al Moreover, laminated hybrid and unidirectional composites, and looks into the effects of carbon to pineapple fiber ratio on mechanical properties. Bismaleimide (BMI) resin is reinforced from hybridizing 3-D braided carbons and pineapple fiber. This braided carbon/ pineapple fiber showed higher flexure strength, which was expected. Linearity was noticed, but only on attaining peak values of loading. It attained maximum flexure strength when the carbon to pineapple fiber ratio was 3:2. Addition of ductile fiber improved its impact properties significantly of all carbon composites. As the volume of the relative pineapple fiber increased, residual flexure and energy absorption also increased which were tested with the impact samples

[10]. R. M. N. ARIB S. M. SAPUAN UNIVERSITI PUTRA MALAYSIA MEGAT MOHAMAD HAMDAN MEGAT AHMAD, PARIDAH M. TAHIR et.al Thereafter, finding an alternative for soft pineapple fiber that is more durable and safe. This hybrid composite had a good tensile property. A seven layer Carbon fiber and a seven layer pineapple fiber was made for comparison. The performance of full Carbon fiber is lesser than the performance of full pineapple fiber. A low velocity impact test was given for all the above specimens. According to the results, the seven layer laminate only with stood an impact energy of 30 Joules. On the other hand, the hybrid had the mechanical properties and performance of full pineapple fiber and greater mechanical properties than Carbon fiber composites. By these tests we can conclude that the pineapple fiber - Carbon fiber hybrid composites can be used as an alternative Moreover, carbon fibers having excellent contenders for establishing huge strength biomaterials and they have good stress transfer and electrical characteristics it can increase tissue forming. Since carbon fibers possess these properties, tubular carbon layered with poly (methyl-methacrylate) was studied as it can be adopted for internal fixation of bones. In order to make the carbon ductile, ductile pineapple fiber was enumerated to the composite.

[11] DRAGAN DZUNIC, PETR VALASEK, SLOBODAN MITROVIC AND ALESSANDRO RUGGIERO et.al Tailor able braiding technology was adopted to make the tubular abaca fiber by modifying fiber orientation in the composite. The results from the experiment revealed that with enhancing braiding criterion, mechanical properties near to bone characteristics can be made. Superior capability of stress distribution on composite was achieved since abaca fiber braid's physical properties, fiber composite distribution and diameter consistency. Adding PMMA matrix and grapheme Nano plates together, it improved composite quality. Hence, it could be adopted as an implant. In this work authors are reported about the execution and examine the characteristics of the novel auxetic abaca fiber composite. This research was particularly based on fracture and impact characteristics. To analyses and differentiate, abaca fiber interlinked composite was used along with polyurethane analysis and in the absence of it. Short nylon fibers of two distinguished fiber measurement and 3 distinguished fiber distinguished fiber densities were converged.

[12] VENKATESHWARAN NARAYANAN REC AYYASAMY ELAYAPERUMAL et.al In this work authors are reported about the execution and examine the characteristics of the novel auxetic banana fiber composite. This research was particularly based on fracture and impact characteristics. To analyses and differentiate, banana fiber interlinked composite was used along with polyurethane analysis and in the absence of it. Short nylon fibers of two distinguished fiber measurement and 3 distinguished fiber distinguished fiber densities were converged.

MATERIALS

On among different types of resins and hardener. Epoxy LY556 and hardener HY951 are chosen. The materials taken to fabricate the specimens are Carbon fiber, Abaca fiber and Graphite powder. These are taken in the different ratios and different combinations. The six different composites are investigated the impact strength, tensile strength, flexural strength.

EPOXY

In present work epoxy LY556 is used as matrix material shown in figure.3.1 to fabricate hybrid fiber epoxy composites. Epoxy LY556 is chosen because it is a one such matrix which is extensively used because it exhibits low shrinkage, higher mechanical properties, easy fabrication, excellent chemical and moisture resistance, good wet ability. Epoxy resins are the most commonly used thermo set plastic in polymer matrix composites. Epoxy resins are a family of thermo set plastic materials which do not give off reaction products when they cure and so have low cure shrinkage. They also have good adhesion to other materials, good chemical and environmental resistance and good insulating properties.

Figure 4 Epoxy Resin LY556

HARDENER

Hardener used for present investigation for initiating gel formation is hardener HY951 which is shown in figure.3.2. The combination of epoxy LY556 and hardener which cures at room temperature, excellent adhesive strength, good mechanical and electrical properties. The ratio of the epoxy and hardener are taken 10:1 that is 10 grams of epoxy and 1 gram of hardener. 10 Percentage of Titanium oxide powder used along with the epoxy and hardener mixture.

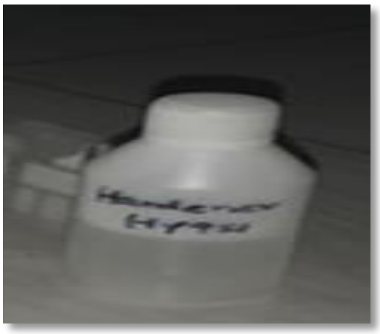


Figure 5 Hardener HY 951

TITANIUM OXIDE POWDER

Titanium dioxide is an excellent matting agent for chemical fibers. If a small amount of titanium dioxide is used in the production of chemical fibers, not only good matting effect can be achieved, but also the strength and toughness of chemical fibers can be improved.

Figure 6 titanium oxide powder

FABRICATION OF COMPOSITESPECIMENS

Hand lay-up technique is the simple and cheapest method of composite processing. The infrastructural need for this technique is also minimal.The standard test procedure for Mechanical properties of fiber-resin composites; ASTM-D790M-86 is utilized to according to the measurements. The mold is prepared on smooth clear film with 2-way tape to the required measurement. At that surface mold is prepared keeping the 2-way tape on the clear film.

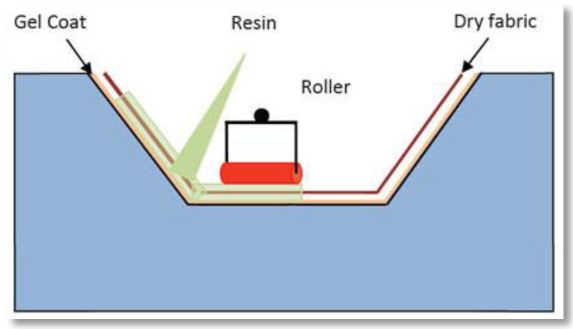


Figure 7 hand layup process

After fabrication specimens are cut form sheets according to the ASTM statndards165mm long, 12.5mm in width and 4.5 mm in thick are fabricated for tensile testing. 100mm long, 25mm width and 4.5 mm in thick are fabricated for flexural testing. 63.5mm long, 12.36mm width and 4.5 mm thick are fabricated for impact testing.

STEPS INVOLVED IN THE FABRICATION OF SPECIMEN:

The Banana fiber +10 grams titanium oxide, Abaca fiber +10 grams titanium oxide, Pineapple fiber +10 grams titanium oxide, Banana fiber +Abaca fiber +10 grams titanium oxide, Banana fiber+ Pineapple fiber +10 grams titanium oxide, Pineapple fiber+ Abaca fiber +10 grams titanium oxide, Banana fiber+ Abaca fiber+ Pineapple fiber +10 grams titanium oxide and 10 grams of hardener (HY951) is mixed with 100 grams of Epoxy (LY556) which is used as matrix in the composite. The thickness of the specimen is 4.5 mm for tensile test and flexural test. Thickness of the specimen that obtained by 2 sheets of 300GSM of Abacafibre is around 1mm. For obtain 4.5 mm thickness 6 sheet of Abacafibre are used. And the thickness of specimen for impact test is 4.5 mm.

TENSILE TESTING OF COMPOSITES

A 2-ton limits electronic tensometer which is shown in figure 3.13, METM 2000 ER-1 model (Plate II-18), supplied by M/S microteach Pune, is used to determine the elasticity of composites. Its capability can be changed by burden cells of 20 kg, 200 kg and 2 ton. The tensile stress is determined by the following relation

$$\textbf{Tensile stress } \sigma_t = \frac{\textit{tensile load}}{\textit{area of cross-section}}$$

$$= \frac{P}{A} \ \text{N/mm}^2$$

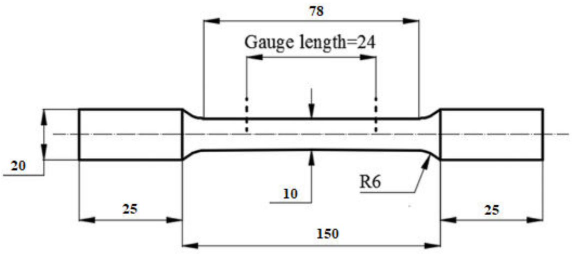
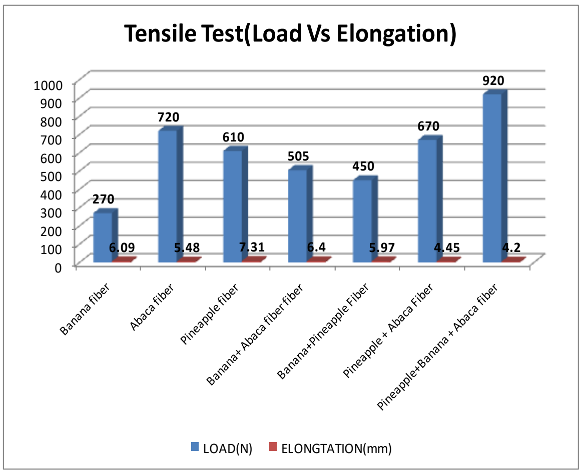


Figure 8 tensile test specimen



Graph 1 tensile test

After successful completion of the tensile strength, we are getting maximum values for the Banana / Abaca /Pineapple + 10 grams Titanium Oxide 920 N.

FLEXURAL TESTING OF COMPOSITES

Three-point bowing test are carried out as per ASTM-D790M-86 test procedure 1, system A to extract flexural properties, the specimens are 100 mm long, 25 mm wide and 4 mm thick. Two indistinguishable specimens are subjected for flexural testing. In three-point bowing test, the external rollers are 70 mm separated and specimens are subjected at a strain rate of 0.2 mm/min. Flexural stress are determined by the following relations.

$$\textbf{Flexural stress S} = \frac{3\,P\,L}{2\,b\,t^2}$$

P= load in N

Figure 9 Electronic tensometer for tensile & flexural testing

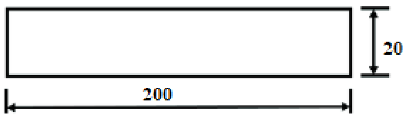
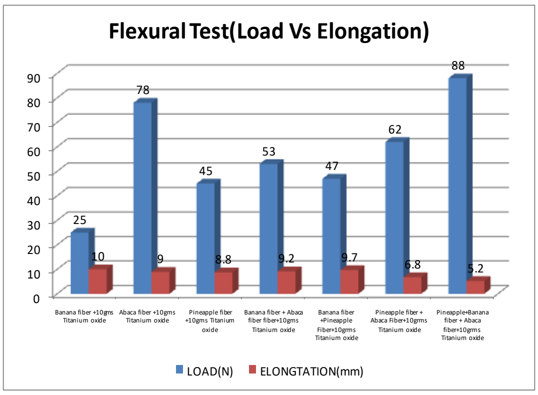


Figure 10 flexural test specimens



Graph 2 flexural test results

IMPACT TESTING OF COMPOSITES

Impact test is also known as charpy v notch, Impact tester was sway analyzer supplied by M/S International Equipment's, Mumbai, was used to test the impact properties of fiber Reinforced composite specimen. The Impact tester has four working abilities of effect quality i.e. 0-2.71 J.0-5.42 J,0-10.84 J and 0-21.68 J, with a base determination on every size of 0.02J, 0.05 J, 0.1 J and 0.2 J individually. Four scales and comparing mallets (R1, R2, R3, R4) are presented in equipment.Impact strength was calculated by the following relation

$$\sigma = \frac{2P}{A}$$

P= Energy observed in J

A= Area in mm

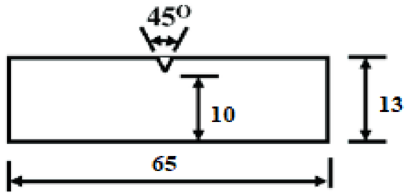
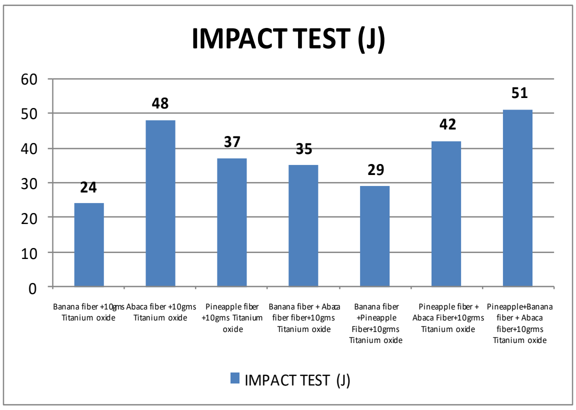


Figure 11 impact specimen

And finally concluded the Banana fiber+ Abaca fiber+ Pineapple fiber +10 grams titanium oxide material possess high impact strength compared to remaining compositions as shown table.



Graph 3 impact test results

HARDNESS TEST

Hardness properties According to ASTM D 785 standards for composites, the specimens were prepared for Rockwell-B hardness test, the specimen is of 25mm diameter and a length of 20mm.Fiber configuration and volume fraction are two important factors that affect the properties of the composite. In this test, the configuration is limited to unidirectional and continuous fibers equal to the length of the specimen. The hardness properties of the composites are studied by applying indentation load normal to fibers diameter and normal to fiber length. The effect of fiber loading and post curing time on Rockwell hardness is illustrated in Figures 3 and 4. Generally, fibers that increase the moduli of composites increase the hardness of the composite. This is because hardness is a function of the relative fiber volume and modulus.

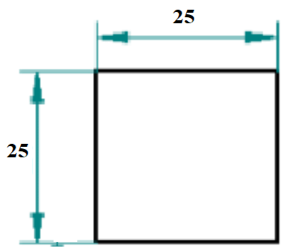
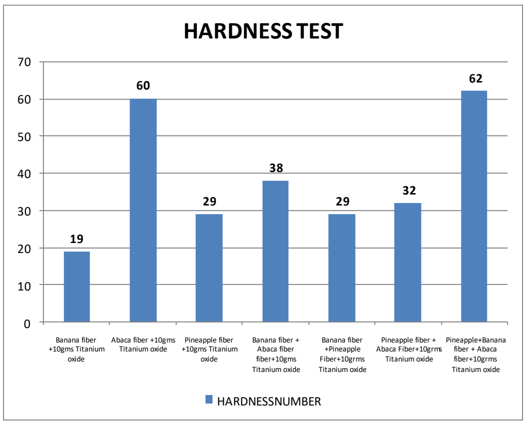


Figure12 hardness test specimen

Brinell hardness vs. experiment number graph of the composite. Figure reveals the graph indicating Brinell hardness values corresponding to the experiment number. The graph shows, experiment with Banana fiber+ Abaca fiber+ Pineapple fiber +10 grams titanium oxide gives the higher value of Brinell hardness.



Graph 4 Hardness test results

DESIGN PROCEDURE IN CATIA

A fully parametric 3d model of sports helmet using the CATIA modules like part design, sketch and surface modules. The multi sectional view of a sports helmet shown in below figure.

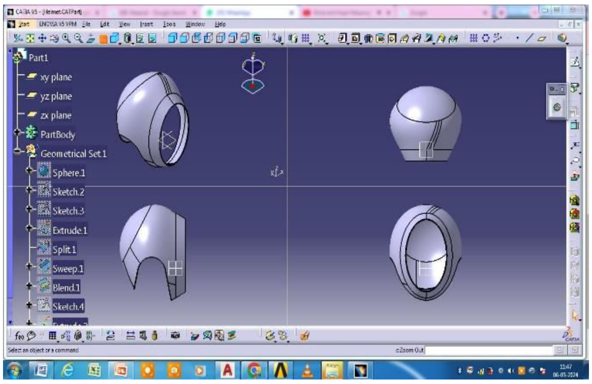


Figure 13 3d model helmet

MESH AND BOUNDARY CONDITIONS

The IGS file imported to Ansys from the CATIA software then select the static structural analysis in ANSYS module. After perform the static structural analysis the component of helmet has divided to into small number of elements and nodes using the meshing option and then apply the boundary conditions to check stresses, displacements, elongations, etc.

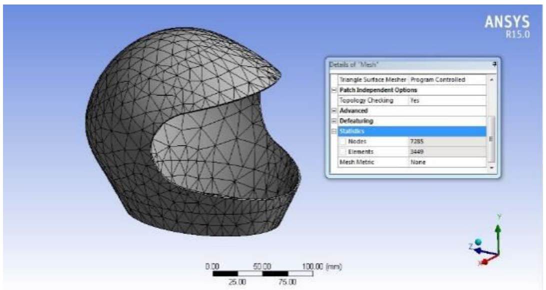


Figure 14 meshing of helmet

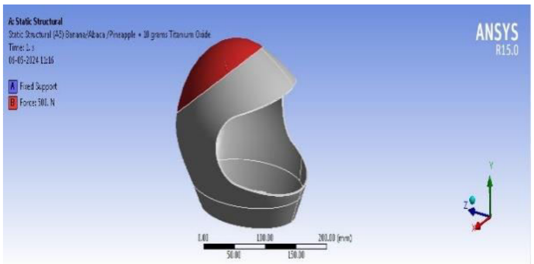


Figure 15 boundary conditions applied in ANSYS

STATIC STRUCTURAL ANALYSIS ON EXSISTING ABS MATERIAL

conducting the static structural analysis on existing ABS material an it's results of stresses, strains and deformations are placed below.

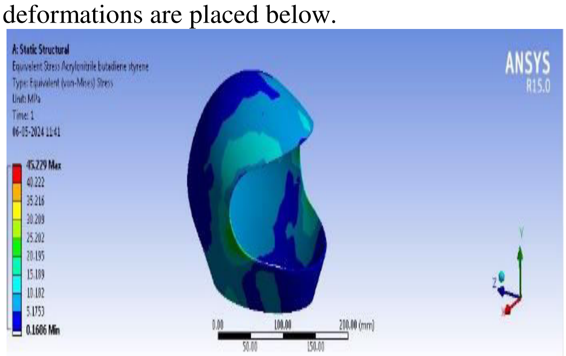


Figure 16 von misses stresses

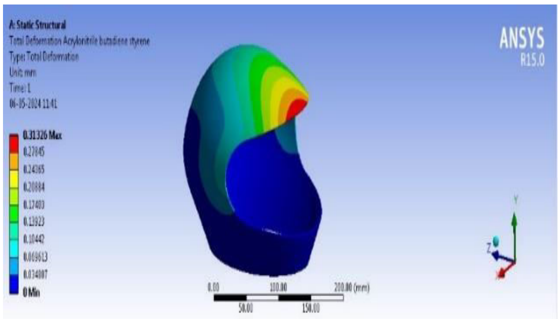


Figure 17 total deformation

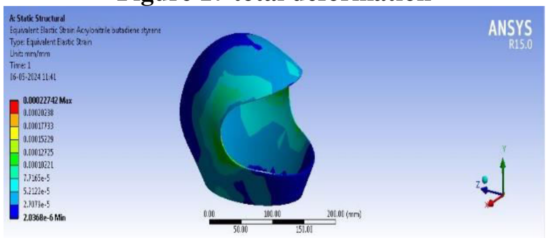


Figure 18 strain

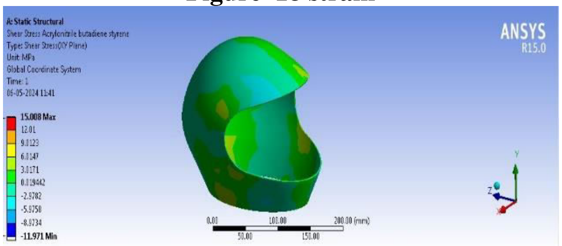


Figure 19 shear stress

STATIC STRUCTURAL ANALYSIS ON PROPOSED ABACA, BANANA AND PALM WITH 10 GRAMS OF TITANIUM OXIDE POWDER

conducting the static structural analysis on proposed abaca, banana and palm with 10 grams of titanium oxide powder material an it's results of stresses, strains and deformations are placed below.

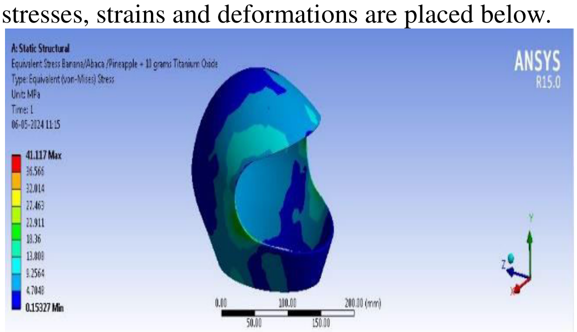


Figure 20 von misses stresses

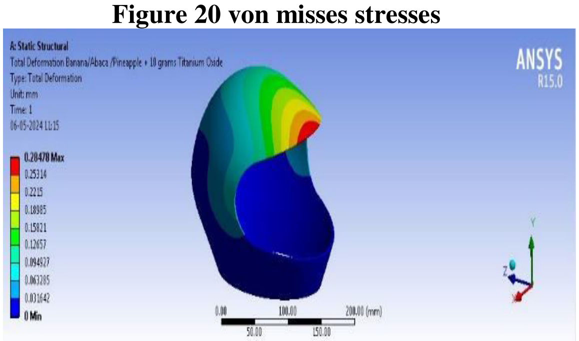


Figure 21 total deformation

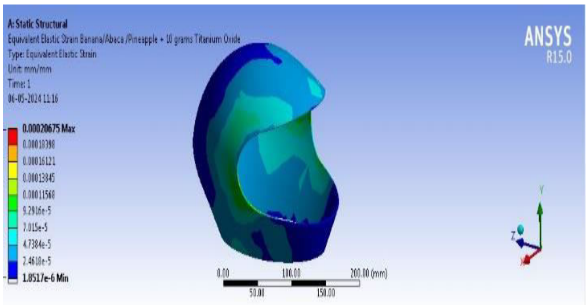


Figure 22 strain

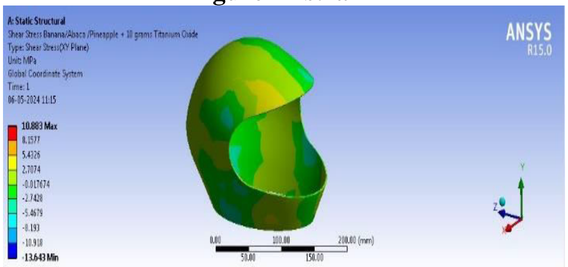


Figure 23 shear stress

Material	Von-misses stress(MPa)	Strain	Total deformation(mm)	Shear stress(Mpa)
ABS	45.229	0.000227	0.313	15.008
A+B+P with 10grams TiO2	41.117	0.000206	0.284	10.883

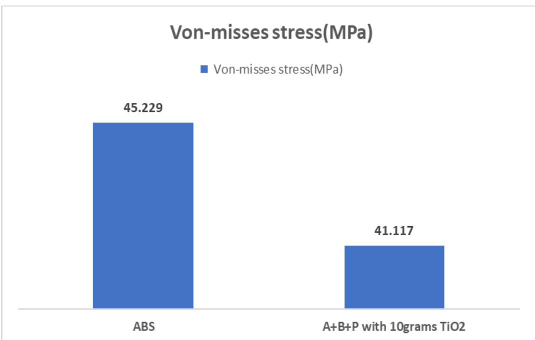
Table 1 static structural results

GRAPHS

The graph between the existing ABS material and the proposed hybrid abaca, banana and palm with 10 grams of titanium oxide powder materialvon misses' stresses, strain, total deformation and shear strain are given below

VON MISSES STRESSES GRAPH

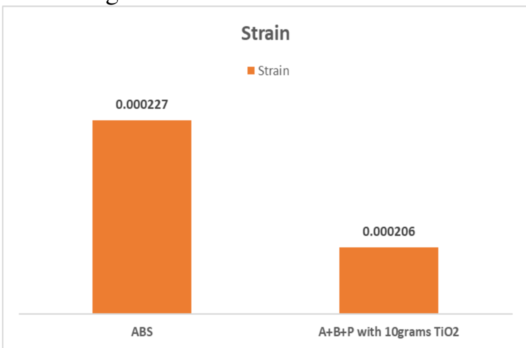
Conducting the static structural analysis on the ABS and the proposed hybrid abaca, banana and palm with 10 grams of titanium oxide powder material are given von misses stress results. Those maximum values are plotted and observing the both proposed and existing materials.



Graph 5 von- misses stress

STRAIN GRAPH

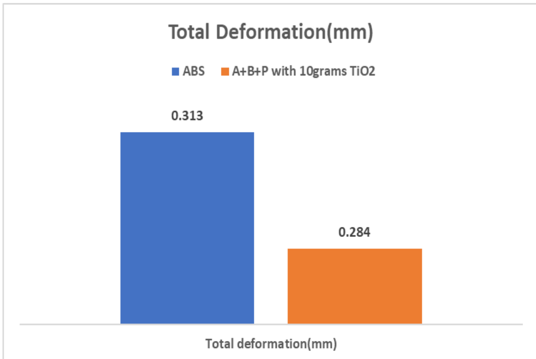
Conducting the static structural analysis on the ABS and the proposed hybrid abaca, banana and palm with 10 grams of titanium oxide powder material are given strain results. Those maximum values are plotted and observing the both proposed and existing materials.



Graph 6 strain

TOTAL DEFORMATION GRAPH

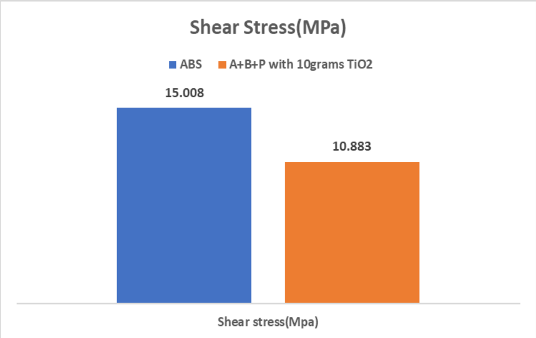
Conducting the static structural analysis on the ABS and the proposed hybrid abaca, banana and palm with 10 grams of titanium oxide powder material are given total deformation results. Those maximum values are plotted and observing the both proposed and existing materials.



Graph 7 total deformation

SHEAR STRAIN GRAPH

Conducting the static structural analysis on the ABS and the proposed hybrid abaca, banana and palm with 10 grams of titanium oxide powder material are given shear stresses results. Those maximum values are plotted and observing the both proposed and existing materials.



Graph 8 shear stress

CONCLUSION

The present work has been done with an objective to explore the use of Banana fiber +10 grams titanium oxide, Abaca fiber +10 grams titanium oxide, Pineapple fiber +10 grams titanium oxide, Banana fiber +Abaca fiber +10 grams titanium oxide, Banana fiber+ Pineapple fiber +10 grams titanium oxide, Pineapple fiber+ Abaca fiber +10 grams titanium oxide, Banana fiber+ Abaca fiber+ Pineapple fiber +10 grams titanium oxide composites. Experiment gives the Banana fiber+ Abaca fiber+ Pineapple fiber +10 grams titanium oxide 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 Banana fiber+ Abaca fiber+ Pineapple fiber +10 grams titanium oxideshows a best result in the tensile strength impact strength, hardness test and as well as flexuralstrength. For the above investigations on CATIA model with ANSYS on static structural analysis conducted with ABS material. The analysis results between the proposed Banana fiber+ Abaca fiber+ Pineapple fiber +10 grams titanium oxide and existing ABS material are most favorable for stress, strain and deformations point of view. So finally,we are proposed the Banana fiber+ Abaca fiber+ Pineapple fiber +10 grams titanium oxide having good mechanical properties when comparing with other results.

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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