EXPERIMENTAL AND TESTING OF MECHANICAL PROPERTIES OF SISAL, PLAM AND FLAX FIBER WITH GROUND NUT SHELL POWDER USING HAND LAYUP TECHNIQUE

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ABSTRACT

Natural Fiber Reinforced Polymeric Composites serve as an important alternative to manmade fiber reinforced polymeric composites because they are abundantly available, economical, recyclable and biodegradable possessing a high mechanical strength and are quickly springing up in terms of research and industrial applications. Natural fiber-reinforced polymer composites play a pivotal part in producing eco-friendly materials since of their immense characteristics such as high modulus and strength. Composite manufacturing is an advanced branch of materials science, does have a broad range of uses in the naval, automotive, aerospace, including sporting industries. Lingo cellulosic plant fibers like Sisal, Plam, Flax etc., are mainly used as reinforcement for natural fiber reinforced polymeric composites. Nowadays, these are used in various applications like transportation, defense, civil engineering applications, packaging, consumer products, etc. Natural fibers have many significant advantages over synthetic fibers.The aim of the project is studying the fabrication of the composite was carried out using epoxy resin as the matrix and the Plam+5% Ground Nut Shell Powder, Flax+5% Ground Nut Shell Powder, Sisal+5% Ground Nut Shell Powder, Plam+Flax+5% Ground Nut Shell Powder, Sisal+Plam+5% Ground Nut Shell Powder, Flax+Sisal+5% Ground nut shell powder, Flax+Sisal+Plam+5% Ground Nut Shell Powder as reinforcement. In accordance with the ASTM guidelines followed for the aforementioned testing, the plates were labeled and divided into several specimen sizes. Tests were carried out to determine the mechanical properties such as tensile, hardness and Impact, Flexural test. Among the above compositions build a full parametric 3d model of a car bumper. The car bumper was developed using CATIA software and analyzed using ANSYS software with existing material and proposed fiber composition. The results were studied and compared with the 7 composites materials and it process that the material developed can be used in structural applications with strong dependence on its mechanical properties.

Keywords: *Sisal, Plam, Flax, Ground nut shell, Tensile, Flexural, Impact, Hardness, CATIA, ANSYS*

INTRODUCTION

The technical improvement has extended on advances in the materials area. A random composite cloth is one, which consists of blending the particles of the substances running together to provide new metallic have properties which can be distinct to the properties of singular cloth that they own. It contains the most important characteristic that the materials are not soluble to each other. Likewise, the random composite material assume the role of the advancements designing material because of their fantastic mechanical properties while being low weight, minimal cost, and profoundly adaptable. Composite essentially comprises a matrix which around the reinforce in this way the strength and durability is existed that is important in a specific field of utilization. Chopped strand mats are arbitrarily situated, give good strand, great wet ability, and scattering, and show even strength thought every which way. A researcher examined the investigation of mechanical properties of E-Glass fiber chopped strand material with epoxy resin nanoclay composites; the point of this work is to dissect the impact of nanoclay effect on the mechanical conduct of chopped strand E-glass fiber, Strengthened in the matrix of epoxy with filler of nanoclay. Composite substances are a massive sort of materials which can be currently available to humankind in huge amount. Lately, many glass strengthened via fiber composite substances are broadly utilized inside the aviation and automobile organizations. Composite substances are good sized for mechanical, chemistry and structural architects, cloth researchers for making use of them on plenty of building and one-of-a-kind packages. These materials have become the choice of normal fundamental substances, for example, metal, wood or metals in numerous applications.

NATURAL FIBERS

Apart from economic considerations, the usefulness of a fiber for commercial purposes is determined by such properties as length, strength, pliability, elasticity, abrasion resistance, absorbency, and various surface properties. Most textile fibers are slender, flexible, and relatively strong. They are elastic in that they stretch when put under tension and then partially or completely return to their original length when the tension is removed.The natural fibers are fibers which can be

produced by using flora, animals, and geological methods. They may be used as a factor of composite materials, wherein the orientation of fibers impacts the properties.The use of natural fiber for the reinforcement of the composites has received increasing attention both by the academic sector and the industry Natural fibers have many significant advantages over synthetic fibers. Currently many types of natural fibers have been investigated for use in plastics including flax, hemp, sisal straw, wood, rice husk, wheat, barley, oats, rye, cane (sugar and sisal), grass, reeds, knead, ramie, flax empty fruit bunch, sisal, flax, water, hyacinth, pennywort, kapok, paper mulberry, raphia, banana fiber, plam leaf fiber and papyrus. Thermoplastics reinforced with special wood fillers are enjoying rapid growth due to their many advantages; lightweight reasonable strength and stiffness. Some plant proteins are interesting renewable materials, because of their thermoplastic properties.

Figure 1 Natural Flax fibers

Wheat gluten is unique among cereal and other plant proteins in its ability to form a cohesive blend with viscous elastic properties once plasticized. For these reasons, wheat gluten has been utilized to process edible or biodegradable films or packing materials. Hemp is abetting lingo cellulosic fiber. Comes from the plant cannabis sativa and has been used as reinforcement in biodegradable composites

Properties of natural fibers

- Low weight,
- Cost of natural fiber is low
- High specific strength
- High specific stiffness

FLAX

Flax fiber is a natural fiber derived from the stem of the flax plant, scientifically known as Linum usitatissimum. Flax has been cultivated for thousands of years for both its fiber and seeds. The fibers are extracted from the stem of the plant and are valued for their strength, durability, and versatility. Flax fibers are among the oldest textile fibers used by humans, with evidence of flax cultivation dating back to ancient civilizations such as Mesopotamia and Egypt. They have been traditionally used to make linen fabric, which is known for its coolness, absorbency, and strength.

In addition to textiles, flax fibers are also used in various industrial applications, including the production of paper, rope, and composite materials. The fibers are biodegradable and environmentally friendly, making them increasingly popular in sustainable manufacturing processes. Moreover, flaxseed, extracted from the same plant, is rich in omega-3 fatty acids and other nutrients, making it a popular health food ingredient. Overall, flax fiber represents a valuable natural resource with a wide range of applications in textiles, industry, and nutrition.

Figure 2 flax fiber

SISAL FIBER

Sisal fiber is a natural fiber derived from the leaves of the Agave sisalana plant, which is native to Mexico but is also cultivated in other regions with suitable climates, such as East Africa and Brazil. It's a durable, strong fiber with excellent tensile strength, making it ideal for various applications. Sisal fibers are commonly used in the production of ropes, twines, carpets, mats, and various other products due to their strength and resistance to deterioration in saltwater. Additionally, sisal has seen increased use in eco-friendly products due to its biodegradability and sustainability. It's often used as a natural alternative to synthetic fibers in various industries.

Figure 3 sisal fiber

PALM

Palm fiber refers to the fibrous material derived from the leaves or husks of various palm trees. This fibrous material is often used in various applications due to its durability, strength, and eco-friendliness.

Figure 4 palmfiber

LITERATURE REVIEW

[1] 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 SISAL fiber-reinforced EP. Fluorinated and Oxy fluorinated Short SISAL Fiber-Reinforced Ethylene Propylene Polymer This paper examines raw SISAL and surface treated SISAL.

[2] Fluorinated and oxy fluorinated SISAL 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, assessment of homes like crystalline, thermal, mechanical of syndiotatic polystyrene composites with surface modified SISAL fiber.

[3] A strong adhesion between PS matrix and oxy-fluorinated SISAL 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. There is a significant increase in thermal conductivity in case of modified SISAL fiber reinforcement. It also shifts to a higher value shown by differential scanning calorimeter and dynamic mechanical analysis.

[4] This research is to establish stab proof material made up of shear thickening fluid (STF) and SISAL fiber. In this research, silica / ethylene glycol suspension was prepared for the use as STF and it was evaluated. From the results, it was seen that STF exhibited a reverse liquid- solid transition at a particular shear. SISAL was treated as STF by 1 dip 1 nip method and mechanical and stab resistant properties were analyzed. After viewing both the results, STF impregnation comprehensively upgraded the stab resistance of SISAL against the spike threats and the safety aspect of SISAL was also increased comprehensively.

[5] It was seen that the addition did not change or deteriorate the flexibility of STF. From the results, we incurred that fumed silica/ SISAL composite fabric would be a fine material for body armored applications. Resistant coating was performed by considering one STF, fumed silica / ethylene glycol suspension of SISAL fabric to enhance the performance of the material. From this research, extensive upgrades in puncture defiance were seen especially in excessive speed loading condition.

[6]In order to overcome this, the SISAL was modified and hence its surface was hydrolyzed malefic anhydride-grafted polypropylene (MA-g-PP). There were clear advantages of using the modified SISAL over the stock one. The properties enhanced and the drawbacks were reduced to nil. This combination showed improved stress distribution due to better surface bonding between the fiber and matrix**.** The SISAL which was used without modifying strengthened the santoprene to quote an extent and it upgraded few properties of the composite, namely low strain modulus and tensile strength but it also had a drawback, lengthening at break reduced heavily.

[7] 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 SISAL 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 is more useful than the thick specimen

[8] To file compressive cloth behavior as expansion of developing pressure charge, the strain stress plots have been achieving and analyzed. The studies endorse that for better overall performance of composite. Moreover, laminated hybrid and unidirectional composites, and looks into the effects of carbon to SISAL ratio on mechanical properties. The braided carbon/SISAL 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 SISAL ratio was 3:2. Addition of ductile fiber improved its impact properties significantly of all carbon composites. As the volume of the relative SISAL fiber increased, residual flexure and energy absorption also increased which were tested with the impact samples

[9] A seven-layerFLAX and a seven-layerSISAL was made for comparison. This hybrid composite had a good tensile property. The performance of full FLAX is lesser than the performance of full SISAL. 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 SISAL and greater mechanical properties than FLAX composites. By these tests we can conclude that the SISAL-FLAX hybrid composites can be used as an alternative

[10]Moreover, FLAXs having excellent contenders for establishing huge strength biomaterials and they have good stress transfer and electrical characteristics it can increase tissue forming. Since FLAXs 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 SISAL was enumerated to the composite.

[11] Tailor able braiding technology was adopted to make the tubular SISAL 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 SISAL 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

[12] FLAXs having first rate contenders for setting up massive power biomaterials and that they've authentic stress switch and electric traits it is able to boom tissue forming. Since FLAXs possess the ones homes, tubular carbon layered with poly (methyl-methacrylate) changed into studied as it could be adopted for internal fixation of bones. In order to make the carbon ductile, ductile SISAL come to be enumerated to the compositeIn this work authors are reported about the execution and examine the characteristics of the novel auxetic SISAL composite. This research was particularly based on fracture and impact characteristics. To analyses and differentiate, SISAL 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. Polyester and hardener HY951 are chosen. The materials taken to fabricate the specimens are flax, palm, sisal with ground nut shell powder. These are taken in the different ratios and different combinations. The six different composites are investigated the impact strength, tensile strength, flexural strength.

POLYESTER

Polyester resin (more loosely referred to as 'laminating resin' or 'fiberglass resin') is a polymer. Simple to use and economical, it is a major component in many industries, from construction to aerospace. Offering incredible physical and chemical properties, it's also comparatively cheap compared to other resins like epoxies and urethanes, yet it offers similar – if not superior – performance in many cases. The term 'polyester resin' largely refers to 'unsaturated polyester resin' unless otherwise specified.

Figure 5 polyester

HARDENER

Hardener used for present investigation for initiating gel formation is hardener HY951 which is shown in figure.3.2. The combination of polyester 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.

Figure 6 Hardener HY 951

GROUND NUT SHELL POWDER

Groundnut shell powder, also known as peanut shell powder, is a byproduct of the peanut (groundnut) processing industry. It is obtained by grinding or milling the outer shell or husk of peanuts after the removal of the kernels. Overall, groundnut shell powder offers various benefits as a sustainable resource with multiple applications across different industries.

Figure 7 ground nut shell powder

FABRICATION BY HAND LAYUP PROCESS

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.

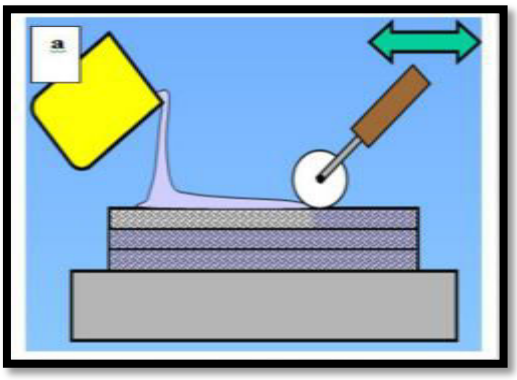


Figure 8 hand layup process

The reinforcement in the form of long fiber is cut as per the mold size and placed on the surface of thin plastic sheet. Then the thermosetting polymer in liquid form is assorted thoroughly in appropriate proportion with a recommended hardener (curing agent) and poured on the surface of clear. The polymer is uniformly spread with the help of brush. 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 consequentialmold is cured for 24 hours at room temperature. After fabrication specimens are cut form sheets according to the ASTM statndards165mm long, 12.5mm in width and 4mm in thick are fabricated for tensile testing. 100mm long, 25mm width and 4mm in thick are fabricated for flexural testing. 63.5mm long, 12.36mm width and 6mm thick are fabricated for impact testing.

STEPS INVOLVED IN THE FABRICATION OF SPECIMEN:

The flax with 5 grams ground nut shell powder, sisalfibrewith 5 grams ground nut shell powder, palm fibers with 5 grams ground nut shell powder,sisal/ palm fiber with 5 grams ground nut shell powder, palm/ flax fiber with 5 grams ground nut shell powder, sisal/ flax fibers with 5 grams ground nut shell powder, palm/ sisal/ flax fibers with 5 grams ground nut shell powderspecimen was fabricated by hand layup technique. In this process 8 sheets of 300GSM E-glass fibre along with Banana (230/300mm) 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 4mm for tensile test and flexural test. Thickness of the specimen that obtained by 2 sheets of 300GSM of E-glass fibre is around 1mm. For obtain 4mm thickness eight sheets of E-glass are used. And the thickness of specimen for impact test is 4.5 mm.

ASTM STANDARDS OF TESTINGCOMPOSITES

The mechanical properties of NFC material are analyzed by using tensile, flexural, impact, and hardness using the test standards provided by ASTM D638, ASTM D790, ASTM D256 and ASTM D2240 standards respectively. The test specimens have been made for the tensile test with a length, width, and thickness of 200 mm, 25 mm, and 0.5 mm, respectively. The test has been carried out in the electronic tensometer machine, and the tensile stress is developed by towing the members apart in the opposite direction. The tensile test has been carried for all seven variants of specimens, with four tests for each case. Therefore, 28 total numbers of specimens are tested, and the best three average values in each case are considered for analyzing the behavior of the material.The flexural test was also carried out for all seven variants with seven specimens with a length, width, and thickness of 200 mm, 25 mm, and 0.5 mm, respectively. During the test, the specimens are subjected to both tensile and compressive forces, and the best three average values in each case are considered for evaluating the flexural strength. The specimen for impact test and hardness has been prepared with a length of 55 mm, a width of 13 mm, and thickness of 0.5 mm and the specimen for hardness test has been prepared with a length of 30 mm, a width of 30 mm, and thickness of 0.5 mm respectively.

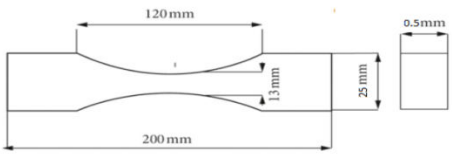


Figure 9 dimensions of tensile specimens

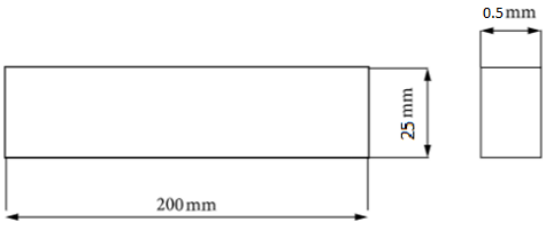


Figure 10 dimensions of flexural specimens

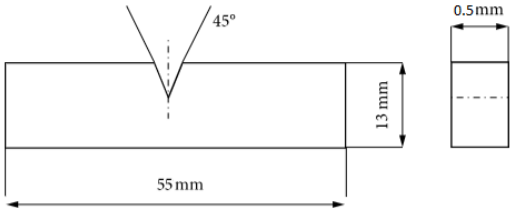


Figure 11 dimensions of impact specimens

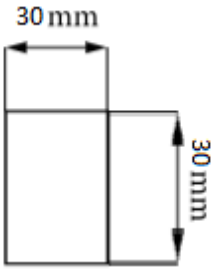


Figure 12 dimensions of hardness specimens

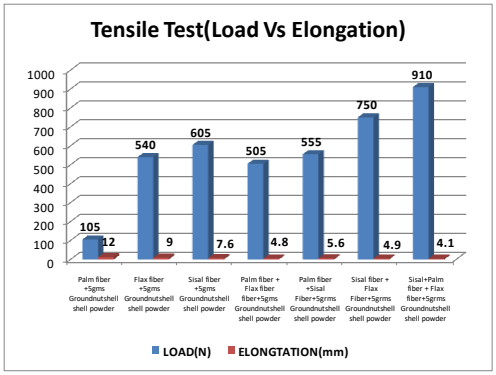
MECHANICAL CHARACTERISTICS OF COMPOSITES

The properties of the Plam+5% Ground Nut Shell Powder, Flax+5% Ground Nut Shell Powder, Sisal+5% Ground Nut Shell Powder, Plam+Flax+5% Ground Nut Shell Powder, Sisal+Plam+5% Ground Nut Shell Powder, Flax+Sisal+5% Ground nut shell powder, Flax+Sisal+Plam+5% Ground Nut Shell Powder as reinforcement reinforced epoxy hybrid composites with of fiber under this investigation are presented in below Table. 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 natural fiber reinforced composites are largely depending on the chemical, structural composition, fiber type and soil conditions and also on atmospheric conditions at the time of fabrication of the specimens.

TENSILE STRENGTH

Fabrication and testing successfully completed in this project the tensile properties of Plam+5 grams of Ground Nut Shell Powder, Flax+5grams of Ground Nut Shell Powder, Sisal+5 grams of Ground Nut Shell Powder, Plam+Flax+5 grams of Ground Nut Shell Powder, Sisal+Plam+5 grams of Ground Nut Shell Powder, Flax+Sisal+5grams of Ground nut shell powder, Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder fabricated by using hand lay-up method. The tensile strength was calculated by the relation

$$\text{Tensile stress } \sigma_t = \frac{tensile\ load}{area\ of\ cross-section} = \frac{P}{A}\ \text{N/mm}^2$$



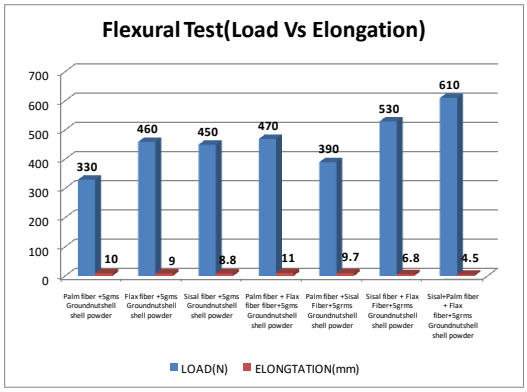
Graph 1 tensile test result graph

After successful completion of the tensile strength, we are getting maximum values for the Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder 910 N.

FLEXURAL STRENGTH

Fabrication and testing successfully completed in this project the flexural strength of Plam+5 grams of Ground Nut Shell Powder, Flax+5 grams of Ground Nut Shell Powder, Sisal+5 grams of Ground Nut Shell Powder, Plam+Flax+5 grams of Ground Nut Shell Powder, Sisal+Plam+5 grams of Ground Nut Shell Powder, Flax+Sisal+5 grams of Ground nut shell powder, Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder are fabricated by using hand lay-up method. The flexural strength was calculated based the following relation

$$\text{Flexural strength } S = \frac{3PL}{2bt^2}$$

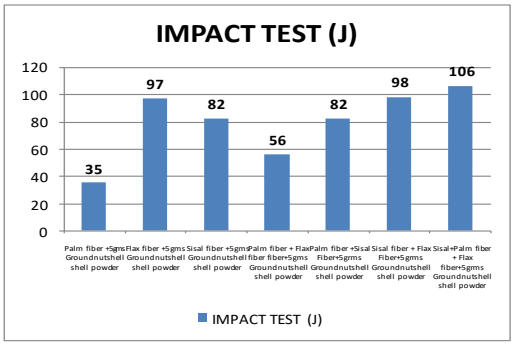


Graph 2 Flexural test result graph

Based on the flexural strength finally concluded that Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder possess high flexural strength compared to remaining composite as shown in table.

6.4 IMPACT STRENGTH

Fabrication and testing successfully completed in this project I also focused on impact strength of Plam+5 grams of Ground Nut Shell Powder, Flax+5 grams of Ground Nut Shell Powder, Sisal+5 grams of Ground Nut Shell Powder, Plam+Flax+5 grams of Ground Nut Shell Powder, Sisal+Plam+5 grams of Ground Nut Shell Powder, Flax+Sisal+5 grams of Ground nut shell powder, Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder fabricated by using hand lay-up method.

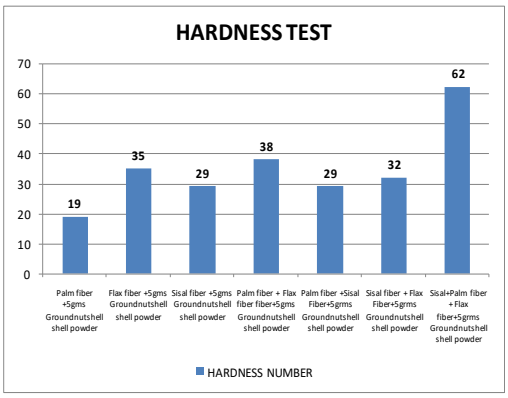


Graph 3 Impact strength result graph

And finally concluded the Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder material possess high impact strength compared to remaining compositions as shown table.

6.5 HARDNESS NUMBER:

Brinell hardness values of Plam+5 grams of Ground Nut Shell Powder, Flax+5 grams of Ground Nut Shell Powder, Sisal+5 grams of Ground Nut Shell Powder, Plam+Flax+5 grams of Ground Nut Shell Powder, Sisal+Plam+5 grams of Ground Nut Shell Powder, Flax+Sisal+5 grams of Ground nut shell powder, Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder composites. Experiment gives the Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder having maximum Brinell hardness value 62, where Wt% ratio of resin &hardener.



Graph 4 Hardness number result graph

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 Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder give the higher value of Brinell hardness.

DIMENSIONS AND DESIGN PROCEDURE IN CATIA:

Modelling of Car Bumper by Catia – Software application within the CAD/CAD/CAM/CAE category, along with other similar products currently on the market. Creo/Engineer is a parametric, feature-based modelling architecture incorporated into a single database philosophy with advanced rule-based design capabilities .The capabilities of the product can be split into the three main heading of Engineering Design, Analysis and Manufacturing. This data is then documented in a standard 2D production drawing and the 3D modelling of car bumper is done with help of catia - software and dimensions are selected from one of car bumper. Design dimension of Maruti Suzuki Alto car bumper same for first design called as existing bumper design. As the impact is more for the front portion of bumper only outer dimensions of car bumper has been considered, Slots provided in middle of car bumper is used for reducing drag effect in car bumper.

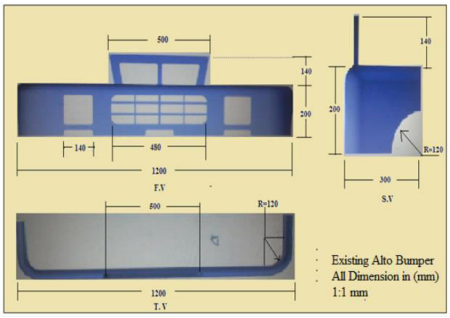


Figure 13 Dimensions of car bumper

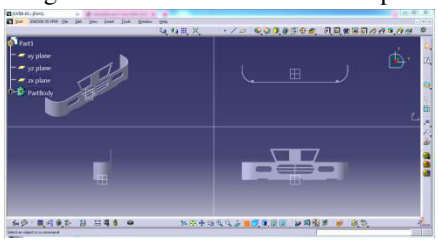


Figure 14 Multiple views in catia

STATIC ANALYSIS RESULTS:

This analysis is performed to find Structural parameters such as Stresses, Deformation Here we observed results on four materials namely Powder, Flax+Sisal+Plam+5 Grams of Ground Nut, Polypropylene (pp)

FLAX+SISAL+PLAM+5 GRAMS OF GROUND NUT SHELL POWDER:

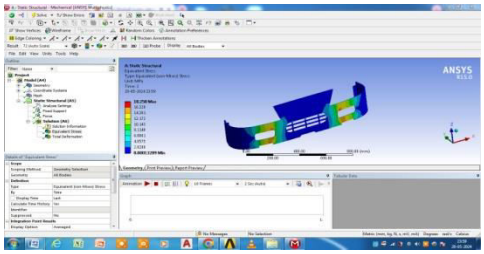


Figure 15 Von-Misses Stress Of Flax+Sisal+Plam+5 Grams Of Ground Nut Shell Powder

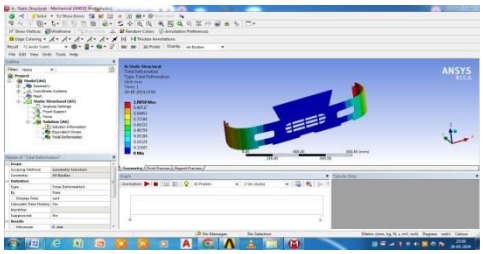
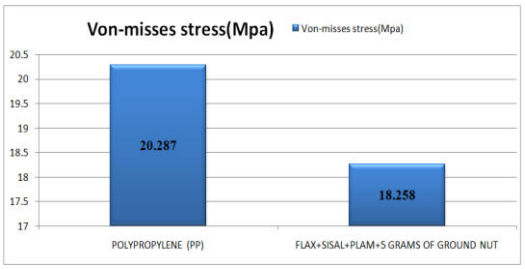


Figure 16 Total deformation of Polypropylene (pp)

VON-MISSES STRESS GRAPH:

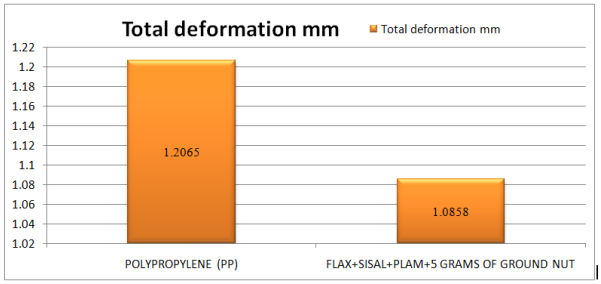
This graph shows the Different maximum von-misses stress values in different materials Using car bumper with Flax+Sisal+Plam+5 Grams of Ground Nut and Polypropylene (pp) finally least von-misses stress obtained Flax+Sisal+Plam+5 Grams of Ground Nut shell powder have 18.258 Mpa compared to another material as shown below graphs



Graph 4 Von-misses stress graph

TOTAL DEFORMATION GRAPHS:

This graph shows the Different maximum Total deformation values in different materials Using car bumper with Flax+Sisal+Plam+5 Grams of Ground Nut and Polypropylene (pp) finally least Total deformation obtained Flax+Sisal+Plam+5 Grams of Ground Nut shell powder have 1.0858 compared to another material as shown below graphs



Graph 4 Total deformation graph

CONCLUSION

The present work has been done with an objective to explore the use of Plam+5 grams of Ground Nut Shell Powder, Flax+5 grams of Ground Nut Shell Powder, Sisal+5 grams of Ground Nut Shell Powder, Plam+Flax+5 grams of Ground Nut Shell Powder, Sisal+Plam+5 grams of Ground Nut Shell Powder, Flax+Sisal+5 grams of Ground nut shell powder, Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder are manufactured using hand lay-up method. Polyester 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 Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder combination show a best result in the tensile strength impact strength, hardness test and as well as tensile&flexural strength. Among the above compositions build a full parametric 3d model of a car bumper. The car bumper was

developed using CATIA software and analyzed using ANSYS software with existing material Poly-propylene and proposed Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder combination fiber composition. Developing a car bumper with Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder fiber materials are cheaper and greater strength. For the above investigations we are proposed the Flax+Sisal+Plam+5 grams of Ground Nut Shell Powder 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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