iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** VII **Month of publication:** July 2022

DOI: https://doi.org/10.22214/ijraset.2022.45728

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VII July 2022- Available at www.ijraset.com

Effect of Fibre Loading on Mechanical Behavior of Kenaf Fibre and Nano Silica Reinforced epoxy Resin Composite Material with and without Silane Treatment

Nabbel Sulthan J[1], Kannan P[2], Kandasamy R[3], Selvaraj G[4]
[1]*PG Scholar,* [2, 3]*Assistant Professor,* [4]*Associate Professor, Department of Mechanical Engineering, Selvam College of Technology, Namakkal, Tamil nadu, India*

Abstract: ***The main objective of in this the paper presents the investigation by kenaf fiber of silane usage of regarding silicon (IV) oxide on to using several mechanical tests similar to tensile strength, flexural and impact test are mechanical properties which helps to use in various industrial mechanical commercial applications. The kenaf fiber is soaked in a mixture of ethanol and silicon (IV) oxide which is known as treatment process and the non-hydrated kenaf fiber in untreated process. The plates are arranged to ASTM based on dimension in the form 3 ply's of kenaf layer is inserted; It is molded with the help of epoxy resin. The composites there was fabricated using the hot press to form plate to Infusion in mixture process by the making of a compressed approximate orientation kenaf mat. The natural kenaf fiber as 50% vol with added of each plate in silicon (IV) oxide of 1%, 2%, and 2.5% there was used to make the hybrid composites. Then various test are flexural, tensile, micro hardness, impact and water absorption test, it is also based on treated and untreated values. These are some of the important stages on the followed in these procedures. Improving the impact of kenaf fiber on crack resistance, durability and mechanical properties in concrete applications. In this research, kenaf fiber is separate in treated and untreated composite materials. The mechanical fields which help to develop the efficiency of the experimental where the kenaf fibre material is being used. The main role of reason for the usage of this material is to avoid plastics. Because of natural fibers are commonly weaker than to synthetic fibers, they tend to weaken mechanically and physically over period due to the porosity of the fibers. The final test performed known as tensile in breakage point to be SEM test, the test we can able to see the 200µ to 500µ range in micro image of this material. The composites with added of 2.5% vol nano silica show greatest mechanical methods of the samples treated with an silica nanoparticles at 264 Mpa and 6352 Mpa for flexural strength, flexural modulus. The effects presented that the adding of nano silica (IV) particles with kenaf fiber in general has a good effect on mechanical properties.***
Keywords: Epoxy Resin, Kenaf Layer, Micro Hardness, Synthetic Fibers, Tensile Strength

I. INTRODUCTION

The natural composite of object can be defined as per the mixture of two otherwise extra products are resulting is the in improved properties than separate components as used to alone. On the divergent Alloys, to each substantial of material in keep its individuality to the improved several chemical, physical and mechanical properties. The main benefit of composite materials are their developed strength and stiffness, compared to lower densities bulk products, allowing you to lose weight as the complete part. The strengthening stage provides to the strength and stiffness. In maximum cases, the reinforcement is some properties harder, stronger, and harder than the matrix. Strengthening is frequently fiber before particle. Specific compounds have sizes, and all directions are approximately equal. They are circular, platelets, otherwise various fixed or unbalanced geometries. Specific compounds are much weaker and less expensive than continuous fiber composites, but they are generally much less expensive. Particularly reinforced compounds generally have low reinforcement (40 to 50) capacity percentage owing in the processing problems and instability. The amount of Length dividend diameter (L / D) Rate This is called to the rate proportion and can contrast greatly. Incessant fibers consume extended proportional ratios irregular fibers have shorter proportions. Continuous in the fiber mixtures composites are usually a chosen orientation, intermittent in the fibers there is usually a casual orientation.

©IJRASET: All Rights are Reserved

To obtain the desired strength and stiffness properties of fiber sizes, they are often made of laminates with single layer sheets of continuous fibers in different directions. From 60 to 70 per cent. The fibers form composites with high strength due to there are small diameter theyhave very few faults (usually shallow defects) as the compared to products formed in bulk. The common law is that the minimum size to the diameter of the fibers, extra strong strength, but normally costs more become smaller in diameter. In addition, high strength fibers with small diameters are high very suitable for flexibility and guiding processes such as weaving or formation in radiation. Typical fibers include glass, agamid and carbon; it can be continuous or intermittent. Continuous phase

$$E_c = (E\alpha E\beta) / (V\alpha E\beta + V\beta E\alpha)$$

matrix, be it polymer, metal or ceramic. Polymers are low strength and stiffness, metals are intermediate strength and stiffness but better ductility, and ceramics have greater strength and stiffness, Common fibers are used for reinforcement include glass fiber , carbon fibers, cellulose (wood/paper fiber and straw) and high strength polymers for example. Silicon fibers are used for some high temperature applications. Transmit conditions of loads matrix for fibers by shear strength loading interface. In Ceramic Matrix Composites, to goal is regularly to increase hardness than strength and stiffness. Physical Formula given below.

A. Hybrid Composite Fabrication

It is exciting that hybrid compounds contain of there are two or more different fibers in a matrix Fiber reinforced polymers field designate. This study includes woven kenaf be used to create hybrid composites. Different fiber configurations of the composite laminated materials were introduced to study the effects of tensile, semi-static groove and low speed impact properties of hybrid and non-hybrid materials. There were compounds a hot press was fabricated by the abstract molding process. There are 9 different types of fiber configurations in composite laminates. The fiber configurations are referred to E, EK, EK_1,EK_2, and EK_3. A total number of 4 fiber layers were fixed in the composite laminates. The composites laminates be ready by stack PP sheets in fixed between the fiber layers to allow finest fiber impregnation. The prepared layups were stacked in a picture structure mould with a Dimension of 270 x 270 x 3 mm (height x width x depth). These the composite laminates together with Picture frame mold were before placed in a hot compress machine and preheated for 4 min follow by hot Compression at the temperature of 175 °C and pressure of 3.5 Maps for 8 min. The composite panel is cooled to room high temperature before in use out from the hot press machine.

B. The need for Natural Composite Material

Recently, the quickly increasing used of natural composite components. In automobile, building, sporting and additional loads industrialized industry have focused on the workable and renewable reinforced composite. Global availability of natural fibers and this is due to the abundant access to agricultural waste research and Search for New Polymer Science and Engineering aimed at a maintainable technology. Natural fibers are introducing the reason of compliant brighter combinations, by fewer costs related to presentfiber kenaf reinforced polymer composites. These composites plays a major rule in the field of industries and help to develop and improve the usage of natural composites in all the fields and area where it is used. This are several test have been carried out by these.

C. Mechanical Testing Methods

1) Impact Test

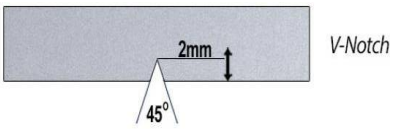


Fig 1.1 V-Notch

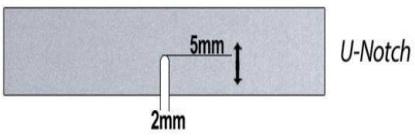


Fig 1.2 V-Notch

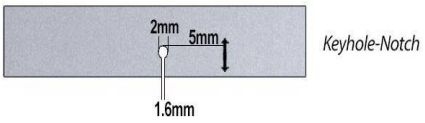


Fig 1.3 V-Notch

2) Pendulum method

In this method is cut into specimen with dimensions 65mm x 13mm x 3mm and notch was made at the center of the specimen at 45º angle for impact testing as per ASTM D-256 are specification. Used for this test measured sample piece be located between provisions.

The machine takes the testimonials.

Display	:	Manual Indicating unit.
Scale range	:	2, 4, 7.5, 15, 25 joules.
Hammer	:	one.

II. LITERATURE REVIEW

D. Chandramohan et al (2017) the result of this paper presents the properties of hybrid composite in mechanical properties at tensile, impact, shear, flexural used with coconut shell and rice husk. In this fabricated fiber process both specimen ratio is 1:1 and epoxy and hardener ratio is 10:1 individually. Then author has calculated in both treated and untreated of composite material. The finish of fabrication the author has taken sample piece for testing under ASTM standard and also tested under standard. At final it shows better result in properties of hybrid composite of natural fiber than glass fiber reinforcement.

J.G.K.Kumaret al (2019)In this process the author has choose CNSL cashew nut itis easy and cheapest available materials because of the liquid of CNSL is 100% permitted from the chemical products are pure. Because this is more with glass fiber and flax to create the good and better strength to the material. Then the fiber is treated with SiO2 to reduce the dust and keep the fiber clean to increase bonding of fiber with resin. The SiO2 is treated in duration time of 72h to growth the strength of substantial and the uses of SiO2 fortreatment is 5%, 15%, and 20%. The author has used Taguchi 1.9 to find the best result in mechanical properties it helps concentration of treatment in SiO2. The Taguchi 1.9 was alsocalled orthogonal array and for better simplification also carried out to test. This made the composite material in flexural strength at the significance level carried out from natural fiber.

M.Shukla et al (2017) : In this work the fabrication was equipped by two roll mixing in moulding. The compression moulding is used for the fabrication process. The outcomeof fiber is 10, 20, 30% on flexural and tensile were tested with treated and untreated of SiO2. The 10% treated test sample shows maximum in tensile testing and 30% of treated found in flexural. To observe behavior of reinforcing in kenaf fiber is carried by Dynamic mechanical analysis. To comparing to both treated and untreated process the matrix shows interface in kenaf fiber good bonding in treated composite material.

Farid bajuri et al (2015): In this the process the natural fiber when comparing with the synthetic fibers the synthetic fiber which having the good grade of the physical and mechanical properties are involved. The nanoparticles of the silica material is used to increase the better quality of composite materials. After the quality improvement process the nanoparticles which get interact with the composite components. Thus the silica nanoparticles are inserted into epoxy material by the use of homogenizer for 10 minutes at 3000 rpm. Thus the result of the composite materials the mechanical properties will be the 43.8 MPa and 3.05 GPa and the flexural strength and modulus will be the 40.0MPa and 3.05 GPa and the compression modules and strength will be same.

A. M. Noor azammi et al (2019) : this paper presents the treatment of kenaf fiber with sodium hydroxide on dynamic analysis and physical analysis. Then the author has usedhot press for fabricating polymer composite to form the plating. The prepared samples are cut for testing under standard and water absorption, thickness, dynamic test, density mechanical test were taken. Due to this process the good bonding performed in compositionwith higher NR amount of physical properties. At last the high temperature at highest properties shows the TPU in more amounts in composite.

W. H. Haniffah et al (2015): In This research paper studied for degradation to tensile strength, tensile modulus material of kenaf strengthened polypropylene composites due to cyclical involvement into two variable material solution, comparison of the improved composites tested as tensile strength properties under continuous and cyclical fabricated involvement. The natural composites material from 40% to 60% fiber loading were immersed in normal water and remove the color for 4 cycles. There are primary effects Suggest further evaluation of the correctness of the reinforced kenap for possible bathroom use where vanities are exposed to water / fluid in the rotation due to improper use of the bathroom.

Aofei guo et al. (2019)In this paper presents to improve the impact in kenaf fiber on mechanical properties, crack resistances in solid material application. The various chemicals are used for treated purpose to improve the fiber properties and the SiO2 (sodium hydroxide), H2O2 (hydrogen peroxide), KMnO4 (potassium permanganate), K2Cr2O7 (potassium dichromate), NaClO2 (sodium chlorite) this are several used for treatment. Due to hydrogen peroxide treatment in kenaf fiber which increase 40% of cellulous satisfied and there crystallinity intensification 26.8%, also the strength in tensile increase by 18.9%. The sodium chlorite increase restrained in treatment. But potassium permanganate and potassium dichromate increase the properties faintly.

Faissal chegdani et al (2017): This paper represents the machinability process of the kenaf fiber composite components by the investigation process of the formation of chips. Due to the continuous repetition of the cut surface material the quality of the material is improved by orthogonal cutting process. Orthogonal cutting process is used to test the unidirectional flax fiber reinforced

polypropylene (UDF/PP) composite material. The UDF/PP elements is tested by tensile, mechanical, shear type of testing process. Then the scanning electron microscopy (SEM) is conducted the inner where in to the machine surfaces. The properties of the thermoset composite elements is lesser than the thermoplastic composite materials. The natural fiber reinforced plastics (NFRP) is mainly used in aerospace and automobile industries. In (NRPF) material the ecological, economicaland other various benefits are involved.

N. Parthipan et al (2019) :In this research the author presents the impact damage in mechanical properties and characteristics in drilling. The author has processed in both treated and untreated composite with SiO2. The mainly aim of the paper is overt the benefit of the treatment with use of silicon (IV) oxide in epoxy resin medium and together with kenaf fiber. The fabrication work is done under 450 GSM to make the composite plating. The various percentages with 0.5%, 1.0%& 2.0 % of silicon oxide is used for fabrication. And 172 Mpa of tensile, 255 Mpa of flexural and 6.45Jof impact were resulted from composite with fiber and silicon contains 50% and 2.0 %. In the testing result of mechanicalproperties EKS_3 (Epoxy+kenaf+silicon with 2.0%) is low damage in impact test comparing to other combinations.

K. Anbukarasi et al (2015): the author has present three different shapes of fiber in luffa fiber mat they are short fiber, particles and short fiber. The experimental investigation in composite to mechanical, water absorption and thermal with SiO2 treatment of fraction (0.3-0.6 VF).Then the composite performed in the test of impact, compressive, tensile, and flexural. The result treated in test compared to untreated has shown higher in tensile, flexural, compressive, and impact with developed of 13.5%, 72.43%, 7%, and 163.6%.In an inert atmosphere the temperature range is between 341.4^0c to 388.2^0c of thermal behavior incomposite material. In the water absorption the two particle fiber contains in composite for better performance. At last by using Field Emission Scanning electron microscope the plating is scanned for better bonding with resin and fiber.

N.Saba et al (2019):This article presents to the fabrication of filler magnesium together with kenaf fiber/epoxy composite with various load of 10%, 15%, 20%, and 25% in wt. The testing properties like impact, tensile, thermal dynamic, and morphological are compared and calculated in the development of kenaf/MH/with hybrid composite. Comparing to hybrid composite and epoxy/kenaf the damping factor was observed as decrease. In this process comparing to overall performance the important remark in MH hybrid composite is 20%,which is better interaction and dispersion of kenaf compare to epoxy.At final the 20% of fiber can be show the better result comparing to the hybrid composite in mechanical properties of impact, tensile, flexural.

K. VenkataKrishna et al (2016): The main study of this paper is to research of treatment in kenaf fiber and reinforcement of epoxy resin. The treatment was done under room temperature for 24 hours with two type of amino acids and the two acids are glutamicacid and lysine. The major comparison of treated and untreated in thermo gravimetric.

III. SCOPE OF KENAF FIBER

The normal natural kenaf fiber is used as a major filler material to be used in the reinforced composite process of the fabrication but the natural kenaf fiber are weaker in properties than other fibers, but it can be improved by major process obtained in composite fabrication. Kenaf fiber in the pure natural fiber which is to be used only the last five years due to the availability of some properties as a good alternative material in paper industry which is to be researched by the researchers.

The scope of this study is to increase the strength of reinforced kenaf fiber composite. Then to do the investigation on Nano silicon (IV) oxide in based on physical and mechanical properties of kenaf fiber composite. Finally, capture the image of fracture in composite in the SEM to analysis there damage level.

The experiments are done in scopes of research as follows:

1) The studies in mechanical properties in terms of strength in tensile and flexural strength.
2) The Physical properties studies in the terms of moisture content and water absorption.
3) Scanning electron microscopy shows the facture of reinforced kenaf fiber silicon composite.in this studies the
4) In mechanical properties the treated fiber were better comparing to the untreated fiber.
5) These studies indicated that the kenaf composite–reinforced epoxy resin in silicon as applied can be considered as an alternative to reinforce materials for the preparation of automotive parts.
6) In general, development of NFC spending continues on a quick rate and there would come into view to be a very positive future in front for the different outside applications.
7) Easy and disposal of waste in economical is one of the most reasons to important the trend in the production of natural fiber composites.
8) To used for agriculture operation by the replacement of plastic food feeder to the natural composite kenaf fiber materials.

A. Objective of Study

The purpose of this research is to produce strength of kenaf compounds and longer ones Kenaf reinforced epoxy resin mixtures. The properties of those composites with mechanical testing is present investigation. The residual tensile strength and the measured impact samples and cut specimen was taken models. From there, it is possible to predict the damage fraction of the compound. Long kenaf compound was found to be high Peak sensitivity rather than kenaf /woven glass in hybrid combination. The kenaf mix was less stronger than the hybrid mix. However, the damage enhancement mechanisms were similar in both products.

Therefore, several objectives in research were recommended as follows:

1) To evaluate the energy absorption of kenaf treated composites with different fiberorientations.
2) Also to evaluate the untreated kenaf composite with different orientation.
3) To determine the impact strength of different type of weaving pattern plain, twilland basket.
4) To optimize impact energy absorption with Taguchi method.
5) To correlate the relationship between impact speed and energy absorption onkenaf woven composites.

IV. MATERIAL

A. KENAF Natural Fiber Material

The kenaf natural fiber is extracted and separate in hibiscus cannabin's it also called Deccan hemp and it is in the family of Malvaceae.The kenaf is harvest most in hand harvested method and the kenaf is used to cut under ground level. Then the hand harvested kenaf is take to next retting process. Then the fibre was retting by natural processes that is usually carried by anaerobic bacteria and different fungi. The kenaf stalk and the bark portion were tied in bundles and placed in canals to remove slow of streams to allow the plant material to 3-6 days to digest in bacteria at barks fibre strands. Elimination of the fiber-free top of the plant improve the response level by reducing the leaf and material of plant that needs be consumed before the mitigation process. Then the retted kenaf stems were washed in running water and top of fiber is removed and dry in sunlight. There are two forms one is short and another is long it is depends on cultivation of fiber plant and growth of the fiber. The properties are given in the below table

The properties of fiber kenaf used in this process

Properties	Natural fiber (Kenaf)
Appearance	White and brown
Length	0.6 to 1.1
Diameter	0.15 to 0.30
Density	1.32
Tensile strength	32 MPa
Flexural strength	47MPa

B. EPOXY RESIN MATRIX

The matrix material used for this analysis is the commercial name of commercial epoxy resin Satyen Polymer Pvt. Ltd., Bangalore, India provided by i-Lab Scientific Tech Enterprise, Madurai, Tamil Nadu, India The general characteristics of vinyl ester are listed in below the Table.

Properties	Epoxy
Appearance	White
Viscosity	1.214
Density	450
Specific gravity	1.10

Cleaned adhesive plate with accelerator and catalyst in 180 mm × 20 mm × 3 mm molds to detect mechanical properties. The untreated models are tested and the average strength of tensile is expected to 135 MPa and tensile modulus is 5679.6 Mpa. Mean flexural strength is found to be 206.4 Mpa and the flexibility modulus is 5139 MPa. The strength of impact is found to be 4.362 J. Treated are tested and the average tensile strength is expected to 553.6Mpa and the modulus of tensile is 5814.6 Mpa. The mean flexural strength is 219.8Mpa and the flexural modulus is 5311 Mpa. The impact strength is 4.874J.



Fig 4.1: Epoxy (LY556)

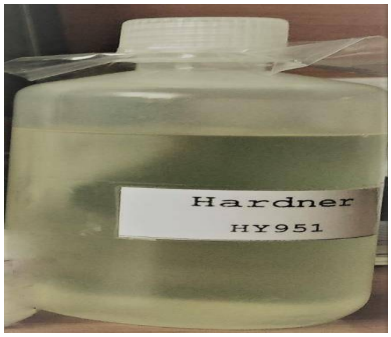


Fig 4.2: Hardener HY951

C. Nano Silica Liquid

Silicon (IV) oxide is a very hard material that is resistant to modifications and chemicals. Both amorphous SiO2 and crystalline are almost insoluble in acids and water. However, in suspensions of aqueous, the amorphous type are slowly at finest forms are converted to n H2O x silicic acid SiO2. At a pH of 7 (neutral) and 25 ° C, but SiO2of 0.12 g(120 ppm) were dissolve per liter of water in that way. The solubility rate of quartz is 10 times lesser than that of amorphous SiO2. In particular, in aqueous solution the amorphous SiO2 can be dissolved. SiO2 is corrosive when exposed to hydrofluoric acid, as it is against other acids.

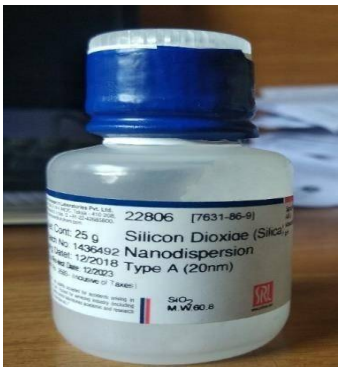


Fig 4.3: SiO_2 (Type A)

D. Ethanol with 3-Aminopropyl (APTES)

The APTES is taken out to the kenaf fiber to increase the fiber strength, also to modification of structure. And the APTES which improve the surface topography. The ethanol is used to wash the kenaf fiber remove the dust in fiber to increase the bonding of epoxy matrix. The solution are mixed and the fiber are extracted in to the solution for 10 min in room temperature and wash with excess SiO2 to remove the un wanted partials. Taken out of the process and allow to dry it in atmosphere temperature in 24 hours.





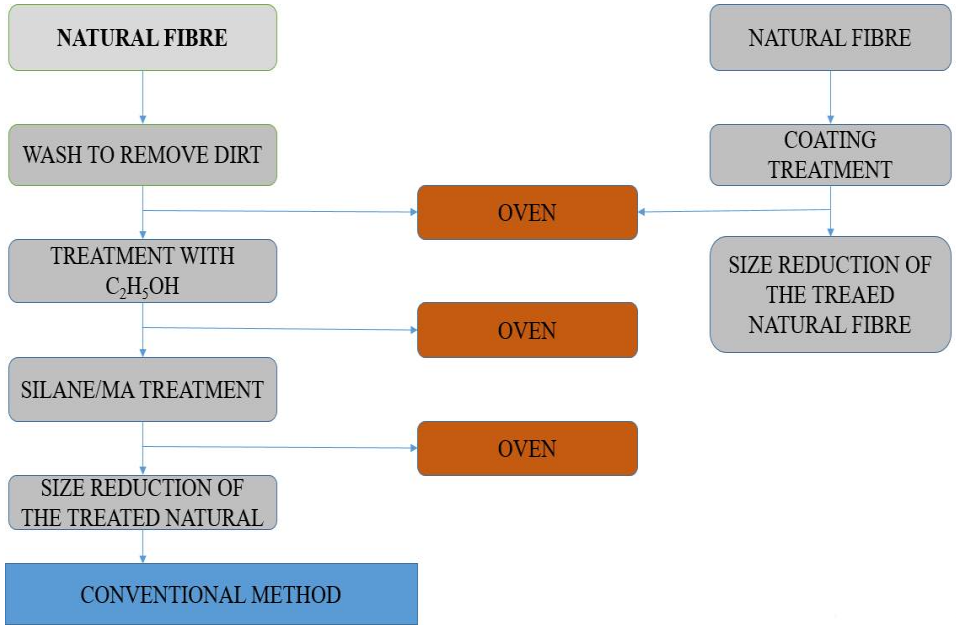
Fig 4.4: C_2H_5OHAPTES ($C_9H_{23}NO_3Si$)

V. METHODOLOGY

A. Fiber Treatment Process

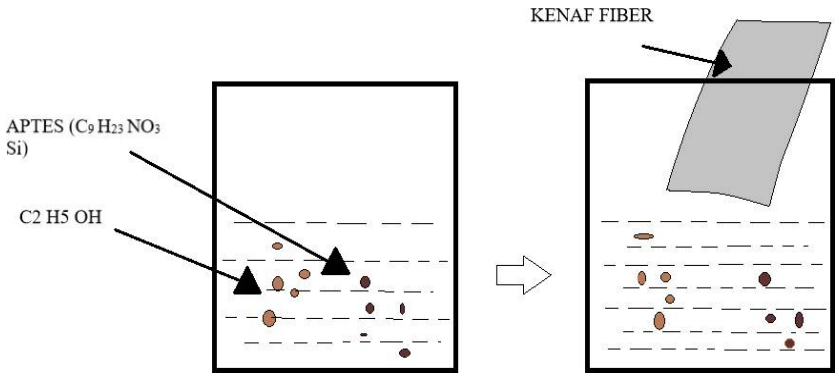
In this the process the kenaf fiber the purchased kenaf fiber is cut in to twenty seven pieces. The kenaf fiber is cut at the dimension of 270mmx270mmx3mm respectively. By the mixing of the ethanol/water of 90/10% were mixed completely in a mixing jar and stirred for 10 minutes and then the 3-Aminopropyletriethoxysiliane (APTES) $C_9H_{23}No_3Si$ was added generally by 50 ml by drop by drop to attend the required condition of the fluid. And the mixed solution is to be continuously stirred for after 5 minutes to form a complete mixture of solution. In that the final prepared solution of Ethanol, Water and APTES the kenaf fiber pieces is to be immersed in that the liquid solution for after 10 minutes without doing of any other work in the intermediate time during the immersion process. After that the completion of the immersion process the treated kenaf fiber pieces is to dried in the atmosphere at normal atmospheric temperature 24 hrs. To removing the wetness substance absorbed by the kenaf fiber material. Then the pieces is to be used for the further testing process in future.

B. Methodology For Kenaf Fiber Material

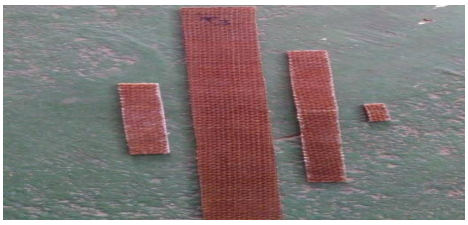


1) Treatment with Ethanol Andaptes (3-aminopropyltriethoxysilane)

Both are completely false, thus forming a homogeneous solution or mixture; If you mix one part of water and one part of ethanol, the resulting mixture will be 1.92.



2) *Dehydrated Process of KENAF MAT:* To get dried in oven to reduce the moisture content the treated kenaf fiber is processed in oven. The atmospheric temperature is used in this stage for dry purpose with 24 hours. The process is done because of good bonding of epoxy resin in next stage, thusthe good bonding process is very important thing for the merged material. The water not allows proper formation of composite materials it reduce the properties and form the undesirable like air bubbles, cross mark, cavity mark, surface unfinished etc. so the avoid ofthis problem the process done in dehydrated.
3) *Creation OF KENAF MAT:* The kenaf mat is plated by using the compression mold. The major process is involved in molding is creating the solid plate with natural fiber and epoxy resin. The LY556 type epoxy resin is used in this fabrication work. The size of mold which is used in this process is 270mm length and 270mm breathe. And hardener with 10:1 ratio with resinis used for mixture. The hardener is used for made the chemical reaction in resin to form in to the solid material.
4) *Dehydrated Process of Plating:* The created kenaf mat is allow to dry in the room temperature, because the kenaf plate from molding after process it is under solidification. This is the reason allow the mat in atmosphere to set in to the solid stage.
5) *Sample Cutting:* The sample specimen is created from composite plating for various mechanical properties. Test samples were carefully prepared under standards of ASTM using the water jet machine (Maximum Water Jet 1516, Kent, USA). The maintained pressure of water jet machine in this process is of 250 MPa, flow of abrasive 0.36 kg / min, and a size ofgrain 80 net and tip width of 1.1 mm.



6) *Testing Of Samples:* The testing is belongs to mechanical behavior like tensile, impact, flexural, ILSS, andwater absorption are the major test performed in fabricated kenaf plate. The plating is cut under the ASTM standard for each test and tested in required machine for testing the samples.

C. *Manufacture of KENAF Fiberplate*

1) *Resources and Techniques:* This section describes in detail the detailed testing procedure analytical study of natural fiber based composites. Sample first fabrication, then a tensile and a flexibility test is conducted on the model.

2) Materials used for experiments

Raw materials for experimental work are:

a) Kenaf fiber.
b) Epoxy resin.
c) Hardener.
d) Silicon (IV) oxide.

3) Composite Fabricated Machine: First the mold is covered with a plastic layer and the first layer of epoxy hardener the mixture is spread uniformly with a soft roller. The thickness of this layer is 3 mm. Then we place a layer of coin fiber that spreads the entire surface the same area. On top of that we pour the hardener-epoxy mixture. It is used in silicon on different range of 1%, 2% and 2.5% are apply on the kenaf fiber. We now lay a layer of sugarcane packaging followed bya layer of epoxy resin and hardener. Then sample is leave for 24 hours. Gets mixed dries for 24 hours, in which polymers stick and silk fibers to themselves balance of hardener. We putout the weights a day later. Then there are careful nail bits impassive from the wood panel. Now the silicon are mixed in. The hardener has a very strong effect that combines with the glass mixer. The temperature of100ºC under pressure of mold 8 MPa for 25-50 minutes in ahot press placed between fiber pressed percentages. This link there are glass and composite fibers on its border, slowly and gently Separate.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



Figure 5.1 : Composite Fabricated machine

D. Diagram of Process

1) Material used for this assignment is

a) Natural kenaf fiber

- Treated kenaf mat
- Un treated kenaf mat

2) Fabrications of kenaf solid dish

a) Epoxy plate

b) Kenaf plate

- Natural kenaf fiber



Fig 5.2: Treated kenaf mat

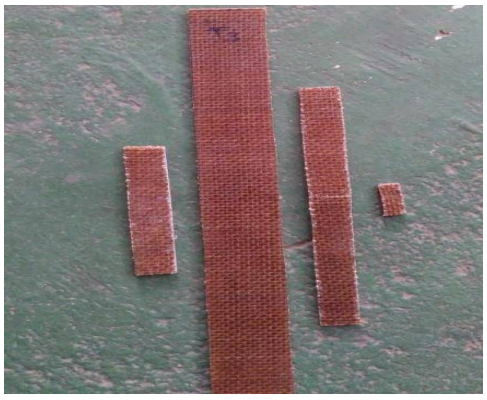


Fig 5.3: Untreated kenaf mat

E. Study of Composite With ASTM Standard

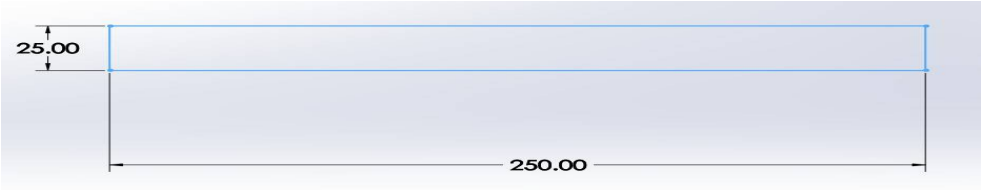
In this process the sample specimen are cut in the test samples were prepared established on standards using the water jet machine in ASTM (Maximum Water Jet 1516). The pressure in abrasive water jet machine of 250 MPa, and flow of abrasive is 0.34 Kg / minute, a grain dimension is 80 wire and width of tip 1.1 m.





F. Tensile test Specimen Dimension

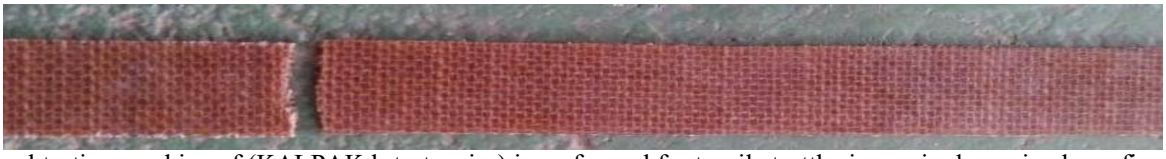
The kenaf fiber is formed in explored in natural fiber for tensile behavior. So in this large test variations in the estimated values for strength in tensile and modulus in the collected works. Because kenaf fibers usually have irregularandvariable intersections, due to thesethe major error in stress are led by their measurement.



1) Tensile Test Specimen

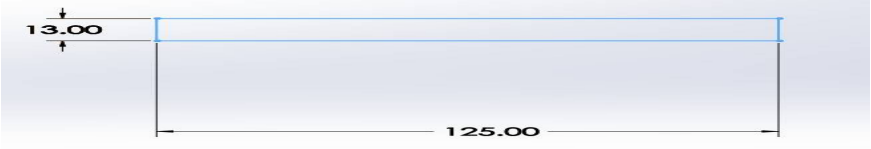
The tensile test and tensile modulus were measured by (Kalpak Universal Testing machine),the machine speed is 5mm/min. The test specimen as per ASTM D - 3039 and standard sizeis 250X25x3mm as shown in fig 1. With initial straight line slop and Stress-strain curve the modulus of tensile was calculated.

2) Tensile Breakage Specimen



The UTM universal testing machine of (KALPAK k-test series) is performed for tensile testthe image is shown in above figure. The testing machine is grade as KIC-1000-C and the capacity of 100 KN. The various type of grips and fixture are held in tensile test, In this screw clamping tensile grip are used for testing. The optional capacity in 100 N, 1KN, 10KN.

G. Flexural test Specimen Dimension



Flexural test were conducted in H10 (bi-axial machine testing), the speed of machine crosshead of (5mm/minute). The test specimen is prepared by ASTM D 790 and thedimension is 125×13×3mm and the total length is 48mm were used in flexural test.

1) Flexural Test Specimen



The elasticity in bending and flexibility Stress, flexural strain and resilient stress-strain response Material. The main advantage of the three-point flexibility test simplicity the sample creating and testing.

2) Flexural Breakage Specimen



©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

The flexural load apply on the specimen to maximum breaking treated strength is EKS3 specimen value is 264 Mpa. Then untreated strength is EKS3 specimen value is 251 Mpa. At finally compare to this results the value is improve in treated better then untreated.

3) Flexural Testing Machine





The flexural is performed in same as in tensile of (KALPAK Universal test machine) as displayed in above fig. The fixture used in this testing kalpak bending / flexural testing withthe capacity options of 1KN,10KN,50KN and three point bending fixture. The testing machine is grade as KIC-1000-C and the capacity of 100 KN.

H. Impact test Specimen Dimension



To analysis the results of izod impact test in properties of treated and un treated on natural kenaf fiber and different percentage of silicon (IV) oxide with epoxy resin. The impact test supported as per standard of ASTM D-256 using impactor scale 2, and for test the used pendulum was 5.5J. The specimen dimension for 65×13mm.

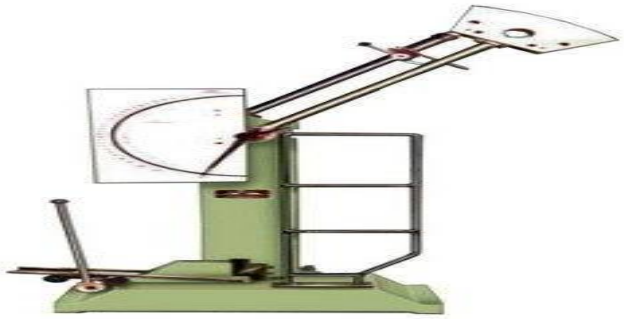
1) Impact Test Specimen





2) Impact Test Machine

The impact machine used in process is from 168J/ 360J capacity for test the specimen.



It is the simple operated machine and not have any air pressure and angle accuracy for control and the weight is under 210 Kg. There are five various scales are used in this machine the scales

Scale I : 0.0- 2.0JScale III : 4.0- 7.5 J
Scale II : 2.0- 4.0 J Scale IV : 7.5- 15.0 JScale V :15.0-25.0 J

I. ILSS (Inter Laminar Shear Stress)

The untreated and silane treated of silicon IV oxide hybrid kenaf material ILSS test results was carried out as standard is (ASTM D5379). For strength test the UTM (universal testing machine) is performed for testing. The specimen is cut for the sample test is 18×6mm in therequired machine.



An Important issue in this experiment is the indentation decay and concentration of compressive and transverse on the loading head. A finite section typical of one half of the test arrangement. Because an equilibrium, only half of the model was sampled.

1) ILSS (Inter Laminar Shear Stress) Breakage specimen:



The shear stress is applied on the specimen to maximum breaking treated strength is EKS_3 specimen value is 37 Mpa. Then untreated strength is EKS_3 specimen value is 3.214 Mpa. At finally compare to this results the value is improve in treated better then untreated.

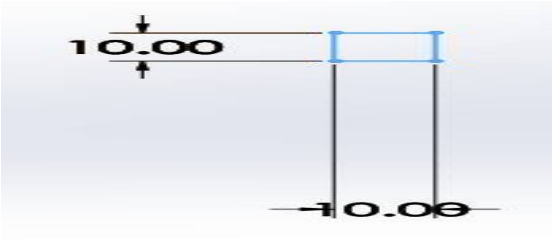




2) ILSS (Inter Laminar Shear Stress) Testing Machine

The inner laminar shear stress are as commonly performed in the (KAL PAL universal testing machine). The fixture which is used in this process kalpak bending testing fixture. The testing machine is grade as KIC-1000-C and the capacity of 100 KN as shown in abovefigure. . The fixture of 3 point and 4 point are located but for the experiment 3 point is performed. The capacity optional from 0.5 KN,1KN, and 10 KN.

J. Micro Hardness Specimen Dimension



©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

The untreated and treated with silane of silicon IV oxide in hybrid kenaf material micro hardness was carried out as standard is (ASTM D-2240). For hardness test in Rockwell hardness testing machine is performed for testing.
The micro hardness specimen is to be cut in to the dimension of 10×10mm. The surface roughness of the natural fiber composite is characterized by the use of the micro hardness method.



Micro Hardness Specimen

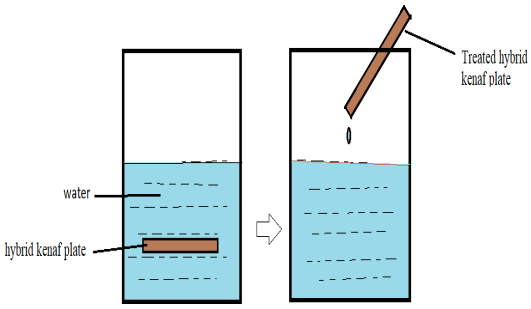


Micro hardness testing machine

The commonly used method in hardness is Rockwell hardness testing in standard of ASTM E-18. The test are performed as shown in above figure. Ana the various specimen with silicon treated has tested in this machine.

K. Water Absorbed Test

In room temperature the water absorption are carried in a time of period by submerging of samples in the water bath. The results recommend that the swelling of kenaf fibers due to water immersion has progressive result on combined material in mechanical stuffs. The test was belongs to 24 hours on composite for the dipping of water in testing.



Water absorbed test



Water absorbed specimen

Absorbed water is the water that deceptions close by to solid plane sbelow the influence of attractive forces. For the specified time in temperature the specimen is placed in the ovenfor dry condition. And to cool the specimen is replaced in desiccator. At last the specimen isImmediately calculate the weight.

L. Cost Analysis

S.No	Description	Budget
1	Composite Material Preparation cost	4500
2	Mechanical Testing cost	10000
3	SEM, OM Testing	6000
4	Miscellaneous Expenses	3000
Total		24000

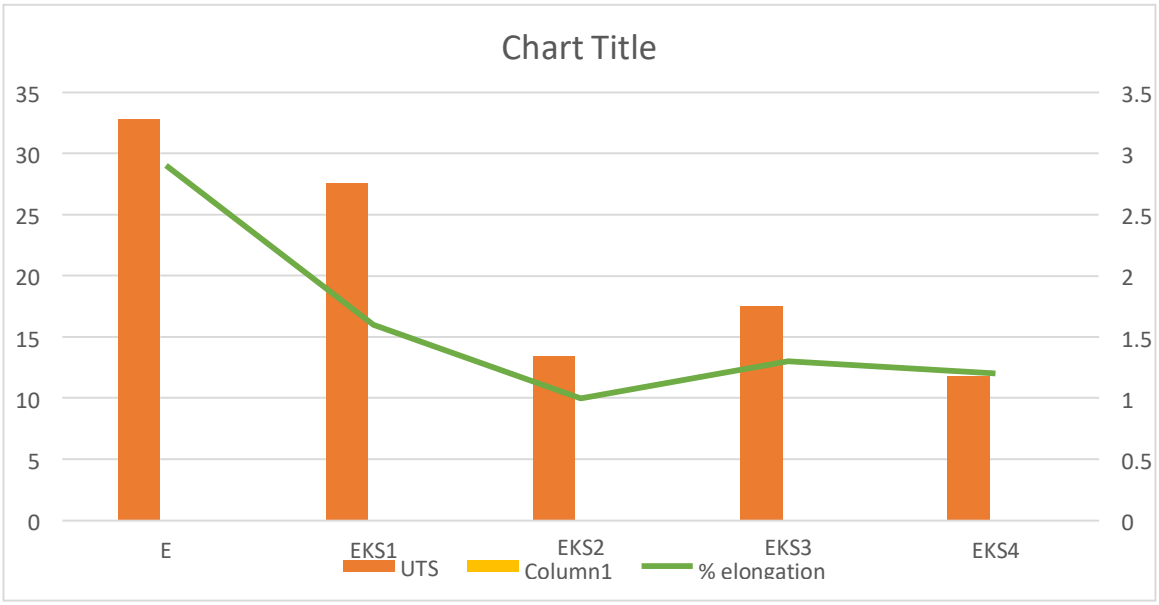
VI. RESULT AND DISCUSSION

A. Result Of Testing

1) Tensile Test in UNTREATED

Sample No	CS Area[mm²]	Tensile Strength (Mpa)	%Elongation	Tensile Modulus(Mpa)
E	75	66	2.91	2829
EKS_1	75	137	1.65	6188
EKS_2	75	143	1.00	6247
EKS_3	75	157	1.37	6456
EKS_4	75	172	1.26	6679

The summary report of treated Tensile test in E (EPOXY) has minimum peak load of 873.26 N, then the tensile strength 2404.2 N is 66 Mpa and tensile modulus E IS 2829 Mpa. But the maximum value increased in EKS_4 of of peak load, 172 Mpa in strength and 6679 Mpa in modulus because of silicon mixture with epoxy matrix.

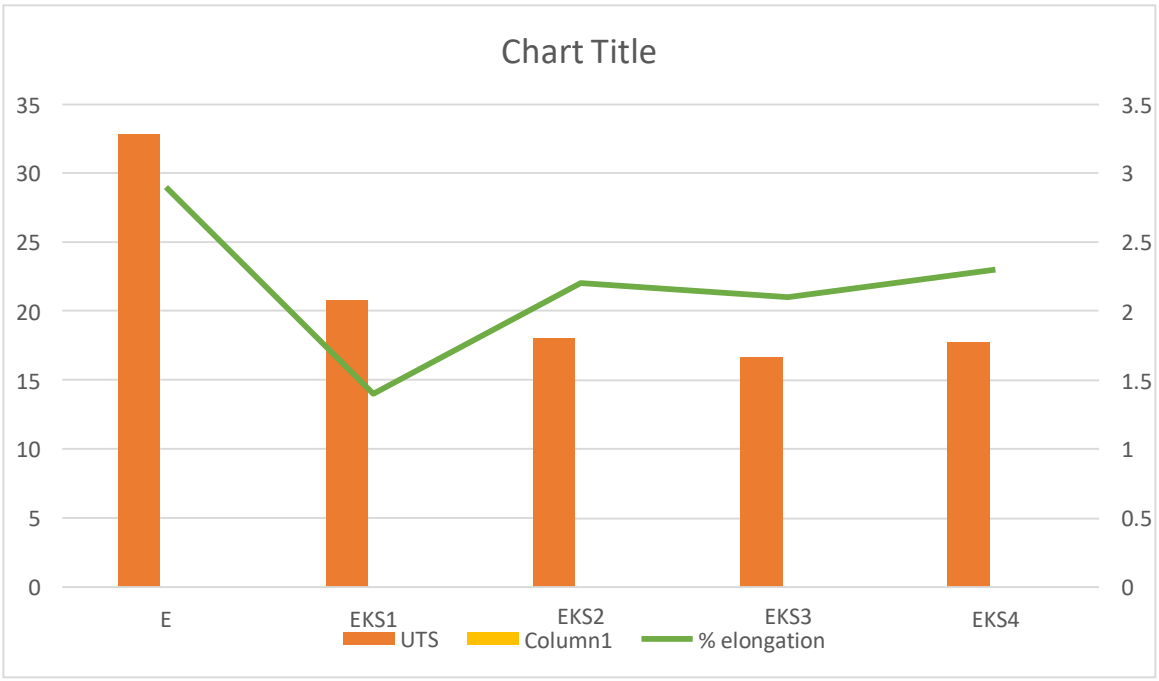


2) Tensile Test In Treated

The summary report of treated Tensile test in E (EPOXY) has minimum peak load of 1255.86 N, then the tensile strength is 66 Mpa and tensile modulus E IS 2829 Mpa. But the maximum value increased in EKS4 of 1560.5 N in peak load, 178 Mpa in strength and 6782 Mpa in modulus because of silicon mixture with epoxy matrix.

Sample No	CS Area[mm²]	Tensile Strength(Mpa)	%Elongation	Tensile Modulus(Mpa)
E	75	66	2.91	2829
EKS_1	75	141	1.40	6388
EKS_2	75	147	2.27	6521
EKS_3	75	164	2.19	6553
EKS_4	75	178	2.36	6782

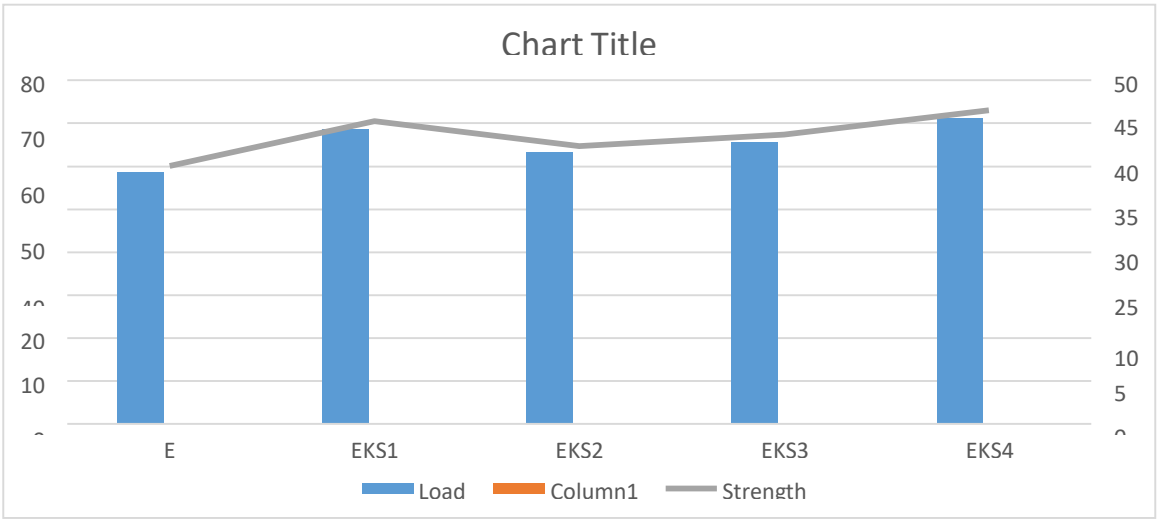
©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



3) Flexural Test Untreated

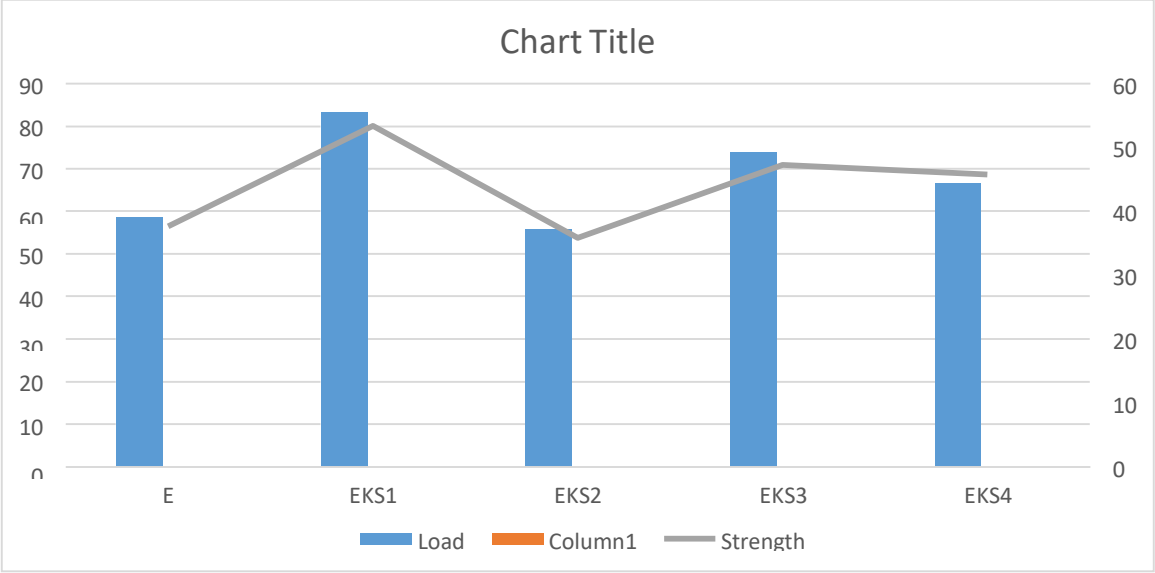
Sample No	Area of CS[mm²]	Highest Load [N]	Strength ofFlexural in(Mpa)	Modulus ofFlexural in(Mpa)
E	39	58.693	106	2049
EKS_1	39	68.680	210	5749
EKS_2	39	63.304	222	5884
EKS_3	39	65.698	243	5934
EKS_4	39	71.299	251	6079

A brief report of the treated tensile test E (EPOXY) has a minimum peak load of 58.693 N, then the strength of flexural is 106 Mpa and the modulus of flexural is 2049 Mpa.But maximum value at EKS4 is 71.299 N at peak load, 251 MPa in strength and 6079 MPa in modulus due to epoxy matrix.



4) Flexural Test Treated

Sample No	Area of CS[mm²]	HighestLoad [N]	Strength ofFlexural in (Mpa)	Modulus ofFlexural in (Mpa)
E	39	58.693	106	2049
EKS_1	39	83.316	229	5922
EKS_2	39	55.848	243	5989
EKS_3	39	73.84	257	6243
EKS_4	39	66.62	264	6352

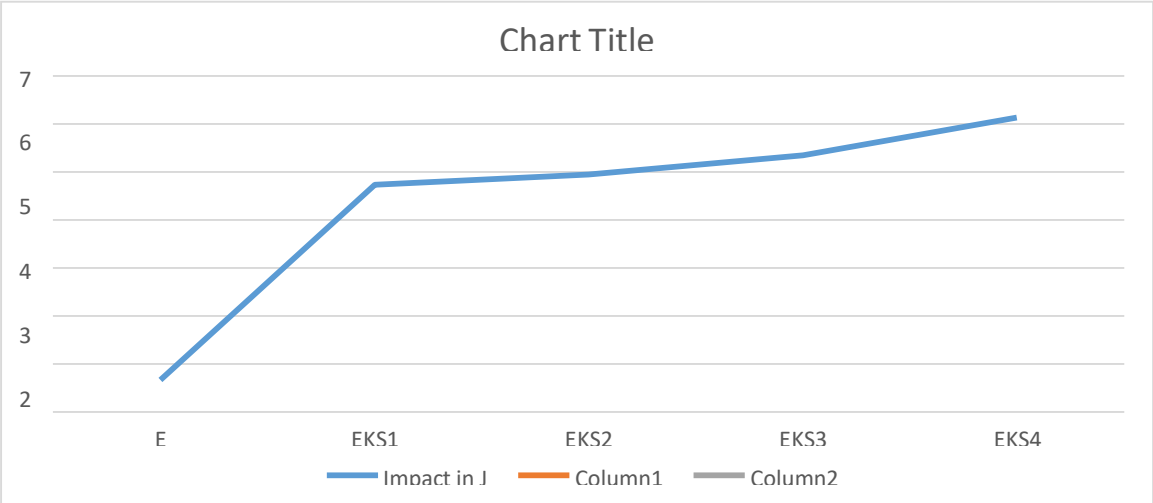


A brief report of the treated tensile test E (EPOXY) has a minimum peak load of 58.693 N, then thestrength of flexural is 106 Mpa and the modulus of flexural is 2049 Mpa. But maximum value at EKS4 is 66.62 N at peak load, 264 MPa in strength and 6352 MPa in modulus due to epoxy matrix.

5) Impact Test Untreated

Sample No	Izod Impact in (J) for 3mm thick
E	0.67
EKS_1	4.73
EKS_2	4.94
EKS_3	5.34
EKS_4	6.13

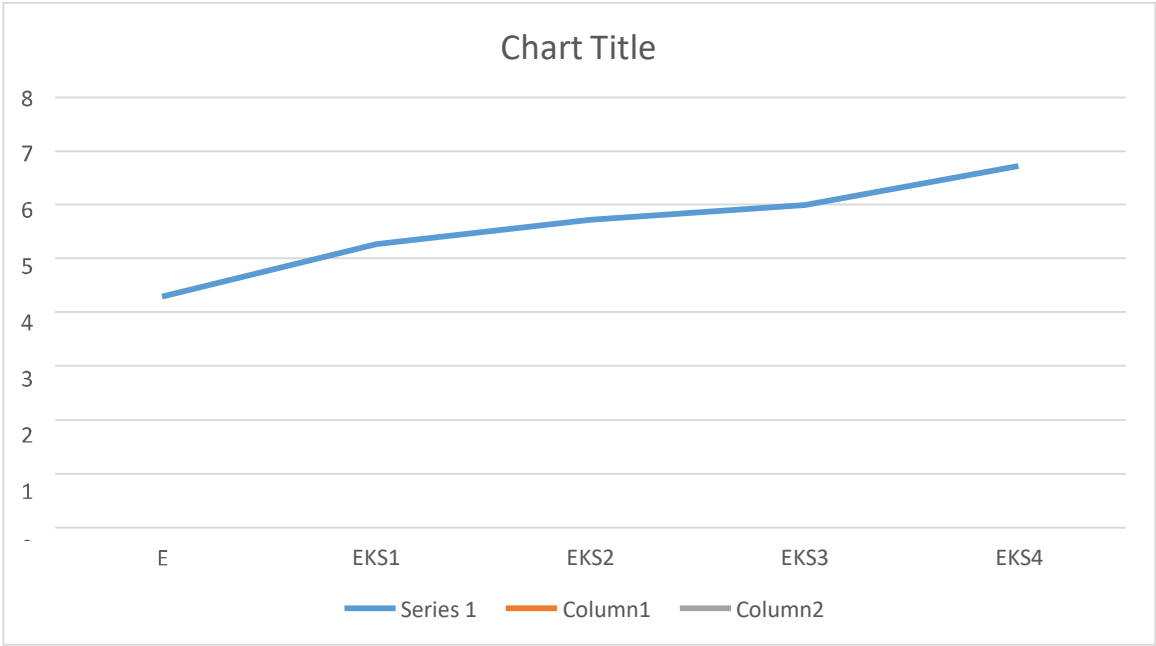
©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



The tested value noted in the above table for izod impact in E(EPOXY)the minimum value for 3mm thickness plating are 0.67 J. But in the EKS_4 value is increased in maximum of 6.13 J because of the silicon (IV) oxide performance in epoxy resin matrix.

6) Impact Test Treated

Sample No	Izod Impact in (J) for 3mm thick
E	0.67
EKS_1	5.27
EKS_2	5.72
EKS_3	5.99
EKS_4	6.72

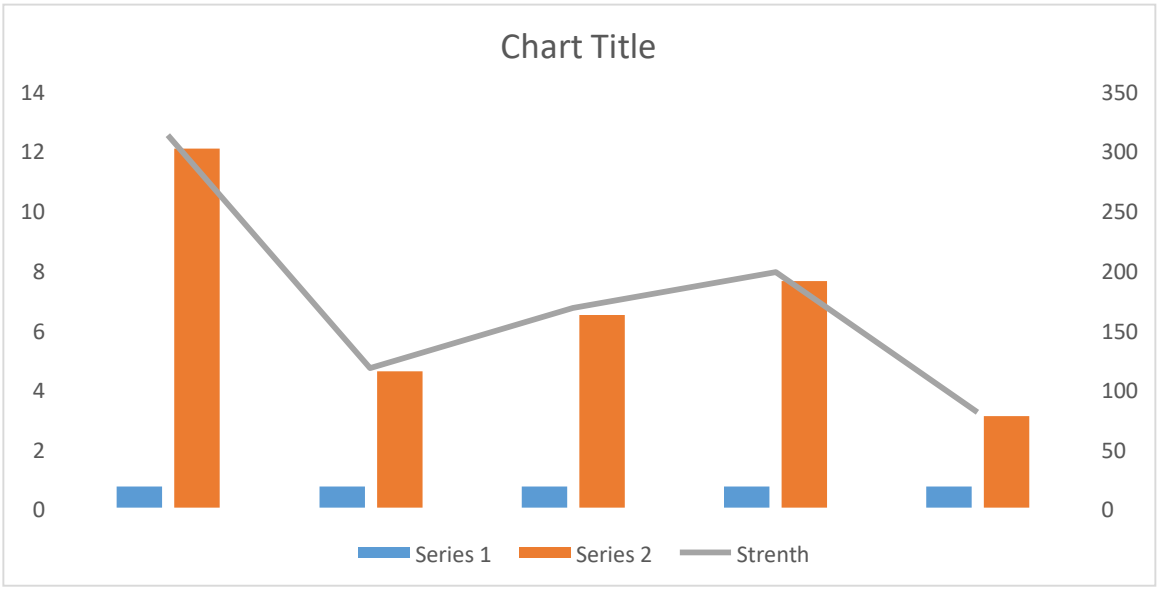


The tested value noted in the above table for izod impact in E(EPOXY)the minimum valuefor 3mm thickness plating are 0.67 J. But in the EKS_4 value is increased in maximum of 6.72 J because of the silicon (IV) oxide performance in epoxy resin matrix.

7) ILSS Test Untreated

Sample No	CS Area[mm²]	Peak load [N]	I.L ShearStrength (Mpa)
E	18	301.393	12.558
EKS_1	18	114.57	4.773
EKS_2	18	161.32	6.721
EKS_3	18	190.29	7.928
EKS_4	18	77.13	3.214

In ILSS the test is performed minimum load and shear strength in EKS_4 (EPOXY+KENAF+ SILICON 2.5%) of 77.13 N and 3.214Mpa.This contains less stress in the prepared composite material. The maximum load and shear strength in E(EPOXY) is 301.393 N and 12.558 Mpa. The values are reduced from the matrix of kenaf and silicon in the order.



8) ILSS Test Treated

Sample No	CS Area[mm²]	Peak load [N]	I.L Shear Strength(Mpa)
E	18	301.393	-
EKS_1	18	176.06	28
EKS_2	18	86.38	33
EKS_3	18	177.52	35
EKS_4	18	147.04	37

In ILSS the test is performed minimum in peak load and maximum shear strength in EKS4 (EPOXY+KENAF+ SILICON 2.5%) of 77.13 N and 37 Mpa.This contains less stress in EKS1 because of the silicon comparison with kenaf and epoxy this shows untreated is better than treated for stress analysis process.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

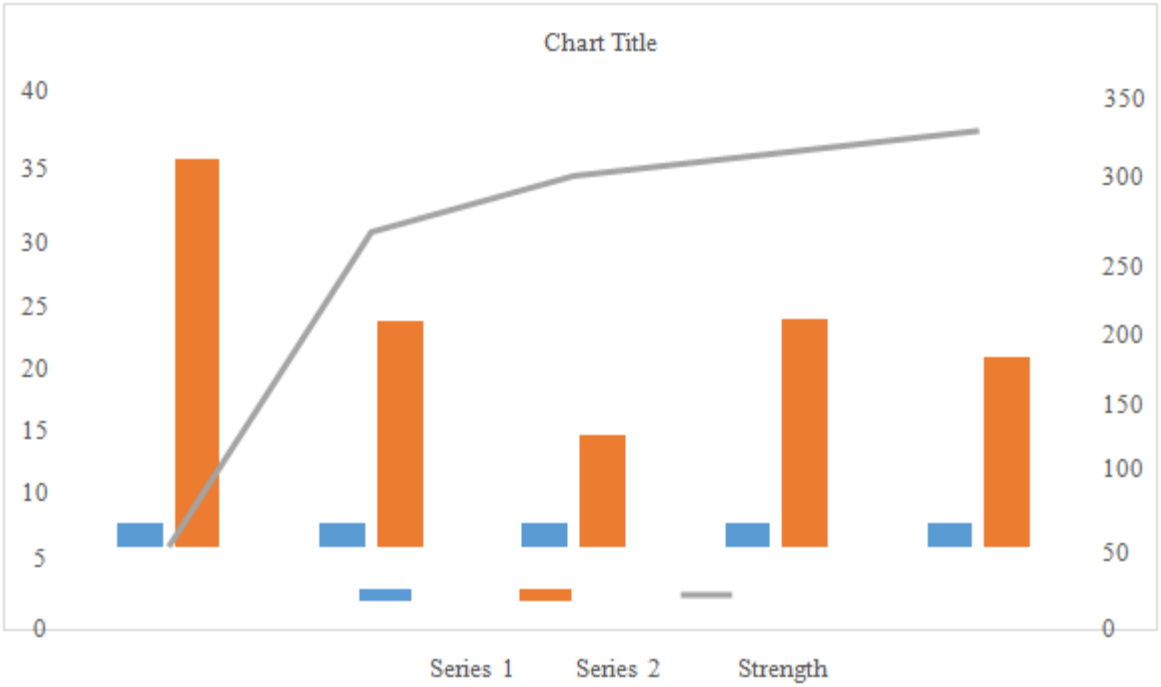
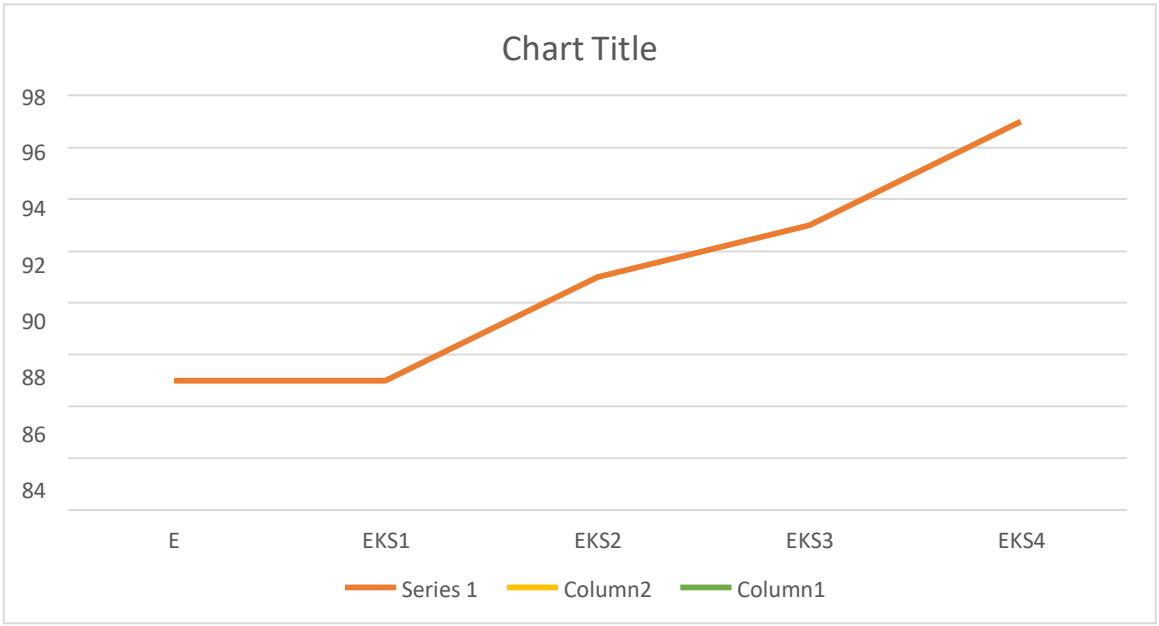


Table : Hardness test untreated

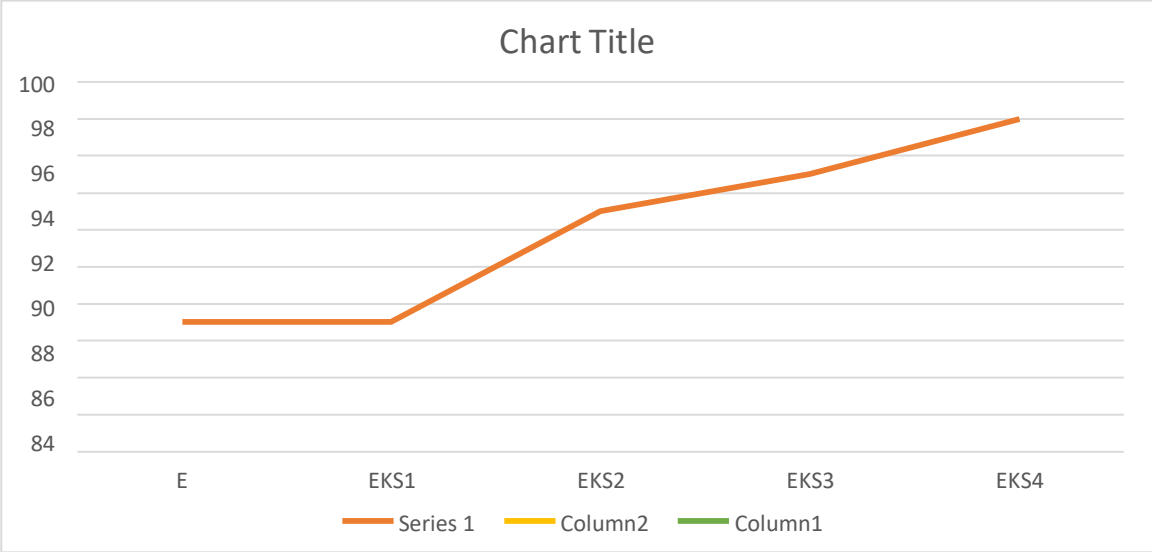
Sample No	**Hardness**
E	87
EKS_1	87
EKS_2	91
EKS_3	93
EKS_4	97



The hardness value which calculated from E to EKS_4 is constantly increased due to the performance level of nano particle in mixture. This give better hardness of the prepared composite material

9) Hardness Test Treated

Sample No	Hardness
E	87
EKS_1	87
EKS_2	93
EKS_3	95
EKS_4	98



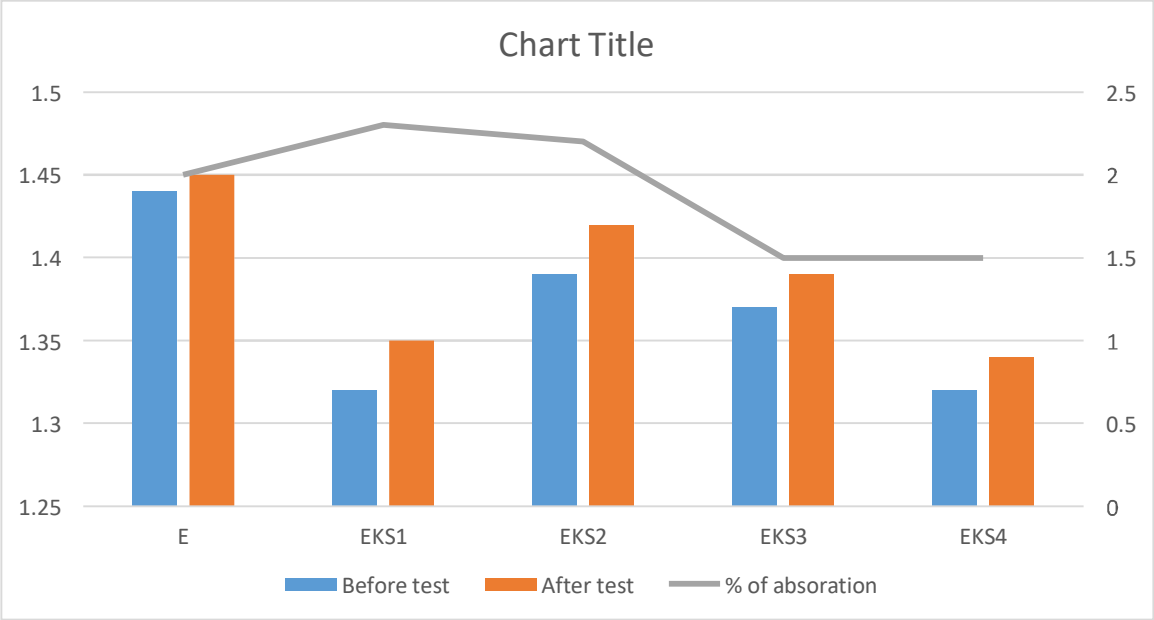
Due to the performance level of the nanoparticles in the mixture, the calculated hardness value from E to EKS4 continues to increase. This gives the best hardness of the prepared composite material.

10) Water test untreated

Sample No	Weight before testin gms	Weight after testin gms	Precentage of waterabsorption
E	1.44	1.45	0.7
EKS_1	1.32	1.35	2.3
EKS_2	1.39	1.42	2.2
EKS_3	1.37	1.39	1.5
EKS_4	1.32	1.34	1.5

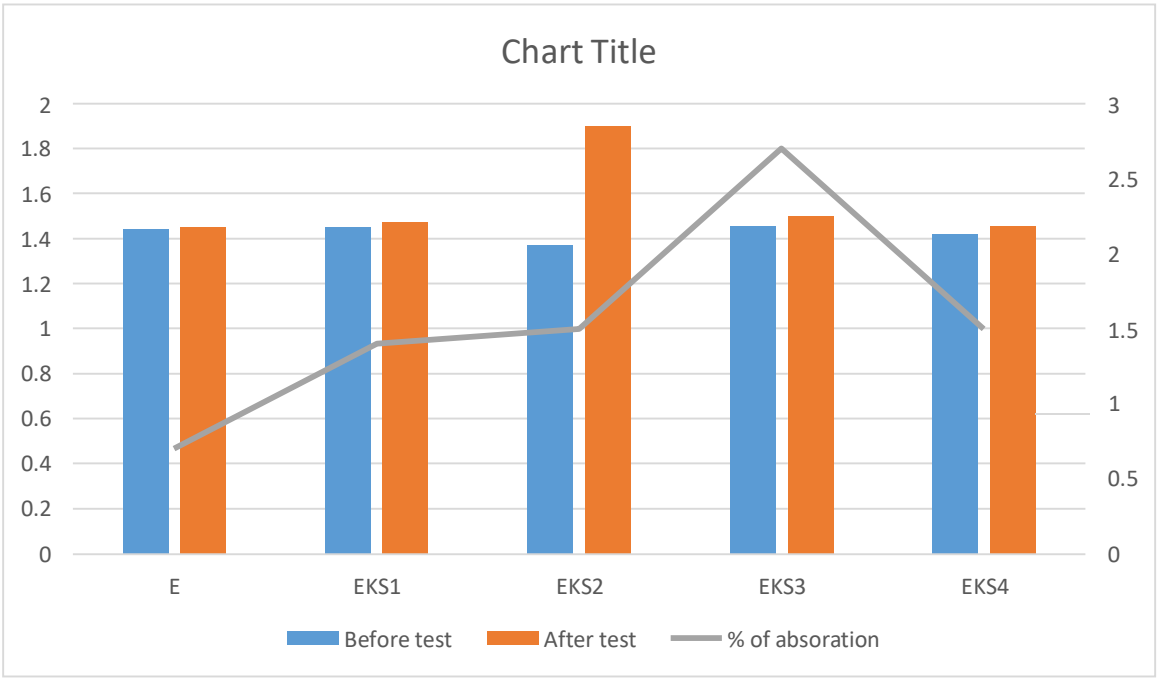
In this testing the materials are analyzed moisture content in composite material. The weight of material is calculated two ways, weight before and weight after water abortion. The maximum level of water to be absorbed by EKS2 in before 1.39 gsm and after 1.42 gsm due to reaction of silicon in the composite. And the percentage of E

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



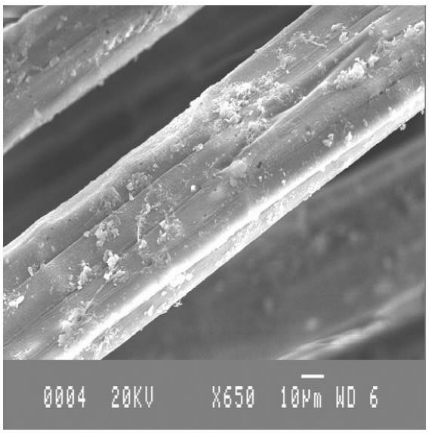
11) KS2 is 2.2 has calcuted. Water test treated

Sample No	Weight before testin gms	Weight after testin gms	Precentage of waterabsorption
E	1.44	1.45	0.7
EKS_1	1.45	1.47	1.4
EKS_2	1.37	1.39	1.5
EKS_3	1.46	1.5	2.7
EKS_4	1.42	1.46	2.8

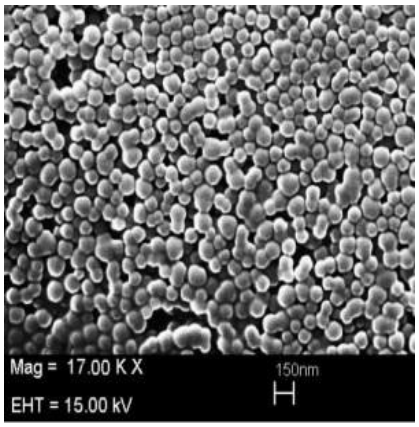


B. Moropology Analysis Of Testing

1) SEM Image of Materials

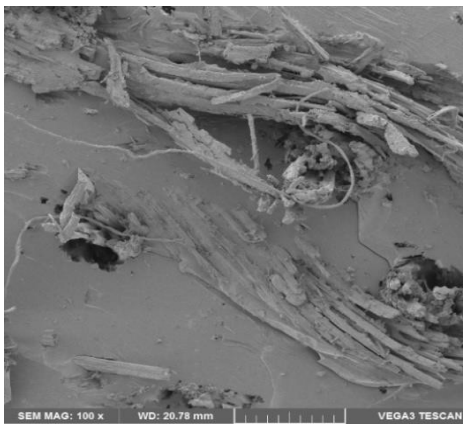


Kenaf fiber

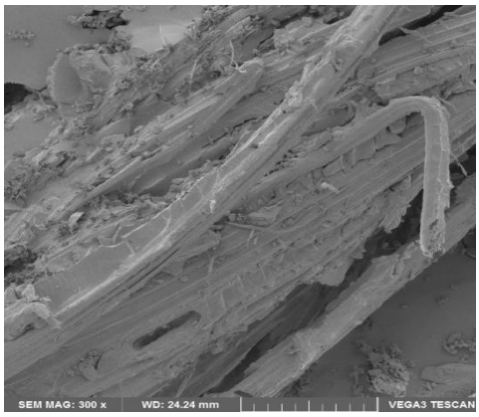


Nano silicon (IV) oxide

2) SEM Image of Tensile test

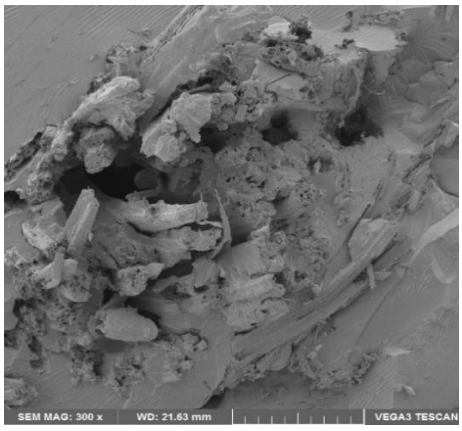


Untreated tensile

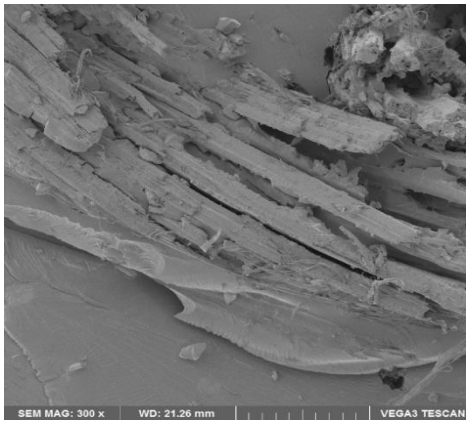


Treated tensile

3) SEM Image of Impact test



Untreated impact



Treated impact

4) Specimen preparation:

The specimen are creating the scanning electron microscope was developed by using these The TESCAN VEGA 3 machine model. This analysis is performed to determine the effect Of loading on the size and distribution of the cells. The bark area reveals the morphologicalPart. Samples carried out cutting to 10 mm x 10 mm x 3 mm.

5) SEM test for Kenaf Matrix and Nano Silicon Dioxide

The fiber measure of 50 vol% through different measurement to percentage of silicon dioxide at 1.0%, 2.0% and 2.5% are mixed of the epoxy resin at room temperature stimulated pending method was stirring at end of the process. Then also epoxy and hardener with ratio 10:1 stirred until a same clarification was done. Then the compression mold usingfor plating is completely apply by wax coating. To separate the plating after molding process. The dispersion of morphology of treated and untreated, surface modification silicon particle of matrix. The fracture portion of damage sample mechanical tests of tensile, flexural, impact by scanning electron microscope. In this sample observation more amount of micro cracks along with river marks, which are present in fractured portion.

6) Fracture of Morphology Analysis

Compounds with 30% reinforcement exhibit a fracture behavior, while those with a fiber content of 20% demonstrate brittle fracture behavior. One possible explanation is to the improved for the fiber content increases the dilution of composites. Matrix plays an imperative part in enhancing the composition because its function is not only to bind the fibers together but also to absorb and transmit attack energy to the fibers.Scanning electron microscopy (SEM) image of the fractured in inner to surface of a tensile test sample. Fiber is taken out and fiber fracture of are detected due to fragile adhesion between the kenaf fiber and the epoxy matrix.The fiber volume fraction strong-minded from the matrix absorption method for nonporous glass reinforced hybrid composites fabricated process wasfound to be 56%.

7) Calculation

Flexural Strength formula

$$\sigma = 3FL/2bd^2$$

F- Is load at the fracture point (N).L- Is the length of the object.
b- Is the width of the object.
d- Is the thickness of the object.

Example:
Treated specimen in EKS_3

Flexural strength = $(3\times264\times125) \div (2\times13\times3^2)$

$$\sigma = 264 \text{ Mpa}$$

Flexural modulus formula:
$E_f = (L^3m/4bd^3)$L - Is the length of object.

m – Is the gradient of the load object.b- Is the width of the object

d- Is the depth of the objectExample:
Treated specimen in EKS_3

Flexural modulus = $(125^3\times264) \div (4\times13\times3)$

$$E_f = 6352 \text{ Mpa}$$

Tensile strength formula:

$$\text{Stress} = \text{load} / \text{area}$$

P- Apply on peak load. A- Cross sectional area.

Example:
Treated specimen in EKS_3

$$\sigma = ((1338.516) / (75.000))$$

$$\text{Tensile stress} = 17.844\ N/mm^2$$

Elongation (%) formula:

$$£ = \text{stress} / \text{cross sectional area} \times 100$$

Example:
Treated specimen in EKS_3

$$£ = 17.844 / 75*100$$

$$£ = 2.360\ \%$$

VII. CONCLUSION

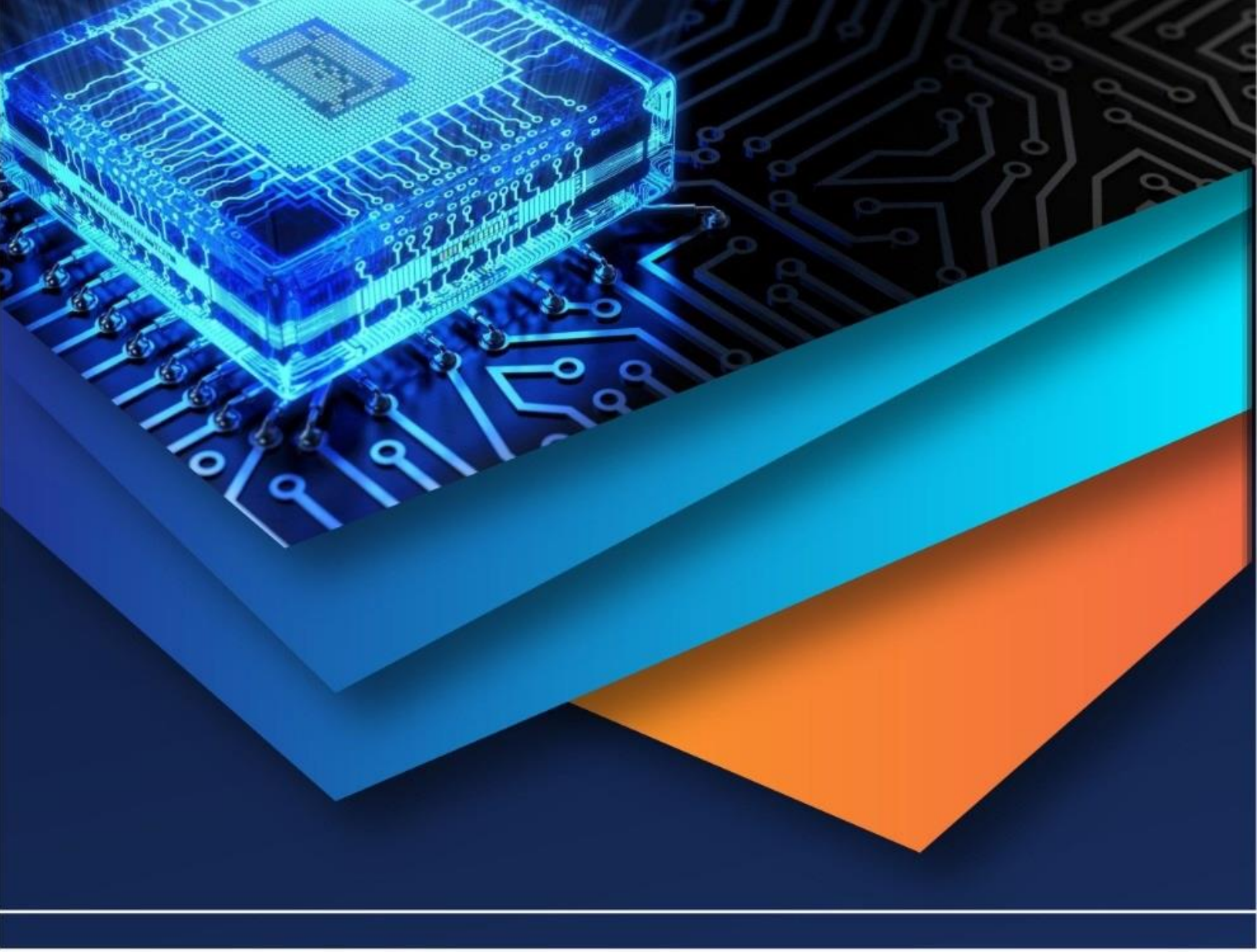
The condition of our subjected kenaf fiber to our many trials, even with the added silicon treated in EKS_3 the nature we have found is very effective and through them mechanical tested in silane treated. The silicon nanoparticle were developed as a protective material. By acquiring these characteristics, epoxy resin dynamic performance can be designed to suit appropriate configuration applications. That are subject to impact and vibration such as epoxy 2.5% vol automobiles. The future of energy degeneracy mechanismthat the avoids damage should be considered using hybrid kenaf in silicon material such as combination of soft and hard fillers. The kenaf fiber was treated and untreated by the silicon dioxide nano particle and epoxy composites prepared. These wet kenaf treated fiber are having high potential to increase the mechanical and durable properties of testing in reinforced composites kenaf fiber material. The composites having 2.5% of silica is in the silica nanoparticle involved at 47.86Mpa and 2321.759 Gpa in specimen to improve the mechanical properties for flexural strength of treated material respectively.

REFERENCES

[1] Noor Azammi A.M, Sapuan S.M (2019), Physical and damping properties ofkenaf fiber filled natural rubber/thermoplastic polyurethane composites.(5):1-5.
[2] AofeiGuo, Zhihui sun (2019), Impact of chemical treatment on the physiochemical and mechanical properties of kenaf fiber.(14):1-7.
[3] N. Parthipan, T.Maridurai (2019), Effect of silane Treated silicon (IV) oxide Nanoparticle Addition on Mechanical, Impact Damage and Drilling Characteristics of kenaffibre-ReinforcedEpoxy composite.(7):100-109.
[4] Saba.N, Jawaid.M (2019), Magesium hydroxide reinforced kenaf fiber/epoxyhybride composites: Mechanical and thermo mechanical properties.(201):138-148.
[5] Faissal chegdani, Mohamed EL Mansori (2017), Mechanics of materialremoval when cutting natural fiber reinforced thermoplastic composites.(6): 1-20.

[6] D.Chandramohan, A. John Presin Kumar (2017), Experimental data on the Properties of natural fiber particle reinforced polymer composite material.(13):460- 468.
[7] M. ShuKla, Rajneesh Verma (2017), Characterization of Machanical Propertiesof Short Kenaf Fiber-HDPE Green Composites.(5):3257-3264.
[8] K.venkata Krishna. K.Gokul (2016), Experimental analysis on mechanicalbehavior of natural fiber reinforced composites using filler material.
[9] FaridBajuri, Norkhairunnisa Mazlan (2016), Flexural and compressive Propertiesof Hybrid Kenaf/Silica Nanoparticles in Epoxy composite.(19):955-960.
[10] W.H.Haniffah, S.M. Sapuan (2015), Kenaf fiber Reinforced PolypropyleneComposites: Effect of cyclic Immersion on Tensile Properties. Article ID 872387, 6 pages. Suhad D. salman, z.leman (2015),Kenaf/Synthetic and Kevlar®/Cellulosic Fiber-Reinforced Hybrid Composites
[11] K. Anbukarasi, S. kalai selvam (2015), Study of effect of fiber volume and dimension on mechanical, thermal, and water absorption behavior of luffa reinforced epoxy composites.(66):331-330.
[12] Jamaludin mohamad yatim, mohd yunus lshak (2015), potentials o kenaf fiber in bio composite production (5): 110-121.
[13] Mulsamy K, Rajendren I (2011), The mechanical properties, deformation and thermo mechanical properties of alkali treated and untreated Agave continuous fiber reinforced epoxy composites. (5):3076-3084.
[14] S.M .Sapuan, E.S. Zainudin (2009), Kenaf fiber as reinforcement for polymericcomposites (4): 239-248.
[15] Abu Bakar. A, Majeed.K (2013), Potential materials for food packaging fromnanoclay/natural filled hybrid composites. (46):391-410.
[16] Chenggng chen,Ryan S (2008), Highly dipersednanosilica-epoxy resins withenhanced mechanical properties. (17):3805-3815.
[17] Shinji.o(2008),Mechanical propertiesof kenaf fiberandkenaf/PLAcomposities. (40):4-5.
[18] B.F. Yousif, A. Shalwan (2008), Flexural properties of treated and un elatedkenaf /epoxy composites. Material and design. (40):378-385.
[19] J.G.K Kumar, R. Venkatesh babu (2019), Mechanical behavior andcharacterization of reinforced CNSL composite material.(22):1-5.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)