

## **Comparison and Analysis of Sisal and Jute Fiber with Crushed PCB Using Epoxy Resin and Cashewnut Shell Resin**

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### **Abstract**

Composite material is a material acquired from different constituent materials (two/more) with fundamentally varies from properties when coordinated; deliver a material with exceptional attributes unique in relation to singular segments. The primary motivation to lean toward composite material is because of the accompanying focal points, for example, more grounded, lighter when contrasted with customary materials. In this work endeavor has been made to think about and dissect the properties of jute fiber strengthened with sisal fiber alongside smashed PCB utilizing E Glass as lattice materials. The incorporating component utilized is epoxy and cashew nutshell gum. In light of these materials research facility tests are led to demonstrate the properties of materials.

**Keywords:** composite, cashew nut shell resin, epoxy resin, E glass, Jute fiber, sisal fiber.

### **1. INTRODUCTION:**

Individuals have thought about composites for some long years. One best precedent is blocks made by utilizing characteristic mud. In those days mud can be dried into block shape to give a building material. By joining mud and straw together it is

conceivable to make blocks that are safe in different conditions to make superb building squares.

In a specific order another old composite is concrete. Concrete is a blend of total (little stones) bond and sand. It has great compressive quality. In any case, as of late it has been discovered that considering metal bars or wires to the solid can build its elasticity. Along these lines it is named as fortified cement. In the present work polymer composites are considered to make a material additionally to test its qualities. Strands are the essential class of fortifications they fulfill the coveted conditions and transmit solidarity to network materials by enhancing its properties.

## **2. LITERATURE REVIEW:**

L.Y. Mwaikambo et al (1). In his work malleable testing of hand weight molded rectangular example was completed utilizing the tractable testing machine show 1185 in connection with ASTM D638. Tests were analyzed at a crosshead speed of 5mm/min and a normal breaking time of 25 S. A 50mm extensometer gadget was utilized to test the example to screen the elasticity of the test example. Readings were at the same time recorded. The rigidity, modulus and resist break were assessed from load extension bend. From this elasticity of crossover composites are to be examined.

Sharifah et al (2). He created composites utilizing a hardened steel shape estimating 240\*60\*40 mm length, width and profundity individually. A discharging operator was showered on to the test example and spread equally on to the surface of shape. Gum was poured on to each layer of fiber in a zig – cross design to guarantee even conveyance of pitch and system was rehashed for each layer of fiber. The layers of filaments are kept in wetting condition in the shape were then put between the electrically warmed heater of a hot press at 180 degree Celsius. The form was warmed for 25 min at a weight of 6 Mpa . The point was to expand the volume part of filaments in the composites to amplify the mechanical properties.

Mary c. lubi et al (3). The prior work distributed concerning the piece of cashew nut oil by staedeler. From that point forward, numerous specialists have advocated the constitution of oil. Normally happening CNSL contains four segments: cardanol ,cardol , anacardic corrosive and 6 – methyl cardol. Therefore they have examined the synthetic natural mixes present with CNSL tar.

B.Ndazi et al (4). Creators have utilized cement fasteners as materials that associate one substrate to another in the composite. The most well-known fasteners utilized are engineered phenol formaldehyde, urea formaldehyde and Diphenyl methane. The level of interfacial holding between these substances differs relying on the similarity of fasteners. From this work we can realize the drying time of the network.

Ramesh.M et al [5] assess mechanical properties, for example, elastic and flexural properties of mixture glass fiber-sisal/jute strengthened epoxy composites and furthermore minuscule examinations are completed to dissect the interfacial attributes of materials, internal stucture of the cracked surfaces and material disappointment morphology by utilizing Scanning Electron Microscope (SEM).

Mohitsood et al [6] examines the impact of compound medicines on tractable and flexural properties of polymer composites manufactured by strengthening treated sisal strands into 50-50 blend of new and reused HDPE network. The sisal strands are treated with NaOH + Malic Anhydride (MA) and NaOH+Benzoyl Peroxide (BP)+MA and the impact of synthetic medicines on mechanical properties of composites is analyzed at two unique substance of treated sisal filaments.

A.T.Beyene et al [7] led an exploratory examination to research the impact of indent on flexural (semi static and exhaustion) execution of E-Glass/Epoxy composites. Standard examples and examples with various sorts of scores design, for example, round gaps, transverse ovals and space geometry have been set up from plates and are considered lastly it is seen that diverse indented geometry act contrastingly for semi static and weariness stacking.

Shivakumar Set al [8] has considered the qualities of fiber fortified composites of polymer type. From this paper it is comprehended that composite materials have an incredible possibility of utilization in structures oppressed principally to compressive burdens. Composite materials have appealing viewpoints like the generally high compressive quality, great flexibility in creating thick composite shells, low weight and consumption opposition.

Feng Zhou et al [9] Sisal strands were changed utilizing silane coupling operators to decide the instrument of the compound response between the fiber and silane. A mix of filtering electron microscopy, Fourier-change TG/mass spectrometry (TG/MS) were utilized to research the impacts of synthetic treatment on sisal strands. The outcomes demonstrated that a layer of film was framed on the fiber surface by silane adsorption. FTIR spectroscopy demonstrated that concoction securities between the silane coupling operator and the fiber. It was additionally confirmed by TG-DSC.

Seyyedvahid Mortazavian et al [10] has considered the weariness conduct and displaying of short fiber fortified polymer composites. In this investigation the creator have considered the utilization of the short fiber fortified polymer composites have been quickly expanding and the greater part of the segments made of this material are exposed to cyclic stacking. In this manner their exhaustion conduct and displaying have been of much enthusiasm for late years. This survey introduces an expansive audit of many factor impacting cyclic disfigurement and exhaustion conduct.

From the above writing study diverse specialists have contributed their thoughts in the territory of polymer composites. Up to the learning creators not considered the utilization of E squander materials strengthened with E Glass strands. This was the hole distinguished in the writing. To conquer the hole, an endeavor has been made to build up a table best item utilizing E squander fortified with pounded PCB, Jute fiber and sisal fiber with cashew nutshell tar and epoxy gum.

### **3. EXPERIMENTAL SET UP:**

The composite is fabricated under ordinary room condition by hand lay up method. Since this comes under hybrid composite. The reinforcement part consists of both

fiber and particulate materials.

**Procedure:**

**Steps involved in the fabrication of composite by hand layup process:**

First a film sheet is having been cut to a dimension of 50\*50 mm because the composite is made for dimension of 30\*30 mm.

Film sheet is laid over a flat bench to prevent leakage of resin over which the composite mold is to be placed.

Then the die is made by using rubber mat of thickness for a dimension of 30\*30 mm is placed over the film sheet such that the composite lay with in the Square die.

The wax is sprayed inside the square die for easy removal of material after fabrication .then jute; glass fiber, sisal fiber is made to cut for dimension of 30 \*30 mm.

The printed circuit board (PCB) is crushed in a grinder into fine particles for adding it into the matrix as particulate reinforcement.

Then matrix material is made by combining of CNSL, epoxy and PCB in three different ratios such as 20: 80:0 , 20:75:5 , 20: 70: 10 percentages respectively. This combination is made and properly stirred for minimum 15 minutes for proper mixing of all materials.

Then the matrix material is poured inside the mold and is made to get distributed evenly using brush.



**Fig 1.** Film sheet



**Fig2.** Rubber mold die



**Fig 3.** Applied resin



**Fig 4.** Glass Fiber



**Fig 5.** Rolling process



**Fig.6.** Sisal Fiber



**Fig .7.** Film Packing



**Fig.8.** Mould under weight

**RESULTS AND DISCUSSION:**

The fabricated composite material is tested for various strength.

**Tensile test for Jute fiber hybrid composites**

**Sample 1:**

**Table 1**

Number of Test	Max.load (Mpa)	Tensile strength	Elongation at break (%)	Extension at max. Load(mm)	Thickness (mm)
1	37.35	32.21	2.97	1.48	2.90
2	25.74	26.06	2.27	1.13	2.47
Mean	31.55	29.13	2.62	1.35	2.68

**Sample 2:****Table 2**

<b>Number of Test</b>	<b>Max.load (Mpa)</b>	<b>Tensile strength</b>	<b>Elongation at break (%)</b>	<b>Extension at max. Load(mm)</b>	<b>Thickness (mm)</b>
1	32.50	36.98	3.25	1.63	2.93
2	30.25	41.02	2.07	1.03	2.50
Mean	31.37	39.00	2.66	1.33	2.71

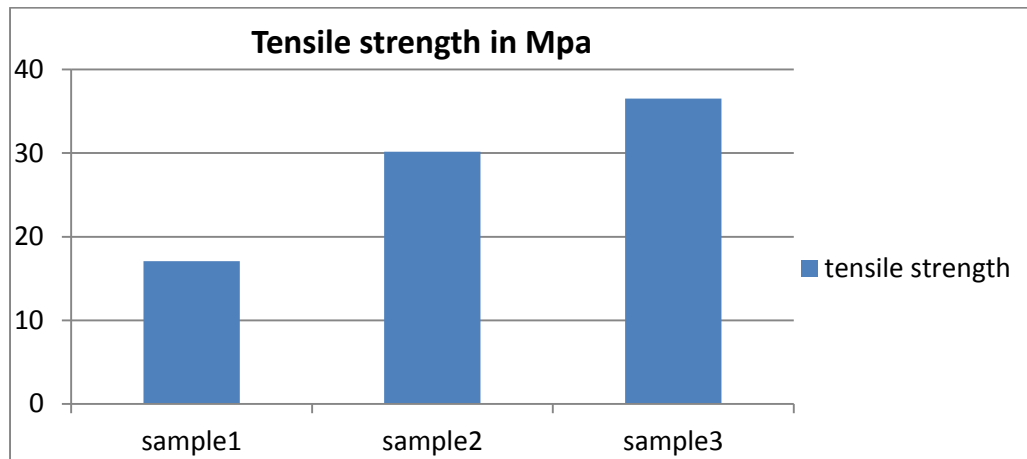
**Sample3:****Table 3**

<b>Number of Test</b>	<b>Max.load (Mpa)</b>	<b>Tensile strength</b>	<b>Elongation at break (%)</b>	<b>Extension at max. Load(mm)</b>	<b>Thickness (mm)</b>
1	32.48	32.64	3.16	1.59	2.91
2	30.13	36.52	2.35	1.24	2.47
Mean	31.31	34.58	2.75	1.41	2.69

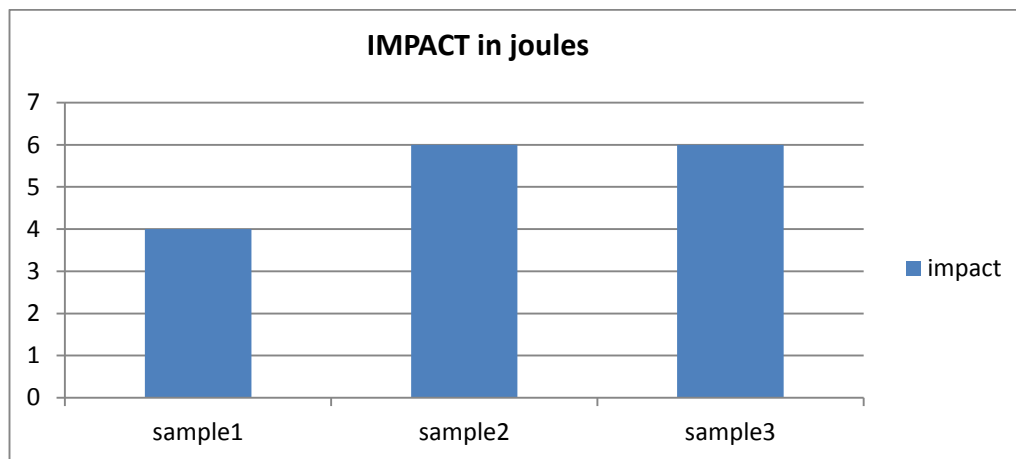
**Tensile test for sisal fiber hybrid composites:****Table 4**

<b>SAMPLE NO</b>	<b>TENSILE STRENGTH (Mpa )</b>	<b>IMPACT ( joules)</b>	<b>HARDNESS SHORE D</b>
<b>1</b>	17.09	4	54.33
<b>2</b>	30.16	6	59
<b>3</b>	36.51	6	61.67

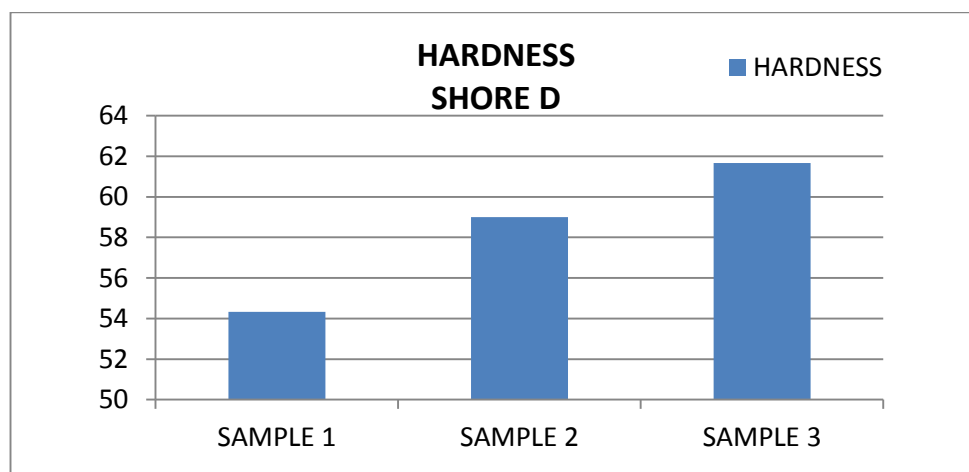
**COMPARISON OF TENSILE STRENGTH:**



**COMPARISON OF IMPACT STRENGTH:**



**COMPARISON OF HARDNESS:**



In this paper the investigation is completed in two unique stages they are as clarified beneath:

1. In stage 1 the malleable test is conveyed for Jute strengthened with E Glass fiber with epoxy and cashew nutshell pitch.
2. In stage 2 the accompanying test, for example, tractable test, hardness test and effect test is completed for sisal strengthened with E Glass fiber with epoxy gum.

From stage 1 investigation over three examples it was seen that example 2 has got greatest heap of 31.31 Mpa for single area of thickness and this material is made of three layers with by and large thickness of 10mm can withstand a maximum. Tractable heap of 10,000N as we close this material can with stand pretty much 10 KN of load.

From stage 2 investigation above table it is reasoned that of the three examples, test with 8 gram PCB is having high elasticity, pressure quality, and effect quality and hardness esteem contrasted with the other two examples.

## **CONCLUSION**

- From this paper, we conclude that this material provides good performance in Tensile, Compression, Impact, Hardness strength.
- Since, we have reinforced this material with fiber which provides more strength. Fiber content also makes the material ductile and provides good yielding during tensile load.
- It is also shown that when we added crushed PCB to the matrix ,it withstand high tensile, compression load compared to the material made without PCB content and also provides good impact and hardness strength.
- As we are crushed PCB as particulate reinforcement, in this which is one of the way to recycle PCB. This also reduces the harmful effects produced by the PCB to the environment.

## **REFERENCES**

- [1] Pornnapa kasemsiri et al “properties of wood polymer composites from eastern redcedar particles reinforced with benzoxazine resin/ cashew nut shell liquid copolymer “, ELSEVIER, Composites: part A 42 (2011) 1454 – 1462.
- [2] Sharifah et al “the effect of alkalization and fiber alignment on the mechanical and thermal properties of kenaf and hemp bast fiber composites: part2 – cashew nut shell liquid matrix “, composites science and technology 64 (2004) 1231 – 1238.
- [3] Mary C. Lubi et al “cashew nut shell liquid (CNSL) – A versatile monomer for polymer synthesis”, published online: 02 April 2012.

- [4] B.Ndazi et al “some opportunities and challenges of producing bio composites from non wood residues”, *J Material science*( 2006) 41: 6984 -6990.
- [5] Shivakumar.s” literature review of fiber reinforced polymer composites”*international advances of engineering and technology* Nov 2011, ISSN 2231.1963.
- [6] SeyyedvahidMortizavian”fatigue behaviour and modelling of short fiber reinforced polymer composites” *international journal*, volume 70. jan 2015.
- [7] M. Ramesh, K. Palanikumar, K. Hemachandra Reddy” Comparative Evaluation on Properties of Hybrid Glass Fiber- Sisal/Jute Reinforced Epoxy Composites”*Procedia Engineering* 51 (2013) 745 – 750.
- [8] SeyyedvahidMortizavian”fatigue behaviour and modelling of short fiber reinforced polymer composites” *international journal*, volume 70. January 2015.
- [9] Feng Zhou, Guangxu Cheng, Bo Jiang”Effect of silane treatment on microstructure of sisal fibers”*Applied Surface Science* 292 (2014) 806–812.
- [10] A.T. Beyene, G. Belingardi, E.G. Koricho” Effect of notch on quasi-static and fatigue flexural performance of Twill E-Glass/Epoxy composite” *Composite Structures* 153 (2016) 825–842.

