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Mechanical Behavior and Analysis of Okra and Pineapple Reinforced Composite Materials

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Abstract: The cutting edge dynamic world can't envision its improvement without getting the idea of progression material composite. Different explores are going on in this field to accomplish the ideal standard. Characteristic Fibre fortified polymer composite has an immense liking to supplant the composite made up of manufactured Fibre. This is essentially a result of the favorable circumstances like light weight, non-harmful, non-rough, simple accessibility, minimal effort, and biodegradable properties. The manufactured strands have higher end of mechanical properties like rigidity and pliable modulus anyway the particular mechanical properties like explicit malleable modulus and other explicit (properties/explicit gravity) of common Fibre gives a wonderful outcome for composites when contrasted with engineered Fibre based composites.

Expanded ecological mindfulness and cognizance, has built up an expanding enthusiasm for normal strands and its applications in different fields. Common Fibre fortified composites assumes a key job in building applications like car parts, vehicle entryways, furniture and so on. The present work expects to decide the mechanical conduct of the pineapple/okra Fibre strengthened in Epoxy LY-556 sap. Pineapple and Okra filaments are separated from the bast of the Okra plant, pineapple leaf of the Tiliaceae family. Their utilization as a potential support in polymer composites requires the comprehension of their mechanical properties. Their utilization in the application world is enormous.

The composites of the Pineapple/Okra fiber filaments fortified with the epoxy sap are made into examples and tried for their mechanical properties. The properties of hardness, sway, elasticity and pressure test are estimated. The malleable test is led on examples made by ASTM D-638-1.

***IndexTerms* - Pineapple Fibre, Okra Fibre, Epoxy Resin, Mechanical Properties.**

I. INTRODUCTION

The improvement of humanity is characterized regarding propels in materials for example the Stone Age. The Bronze Age, and the Iron Age. The present period of material has a place with the composite materials as a result of its lighter weight, higher quality, erosion obstruction, straightforwardness to shape and strength. The composites are not new to the humankind. It has a past filled with over 3000 years. In old Egypt, individuals used to construct dividers from the blocks made of mud with straw as fortifying segment. Another significant utilization of composites can be seen around 1200 AD from Mongols. Mongolians created a bow made up of composites. The word composites, got from the Latin word composites, which means set up together, implying something made by assembling various parts or materials. When all is said in done, composites are materials which comprise of at least two physically unmistakable and precisely divisible parts, existing in at least two stages.

The mechanical properties of composites are better than those of its individual constituents, and at times might be one of a kind for explicit properties. More often than not, composites have two stages for example constant and spasmodic. The spasmodic stage is normally more grounded and harder than the ceaseless stage and is known as the fortification, and constant stage is named as the grid. The developing biological concern and administrative guidelines lead to ascend in the interest of the characteristic strands as a substitute of manufactured filaments. The characteristic filaments, for example, hemp, sisal, jute, flax and bamboo are sustainable and biodegradable in nature and have high specialized characteristics, for example, great modulus and explicit quality, low thickness and cost, and diminished dermal and respiratory aggravation. The mechanical properties of regular strands, especially hemp, sisal, flax, and jute are moderately great, and may contend with glass Fibre regarding explicit quality and modulus.

In the course of the most recent thirty years composite materials, plastics and pottery have been the predominant developing materials. The volume and number of utilizations of composite materials have developed consistently, entering and overcoming new markets tenaciously. Present day composite materials comprise a noteworthy extent of the designed materials market extending from ordinary items to advanced applications. While composites have officially demonstrated their value as weight-sparing materials, the present test is to make them financially savvy.

COMPOSITES

The endeavors to create monetarily alluring composite segments have brought about a few inventive assembling systems as of now being utilized in the composite enterprises. It is self-evident, particularly for composites, that the improvement in assembling

innovation alone isn't sufficient to conquer the cost obstacle. It is basic that there be a coordinated exertion in planning, material handling, tooling, quality affirmation, fabricating, and even program the board for composites to wind up aggressive with metals.

The composites business has started to perceive that the business utilizations of composites guarantee to offer a lot bigger business openings than the aviation segment because of the sheer size of transportation industry. Consequently the move of composite applications from air ship to other business uses has turned out to be unmistakable as of late. Progressively empowered by the presentation of more up to date polymer pitch lattice materials and elite support filaments of glass, carbon and aramid, the infiltration of these propelled materials has seen an enduring extension in employments and volume. The expanded volume has brought about a normal decrease in expenses.

Characteristics of the Composites

Composites comprise of at least one irregular stages installed in a nonstop stage. The broken stage is normally harder and more grounded than the nonstop stage and is known as the 'support' or 'strengthening material', though the persistent stage is named as the 'network'.

Properties of composites are firmly reliant on the properties of their constituent materials, their dispersion and the cooperation among them. The composite properties might be the volume portion whole of the properties of the constituents or the constituents may interface in a synergistic manner bringing about improved or better properties. Aside from the idea of the constituent materials, the geometry of the support (shape, size and size circulation) impacts the properties of the composite all things considered. The focus dispersion and direction of the fortification likewise influence the properties. The state of the irregular stage (which may by round, barrel shaped, or rectangular cross-authorized crystals or platelets), the size and size dissemination (which controls the surface of the material) and volume part decide the interfacial territory, which assumes a significant job in deciding the degree of the connection between the fortification and the network. Fixation, generally estimated as volume or weight division, decides the commitment of a solitary constituent to the general properties of the composites. It isn't just the absolute most significant parameter affecting the properties of the composites, yet in addition an effectively controllable assembling variable used to adjust its properties.

Classification of Composites

Composite materials can be ordered in various ways. Arrangement dependent on the geometry of a delegate unit of fortification is advantageous since it is the geometry of the support which is in charge of the mechanical properties and superior of the composites. A run of the mill characterization is exhibited in Table .The two wide classes of composites are:

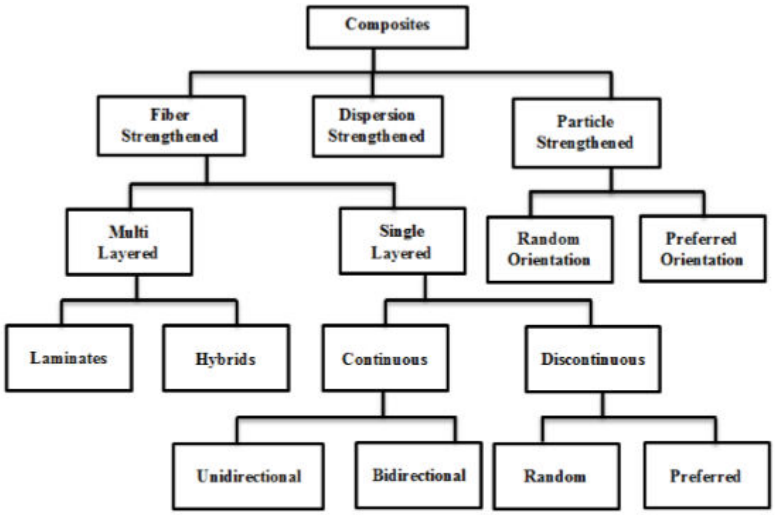

Fig. Classification of composites based on geometry and physical structure of matrix and reinforcement.

II. LITERATURE SURVEY

In the take a stab at expanding the quantity of species from which plant fibres are removed to be utilized as a filler (perhaps with some fortification impact) for polymers, a substantial alternative might turn nearby fibres, which might be promptly accessible and don't include unsustainable expenses for transportation.

Cellulosic fibres separated from the plant bast seem, by all accounts, to be especially appropriate for polymer fortification purposes: in actuality, plant fibres most as often as possible utilized in composites are best extracted. This incorporates e.g., jute, flax and hemp, which are hard fibres and all around misused modernly.

The stalk from herbaceous plants can be utilized for this reason as well, in spite of the fact that these plants are less much of the time utilized for the not in every case simple and compelling fibre extraction, through conventional retting. Instances of fibres removed from herbaceous plants that have been proposed for use in materials incorporate e.g., switch grass, alpha esparto, celer and vex, despite the fact that now and again more as an agro-squander filler than for semi-auxiliary purposes.

III. EXPERIMENTAL PROCEDURE

Fortification Material Okra filaments removed from okra plant are utilized as support 1 material. New okra stems gathered from ranch are drenched and held in water for 20 days. The microbial debasement enables the stems to corrupt adequately to empower Fibre extraction. The extricated strands are washed a few times utilizing water. The washed strands are dried in outside and kept in dampness evidence holder. Two sorts of substance medicines were performed on the strands. First the Fibre are absorbed 2% NaOH arrangement at 70oC for about 2.5 hours, washed with water. In the second stage the filaments are absorbed essential sodium sulfate (PH4) for three hours washed with water and dried in outside.

Pineapple fiber:-

Pineapple Fibre is commonly gotten from the steam of a pineapple plant. It is a yearly plant that develops to 2.5-4.5 m and twists in rainstorm atmospheres. Pineapple is a language cellulosic Fibre since its real synthetic constituents are lignin and cellulose. The warm and electrical conductivity, natural debasement, inclination to mold and moths, capacity to shield from warmth, cold and radiation, response to sun and light, and so forth are controlled by cell constitution and morphology. The concoction structure of the pineapple Fibre has been accounted for by numerous scientists. Among various characteristic strands, pineapple Fibres are effectively possible in Fibre and texture frames with great warm and mechanical properties. The inherent properties of pineapple Fibre, for example, low thickness, high tractable modulus and low prolongation at break and its particular firmness and quality practically identical to those of glass Fibre draws the consideration of the world. More than many years it has been utilized in the uses of ropes, beds, sacks and so forth. High caliber and new employments of this Fibre can make more opening for work in the country sector.Pineapple has likewise got applications in the car business and pressing materials.

Fig: Woven pineapple Fibre Mat

Fig: Woven pineapple Fibre Mat

3.1Naturel Fiber Properties:-

A decoction of the root or of the seeds is utilized as a size .Used for: Sylvia Zook, a certified nourishing pro, expresses that okra can support one's body because of its properties.

a. Strands contains exceptional Fibre which takes sugar levels in blood leveled out, giving sugar amount, worthy for the entrails.
b. Adhesive, found in okra, is in charge of washing endlessly lethal substances and awful cholesterol, which loads the liver
c. Laxative properties okra has are advantageous for entrail sanitization. Because of okra Fibre content, adequate water levels in countenances are guaranteed.

3.2 Mould Preparation:

GI Sheet boxes of size 30*30* .05 cm were used for the moulding process. The moulded sheets are transformed into a square box such that the mixture of resin and hardener are poured in it. Through the HAND LAY-UP technique the prepared mould was transferred to mould cavity by care that the mould cavity should be thoroughly filled. Levelling was done to uniformly fill the cavity with the help of the rollers support. Before that make sure that the moulding gel is to be used because, it will act as layer

between the mould and box without giving any sticky nature to it. Because it leads to changes the properties of the composite material. Curing was done at room temperature for approx. 24 hrs. After curing the mould was opened slab taken out of the mould and cleaned.

4. RESULTS

4.1 Expermantation:-

GI Sheet boxes of size 30*30* .05 cm were used for the moulding process. The moulded sheets are transformed into a square box such that the mixture of resin and hardener are poured in it. Through the HAND LAY-UP technique the prepared mould was transferred to mould cavity by care that the mould cavity should be thoroughly filled. Levelling was done to uniformly fill the cavity with the help of the rollers support. Before that make sure that the moulding gel is to be used because, it will act as layer between the mould and box without giving any sticky nature to it. Because it leads to changes the properties of the composite material. Curing was done at room temperature for approx. 24 hrs. After curing the mould was opened slab taken out of the mould and cleaned.

We have taken four examples

1. Okra + Pineapple Uni-directional using Epoxy Resin(LY-556) along with Hardener(HY-951)
2. Okra + Pineapple Uni-directional + Groundnut Shell Ash Epoxy Resin(LY-556) along with Hardener(HY-951)
3. Okra + Pineapple Orthogonal using Epoxy Resin (LY-556) along with Hardener (HY-951).
4. Okra + Pineapple Orthogonal + Groundnut Shell Ash Epoxy Resin (LY-556) along with Hardener(HY-951)

4.2 Tensile Test Purpose

The essential utilization of the testing machine is to make the pressure strain chart. Pliable test decides the quality of the material exposed to a straightforward extending activity. Regularly, standard measurement test tests are pulled gradually (static stacking) and at uniform rate in a testing machine while the strain (the stretching of the example) is characterized as:

Building Strain = (change long)/(unique length) and the pressure (the connected power separated by the first cross-sectional region) is characterized as: Engineering Stress = (connected power)/(unique region).

Table :1Tensile Test Specimen Loads

S.NO	SPECIMEN NO.	LOAD AT BREAK(KN)	MAXIMUM LOAD (KN)	UTS (MPa)
1	Okra + Pineapple (Unidirectional)	2.69	2.6989	34.60
2	Okra + Pineapple + Groundnut Shell Powder Ash (Unidirectional)	3.21	3.2171	41.24
3	Okra + Pineapple (Bidirectional)	2.58	2.5898	33.20
4	Okra + Pineapple + Groundnut Shell Ash (Bidirectional)	2.47	2.4701	31.67

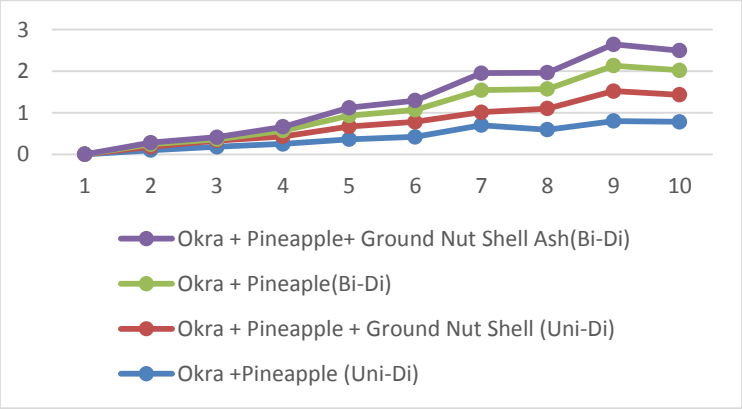

Figure: Stress-Strain diagram for all specimens

4.2 Compression Test:-

Pressure test is utilized to get the mechanical properties and is the premise acknowledgment and refusal of weak non-metallic and different materials that have low quality in strain like solid, wood, stone work, and so on. Pressure test could be utilized to acquire the mechanical properties of metals anyway it isn't favored because of the accompanying It is hard to apply a really hub load in pressure which prompting non-uniform burdens.
Grinding between the machine head and the example, impacts the outcomes making stresses have a little tendency.

Table. Compression test specimens

S.no	Sample No	Peak load(KN)	Compression strength, (MPa)
1.	Okra + Pineapple (Unidirectional)	22.0	60
2.	Okra + Pineapple + Groundnut Shell Powder Ash (Unidirectional)	27.0	72
3.	Okra + Pineapple (Bidirectional)	15.8	55
4.	Okra + Pineapple + Groundnut Shell Ash (Bidirectional)	29.7	74

4.3 Hardness:-

The Rockwell Hardness Test strategy comprises of indenting the test material with a precious stone cone or solidified steel ball indenter. In our experimentation, The Rockwell Hardness Tester was utilized for investigation of hardness test with L-scale and M-scale in Rockwell Hardness Testing having ¼ inch ball indenter. The indenter is constrained into the test material under a fundamental minor burden. Higher the hardness number lower the temperature to extinguish it. The Rockwell Hardness test is completed for various examples and qualities are arranged.

Table: Hardness Number for Various Specimens

S. NO	SPECIMEN	INDENTOR USED	LOAD	RHN	AVERAGE	LOAD	RHN	AVERAGE
1.	Okra + Pineapple (Unidirectional)	DIAMOND	60	49 50 51 50 51	50.2	100	54 53 53 52 53	53
2.	Okra + Pineapple + Groundnut Shell Powder Ash (Unidirectional)	DIAMOND	60	53 52 53 54 53	53	100	52 51 51 50 51	51
3.	Okra + Pineapple (Bidirectional)	DIAMOND	60	52 52 53 53 52	52.4	100	53 53 54 54 53	53.4
4.	Okra + Pineapple + Groundnut Shell Ash (Bidirectional)	DIAMOND	60	40 41 41 40 42	40.8	100	52 52 53 51 52	52

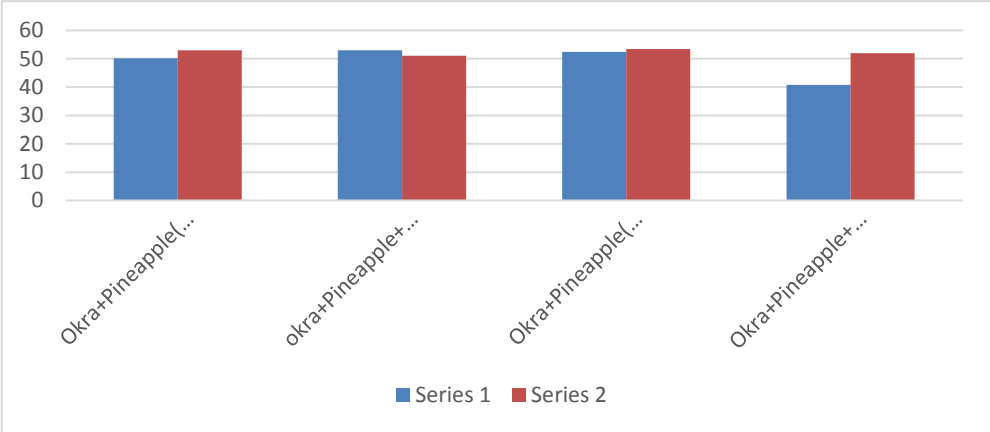

Figure: Number of Specimen tested for Hardness

4.5 Impact Strength:-

Effect quality is the ability of the material to withstand an abruptly connected burden and is communicated as far as vitality. Effect quality is the obstruction of a material to break under unique burden. The effect quality is determined as the proportion of effect retention to test example cross-segment. The Impact quality is estimated by IZOD Impact Test and CHARPY Impact Test, the two of which measure the effect vitality required to break an example.

In the present examination, we have taken four example examples for testing reason. These examples were made to the required measurements individually for the Izod and Charpy Tests. The cross sectional region of the example underneath the indent part is to be determined. The examples were set in the needed help to such an extent that the score is confronting the striking end. The striking edge strikes against the example and bursts it. The vitality ingested to break the example is shown on the scale. The test is completed for examples and qualities are organized beneath.

Table: Various Specimens impact strength on izod

S.NO	SPECIMEN	IMPACT STRENGTH ON IZOD(J/MM^2)
1.	Okra + Pineapple (Unidirectional)	0.0248
2.	Okra + Pineapple (Bidirectional)	0.0241
3.	Okra + Pineapple + Groundnut Shell Ash (Bidirectional)	0.0512
4.	Okra + Pineapple + Groundnut Shell Ash (Bidirectional)	0.0509

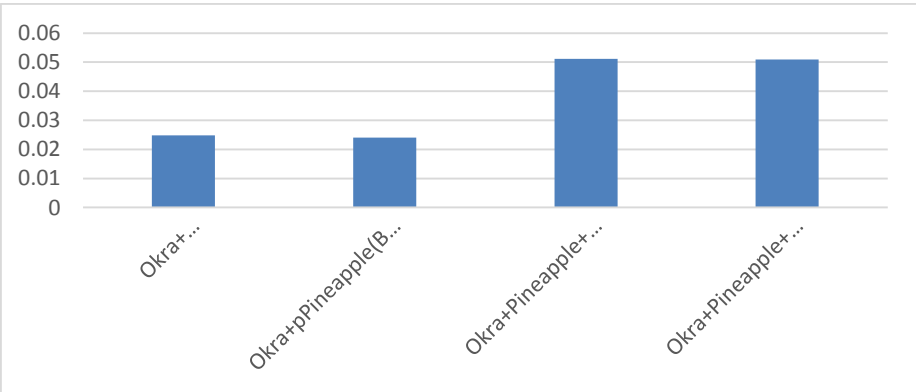

Figure: Impact strength test on izod

5. Conclusions:

The detailed strain curve experimental conclusions are drawn below:-

a. Fabricated of a new class epoxy based composites reinforced with short pineapple and okra natural fibres.

b. Evaluated the mechanical properties such as flexural strength, impact strength, tensile strength and micro-hardness of the obtained specimens.
c. According to the tensile test experiments, the specimen Okra + Pineapple (Unidirectional) possess maximum stress strain curve and Okra + Pineapple + Groundnut Shell Ash (Bidirectional) has minimum stresses.
d. The compression test for the specimen Okra + Pineapple + Groundnut Shell Ash (Bidirectional) has maximum and minimum for Okra + Pineapple(Bidirectional)
e. The Hardness test for the specimen Okra + Pineapple (Bidirectional) is maximum and minimum for Okra + Pineapple + Groundnut Shell Ash (Bidirectional)
f. The Impact Strength for Specimen Okra + Pineapple (Bidirectional) is maximum and minimum for Okra + Pineapple + Groundnut Shell Ash (Unidirectional)
g. The mechanical properties will be change with change in sythesis of filaments.
h. Increase in hardener proportion with epoxy tar mechanical properties will change and over the top hardener will lead towards weakness of composite material.
i. As pineapple Fibre is known for its amazing smoothness its blend with Okra Fibre will lead towards better surface completion of the item with wanted quality.

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