EVALUATION OF MECHANICAL PROPERTIES OF ALOE VERA NATURAL FIBRE REINFORCED COMPOSITE

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ABSTRACT

The details studies about the properties of unsaturated polyster reinforced with banana and Aloe vera woven fabric are collected the data are studied. We are using the techniques of sacking by composite material properties are followed in flexural, impact and water resistant properties were function are tested in total fiber volume fraction. to investigated the properties of flexural and impact properties of natural fiber are higher than the value of pure polyester. due to the difference cross section occur in banana woven composite properties is have its higher flexural and impact strength and higher cellulose content compared to that of Aloe vera woven composites. Above 10 and 15 vol. fraction of fibers, the flexural and impact properties of these two woven composite systems decreased due to insufficient resin, respectively it has more water absorption content taken in woven Aloe vera fiber composite increased than banana composite that might due to higher hemicellulose and some defects in composite system.

KEYWORDS: *Mechanical Properties, Aloe vera-Epoxy fiber Composites*

1.INTRODUCTION

In recent years, the natural fibres have attracted substantial importance as potential structural material. The attractive plus point of natural fibre is in terms of industrial usage which has made its availability more demanding. Keeping this visible the current work has been undertaken to develop a compound matrix composite (epoxy resin) exploitation aloe fibre as reinforcement and to check its mechanical properties and performance. The composites area unit ready with completely different volume fraction of pulp fibre.

Kenya could be a country that for the most part depends on agriculture. The mechanical properties of many sorts of epoxy systems area unit designed supported the chemical structure, network structure and morphology aiming at refrigerant applications. The enticing options of natural fibres like jute, sisal, fiber and banana are their low value, light-weight weights, high specific modulus, renew ability and biodegradability.Natural fibres area unit lingo-cellulosic in nature.The fibre composites will be terribly value effective material particularly for building and industry. but in several instances residues from ancient crops such sugarcane pulp or from the same old process operations of timber industries don't meet the requisites of being long fibres. pulp contains regarding four-hundredth polyose, half-hour hemi-cellulose, and V-J Day polymer.

The present use of pulp is especially as a fuel within the sugar cane mill furnaces. Keeping this visible the current work has been undertaken to develop a compound matrix composite (epoxy resin) exploitation pulp fibre as reinforcement with volume fractions ten, 20, thirty and to check its mechanical properties. within the next a part of this project the most stress was ordered on the experimental work with reference to the mechanical behaviour of this composite. Kenya is endowed with an abundant availability of natural fibres such as Jute, coir, sisal,pineapple, ramie, bamboo, banana etc. The physical properties of natural fibres are mainly determined by the chemical & physical composition, such as structure of fibres' cellulose content, angle of fibrils, cross section and by the degree of polymerization.

Only a few characteristics values but especially the specific mechanical properties can reach the compensable values of traditional fibres. An important property of natural fibres to be used as reinforcements is their availability in large

quantities. For several more technical oriented applications, the fibres have to be specially prepared or modified regarding, homogeneity of the fibre's properties, degrees of elementarization and degumming, degree of polymerization and crystallization, good adhesion
between fibre and matrix, moisture repellent properties and flame retardant properties.

Particle composites Particle bolstered composites carries with it a matrix bolstered by a dispersed phase within the style of particles. It is either of random orientation or preferred orientation.

Fibrous composites- Short fiber: they contains a matrix strengthened by a dispersed particles in the style of discontinuous fibers either of random or most popular orientations.

Long fiber composites -they encompass a matrix strengthened by a form within the form of continuous fibers. they will be either simplex or two-way.

Laminate composites- when a fiber strengthened composite consists of many layers with different fiber orientations, it's known as multilayer composite.

2.MATERIALS AND METHODS

2.1. ALOE VERA FIBER

Aloe Vera is basically a native plant of Africa. It is also known as lily of the desert and plant of immortality due to its medicinal effects. This plant has 96 percent of water content. The leaf of this plant contains over seventy 5 nutrients and 2 hundred active compounds like twenty minerals, eighteen amino acids and twelve vitamins. The spikes and margins were removed before slicing the leaf. The cortex was strictly separated from the parenchyma using a scalpel-shaped knife. Filets were washed thoroughly with distilled water to remove the exudate from surfaces. Fresh aloe filets were stored for no longer than 1 h at -18ºC prior to lyophilization. Glucomannan, a mannose-rich polysaccharide, and gibberellin, a growth hormone, interacts with growth factor receptors on the fibroblast, thereby stimulating its activity and proliferation, which in turn significantly increases collagen synthesis after topical and oral Aloe vera.Aloe gel not only increased collagen content of the wound but also changed collagen composition (more type III) and increased the degree of collagen cross linking. Due to this, it accelerated wound contraction and increased the breaking strength of resulting scar tissue. An increased synthesis of hyaluronic acid and dermatan sulfate in the granulation tissue of a healing wound following oral or topical treatment has been reported.

2.1.2.ADHESSIVE PROPERTIES

Adhesive properties of the resin system are important in realizing the full mechanical properties of a composite. The adhesion of the resin matrix to the fibre reinforcement or to a core material in a sandwich construction is important. Epoxy system offer the best performance of all the three resins considered here. Polyester resins generally have the lowest adhesive properties of the three. On the other hand,vinly-ester resin shows improved adhesive properties over polyester. This is due to their chemical composition and the presence of polar hydroxyl and ester group.

2.2.METHODS

2.2.1.FLEXURAL STRENGTH

Flexural strength, also known as modulus of rupture, bend strength, or fracture strength, a mechanical parameter for brittle material, is defined as a material's ability to resist deformation under load. The transverse bending test is most frequently employed, in which a rod specimen having either a circular or rectangular cross-section is bent until fracture using a three point flexural test technique. The flexural strength represents the highest stress experienced within the material at its moment of rupture.

2.2.2.LONGITUDINAL TENSILE STRENGTH

Normal strength is taken because the most stress on the strain strain curve, If we tend to assume $\varepsilon f < \varepsilon m$ that is that the usual case then the fibres can fail before the matrix. Once the fibre have broken the bulk of the load that was borne by the fibres is currently transferred to the matrix. This being the case it's doable to adapt the expression for the strain on this sort of composite.

2.3..PREPARATION OF PURE EPOXY RESIN

The epoxy resin and hardener were both weighed on an electronic balance mixed in the ratio of 3:1 as recommended by the supplier and stirred properly to attain a uniform mix.

2.3.1.PREPARATION OF THE COMPOSITE SPECIMEN

A thin layer of petroleum jelly was the smeared on the inner surfaces of the moulds.
The mixture of epoxy resin was poured in the mould gradually and carefully spread with the help of a spatula about 2mm thick.Then the Aloe vera fibres were spread evenly as per the volume fraction required.For particulate fibre composite, the particles were stirred together with the epoxy uniform mix.
This process was repeated and it was made sure that there was even distribution of the fibres in the resin.The mould was filled to the brim and care was taken to ensure that the mould laid on a flat surface.

The test piece was subjected to a tensile load. Testing was done under room atmospheric conditions.

Fig 2:3D Mould

3.RESULTS AND DISCUSSION

It is evident from the results carried out that the tensile and flexural strength of Aloe vera/epoxy composites increases with fibre addition for the case of parallel aligned fibres.O the other hand the flexural strength showed appreciable decrease in strength with increase in fibre fraction. This was quite in order with the predictions from the rule of mixtures.The casting method employed in the fabrication of Aloe vera/epoxy resin composite resulted in the formation of voids within the specimens due to entrapped air.

3.1.VOLUME FRACTION

Table 1-Volume Fraction Fibre

SPECIMEN TESTED	VOLUME FRACTION(%)
1	10
2	20
3	30
4	40

3.1.1EXPERIMENTAL TENSILE STRENGTH

Parallel and aligned fibres
Longitudinal loading

Table 2- Longitudinal loading of Experimental Strength

FIBRE VOLUME FRACTION %	LOAD N	EXPERIMENTAL TENSILE STRENGTH (MPa)
10	6000	75
20	7190	90
30	8385	104
40	9578	119.7

Transverse loading

Table 3- Transverse loading of Experimental Strength

FIBRE VOLUME FRACTION %	LOAD N	EXPERIMENTAL TENSILE STRENGTH (MPa)
10	4401.077	55.0
20	5817.365	72.7
30	7233.653	90.4
40	8649.94	108.0

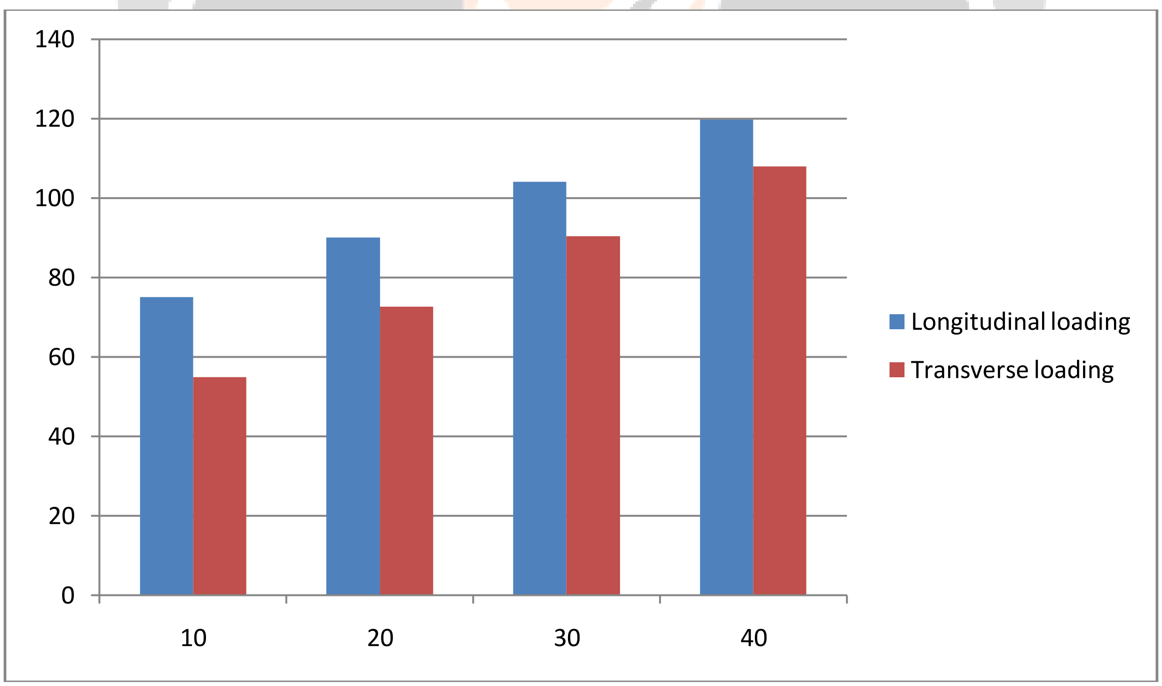

Fig 3: Comparison Of Experimental Tensile Strength in Parallel & Aligned Fibres

4.2.1.EXPERIMENTAL TENSILE MODULUS

Parallel aligned composite-Longitudinal loading

Table 4- Longitudinal loading of Experimental Strength

VOLUME FRACTION	EXPERIMENTAL TENSILE STRENGTH (MPa)
10	4.05
20	5.34
30	6.62
40	7.92

Parallel and aligned fibres-Transverse loading

Table 5- Transverse loading of Experimental Strength

VOLUME FRACTION	EXPERIMENTAL TENSILE STRENGTH (MPa)
10	3.00
20	3.31
30	3.67
40	4.12

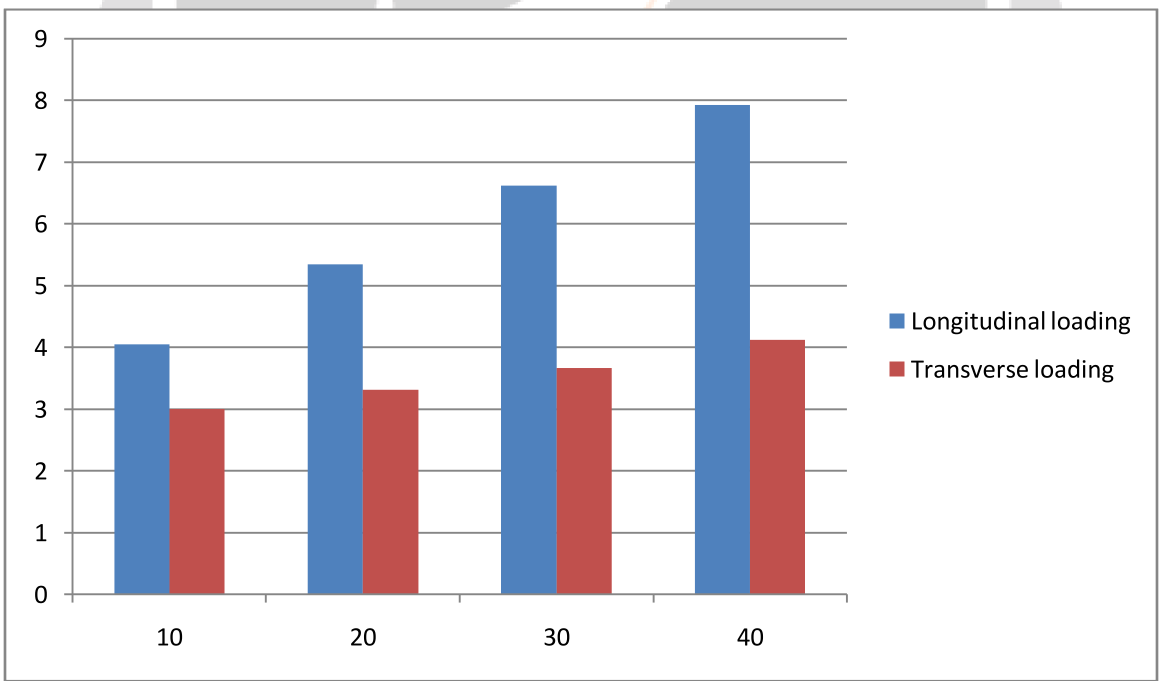

Fig 4: Comparison Of Experimental Tensile Modulus in Parallel & Aligned Fibres& Composites

4.3.1.EXPERIMENTAL ELASTIC MODULUS

Discontinuos and randomly oriented fibres

Table 6- Discontinuos and randomly oriented fibres of Experimental Tensile Strength

VOLUME FRACTION	EXPERIMENTAL TENSILE STRENGTH (MPa)
10	3.30
20	3.63
30	3.96
40	4.30

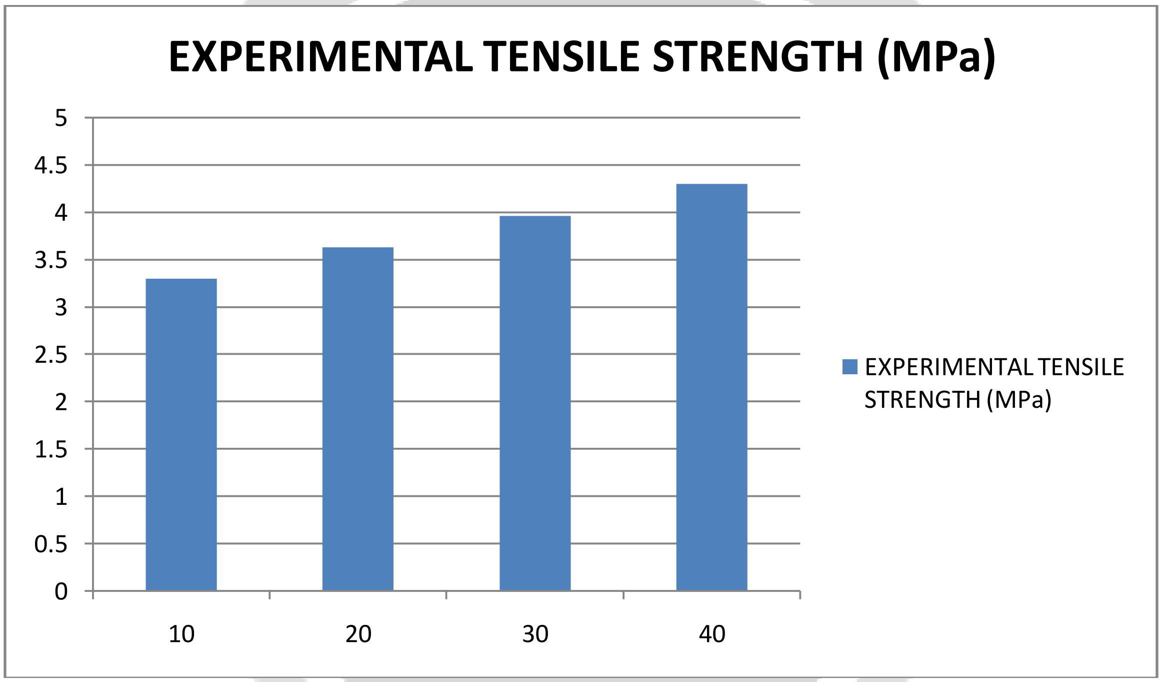

Fig 5: Experimental Elastic Modulus For Discontinuos & Randomly Oriented Fibres

4.4.1.EXPERIMENTAL FLEXURAL STRENGTH

Three Point Loading-Parallel and aligned fibres

Table 7- Parallel and aligned fibres of Experimental Tensile Strength

VOLUME FRACTION	EXPERIMENTAL TENSILE STRENGTH (MPa)
10	116.7
20	128.6
30	140.5
40	152.4

4.5.1.EXPERIMENTAL FLEXURAL STRENGTH

Three Point Loading-Discontinously Oriented Fibres

Table 8- Discontinously Oriented Fibres of Experimental Tensile Strength

VOLUME FRACTION	EXPERIMENTAL TENSILE STRENGTH (MPa)
10	113.9
20	125.5
30	137.1
40	148.7

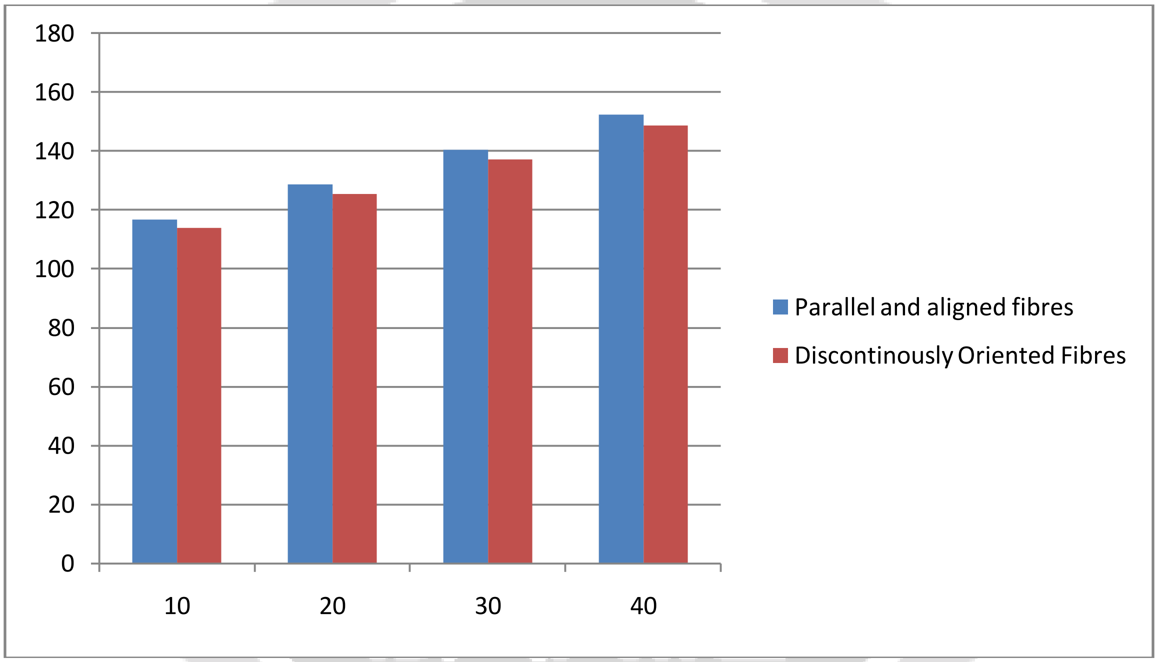

Fig 6: Comparison Of Experimental Flexural Strength In Three Point Loading

4.6.1.EXPERIMENTAL FLEXURAL STRENGTH

Four point loading-Parallel aligned fibres

Table 9- Parallel aligned fibres of Experimental Tensile Strength

VOLUME FRACTION	EXPERIMENTAL TENSILE STRENGTH (MPa)
10	114.9
20	128.5
30	141.1
40	149.7

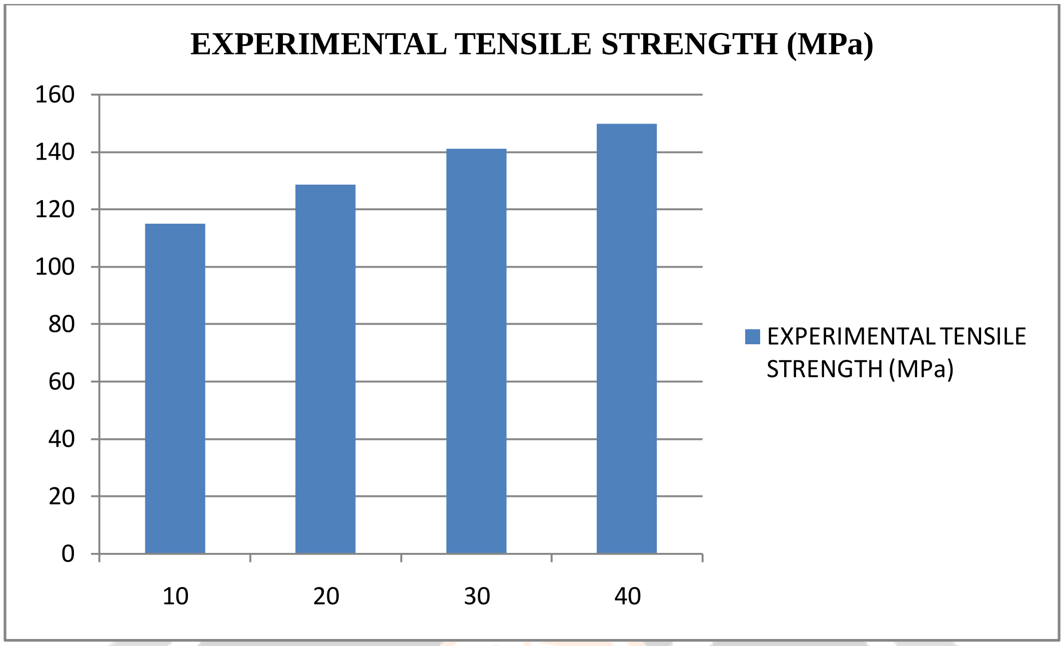

Fig 7: Experimental Flexural Strength For 4-Point Loading In Parallel Aligned Fibres

5.CONCLUSION

It has been demonstrated that Aloe vera fibre can be used to reinforce epoxy resin as the resulting composite has been found to have very attractive physical and mechanical properties. As renewable materials, they can be used to replace or extend non-renewable materials such as those based on petroleum and as a result, the material promises application in many areas.More than enough agricultural fibre residues are available to support composite manufacturing needs, although the agro-based materials may not have a suitable geographical distribution to provide an economically feasible endeavor.

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