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Study on Mechanical Properties of Natural Fibre Mat with Fibre Composites

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Abstract

High performance material have an unusual mix of characteristics and unique design options. With an annual growth rate of 25% and the fastest demand for engineering and rubber plastics, its potential lies in Biomedical Application. This is mainly due to the benefits of low weight, non-toxicity, abrasion resistance, availability, low cost and biodegradability. Synthetic fibers have higher mechanical properties such as tensile strength and tensile strength, but certain mechanical properties such as the specific tensile strength of natural fibers and other specific properties (specific properties / weight) are based on fibers. It provides satisfactory results compared to composites. Recently, attention has been focused on the use of bio fuels in automotive, construction, packaging and medical applications where environmental sustainability is becoming increasingly important. The materials are produced by hand. The mechanical properties of natural fiber compounds are investigated by testing high strength composite materials on samples.

Keywords; *Natural fibre, Manufacturing, fibre composite, tensile strength*

I. INTRODUCTION

The mixture generally has superior properties to any material. You need to use a combination of materials to solve the problem, as it is not possible with just the right costs or a complex mixture of two or more different substances. The strengths of glass reinforced composites are not made on simple structures and simple design structures by placing the structural elements on top of each other to achieve the desired design. The strengths of glass reinforced composites not only on the properties of the components Fiber reinforced cars are increasing in use in widely used applications. Natural fibers are obtained from various parts of plants such as jute, linen, sugar cane, coconuts, cannabis, For example, hemp, jute, linen and sisal fibers are already used in the automotive industry. In composite polymers, the natural fiber reinforcement is a set of long or short natural fiber ribbons manufactured to make flat sheets or mats of one or more fiber layers. These layers are bonded together by mechanical interlocking muscle fibers. Low density plastic materials are relatively easy to use, weather resistant, and do not require surface treatment. Natural fibers are naturally occurring. Heme cellulose, Cellulose, hemsulose, and lignin are the basic components of natural fibers that determine the physical properties of the fibers. In order to make full use of natural fibers, it is important to know their physical properties and mechanical properties. The unique properties of natural fibers depend on the differences in the nature and amount of these components, as well as the differences in their cellular structure. Numeral studies have been conducted on nature of mechanical properties of natural fibers that must be considered so that natural fibers can be used optimally and effectively in automotive and industrial applications.

II. LITERATURE SURVEY

Calabrasad et al. (1) promoted two types of fibers in a single matrix, often leading to better expected

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properties of base blends. This includes the effect of incorporating short glass fibers into LDPE-reinforced polyethylene. It has been found that the tensile strength increases by about 80% by adding a relatively small portion of about 0.03 cup. The tensile strength of compounds containing alkaline sisal fibers shows an improvement of more than 90% by adding the same volume of glass.

GauravSainil and (2) Nowadays, green technology is spread around the world in materials science because of environmental problems. Working with a biological compound, such as environmental conditions (temperature, humidity, etc.) and strength, presents some challenges. A comprehensive literature review of the polypropylene matrix with different natural fibers (nut shells, almond shells, pine heart, domes and hemp) was presented in this article.

Neelakandan et al (3) have varied considerably glass and sisal, and the resulting hybrid effect of these reinforcements in the matrix itself is of great importance. This survey is very successful in the fields of industry and engineering. Changes in the mechanical properties of LDPE with the incorporation of semi-synthetic fibers are studied. All properties, with the exception of elongation at break, were observed with increased fracture size of the fiberglass.

Gracia and (4) The specific growth process used in the study of the basic mechanical properties (Young's modulus and strength) of the fiber Through each trial's tensile tests a single study would also be carried out to reduce the growth of CNT technologies and also included the hydration of CNTs with advanced polymers under advanced (viscosities).

Sabo Thomas et al. (5) prepared hybrid compounds based on the relative size of the two blades. Orientation of fibers and effect of sodium hydroxide treatment of sisal fibers is observed. For longitudinal vehicles, it was found that the pulling force increased by about 80% by adding a very small part. He also noted that the direction of water absorption of a compound decreases during the hybridization process.

Olusigon and his collaborators (6) prepared slices by hand. Due to its simplicity and material accessibility, the technique used in this research was used. Details of the actions undertaken in the production of slices in manual mode were reported. The hand-made natural fiber composite offers the ability to replace existing materials offering increased strength and a low-cost alternative to the environment.

Gourav Gupta and (7) have discovered the prosperity of human civilization and the infrastructure of the country. The composite materials have unlimited geometric application requiring a strength/ weight ratio, low cost and ease of manufacture. The airspace is composed of about 50% of the composite cell because of its high strength, lightness and rigidity.

Venkatachalam and (8) Prepared with the promotion of a hybrid consisting of two distinct kinds of fibers, such as jute and gongura, consisting of walnut resin consisting of polyester and cashew nuts. The assessment found that the period of the fiber therapy and the alkaline solution concentration should be chosen for 12 hours and 10% respectively.

MehranTahrani, [9], prepared carbon nanotubes grown at a moderate temperature (550 ° C) under atmospheric pressure. This process of atmospheric pressure derived from the process, designs graphite structures (GSD). The temperature is low enough to avoid severe structural carbon damage at the substrate scale and this process is inexpensive. Growth of the fiber over the GSD is undesirable; however, their strength is minimized compared. Therefore, it is believed that the GSD needs to be further improved in terms of growth temperature and protection of the base fibers.

AhmatCaliket,et.al(10) It has been found that composite biomaterials are produced from natural

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fibers or natural resins instead of composite fibers (carbon, glass, other fibers) or resins (polyvinyl alcohol, epoxy, other resins). Biologically based fibers such as jute, sisal, hemp, bamboo, hair, wool, silk, etc. are obtained from plants or animals. In addition, natural matrix materials are produced such as natural rubber, polyester and other plants.

M. S. EL-Wazery,et.al (11) Randomized fiberglass was created in polyester tar grid through hand-held method with differing rates of fiber. Pliable, bowing, effect and Brinell effect tests were performed and their presentation evaluated. The elasticity was observed to be in the scope of 28.25 MPa to 78.83 MPa. The flexural quality is in the scope of 44.65 MPa to 119.23 MPa.

AlexandreLandesmann,et.al (12) We have made a determination and configuration utilizing composite materials. They analyze the likelihood of connecting accessible outcomes concerning the accompanying mechanical disappointment modes. -Of composite polymer with glass fiber type E Last least, the fiber substance of the mechanical properties, which can affect the relating last quality. Since just a moderately modest number of tests are displayed, more information must be gotten.

T.Prabhuram,et.al (13) The manufacture of composite materials was made from wood powder, peanut pods and cashew nuts and analyzed its properties. The wood usually has a good load capacity. They discovered that composite materials made of wood powder and peanut bark powder had better load ability. The materials discover their application where they achieve the minimum load, such as keyboards, photo frames, pen holders and other items of interior design. It is possible to use an enhanced composite material.

M.P.Ansell,et.al (14) Reinforced fiber polyester fibers containing jute and mono-oriented jute fibers were prepared. Here is the variation of the tensile strength and the parameterization according to the fraction of volume Vf of the jute between Vf = 0 and 07 force with the fraction of the volume of jute The Factor of Small Factor Unit, Fiber Factor Is derivative of 55.5GNm -2.

VinodP.Veedu et.al (15), CNTs were arranged vertically for 2D SiC woven textures to create three-dimensional tissue. A few investigations have been directed to show improved mechanical properties. Depict the nearby conduct of the base compound and the three-dimensional fortified composite measure (see Methods area) the hardness and effect coefficient utilizing the nanoindenter dynamic correspondence unit. Surfaces of composite examples were cleaned and metallic.

Paul A Fowler,et.al(16) Biocomposites have been distinguished as a significant non-sustenance showcase for rice and harvest saps. The utilization of biomarkers has expanded altogether in the car and design advertises in the course of the most recent decade or something like that, however has so far been constrained in different parts.

Velmurgan.R,et.al (17) The mechanical properties of the waste fiber and the compound made of the cross breed glass fiber compound were readied. Tractable properties, flexural properties, shear properties and effect properties were researched. Vehicles with about -65% strands demonstrated a slight improvement in flexural quality.

Mustafa Kemal Yalinkilic (18) Set up the natural, physical and mechanical properties of tea leaf pellets. The extraction of exceedingly phenolic tea leaves and their value as leftover waste in tea plants require examine on the utilization of these losses in the creation of pellets. Tea leaf squander (WTLB) is relied upon to be increasingly impervious to organic specialists because of its quick phenol extraction rate. The weight reduction of WTLB was 3.5-8.6% for epoxy and 6-12. 1% when paraffin tests were included.

GouravGupta,et.al (19) Found the flourishing human civilization and infrastructure of the country. The composite materials have unlimited geometric application requiring a strength / weight ratio, low

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cost and ease of manufacture. The airspace is composed of about 50% of the composite cell because of its high strength, lightness and rigidity. Thecomposite material is characterized by high resistance to fatigue, its effect, its resistance to the environment and its reduced maintenance, its maximum fatigue tolerance (up to 60% of the maximum tensile strength.

GouravPandey,et.al (20), its characteristics are multifunctional behaviors to perform this study. Strength and stiffness tests were performed to form homosilk, a matrix obtained from four weight ratio matrix samples. The flexibility properties were evaluated by tensile and endurance test according to ASTM standard. The incorporation of phenyl ester has been shown to improve the Yong coefficient in both directions of linear orientation while. The tensile strengths of the composites were tested and their distribution was analyzed on the basis of a normal distribution model.

III. CLASSIFICATION OF NATURAL FIBRES

Fig.1. shows the classification of the natural fibres which have ample research in the current scientific community. There are many leading manufacturers of these flax-based products in the world. The different linen products blended are cotton, linen, cotton-based linen, synthetic linen, etc.

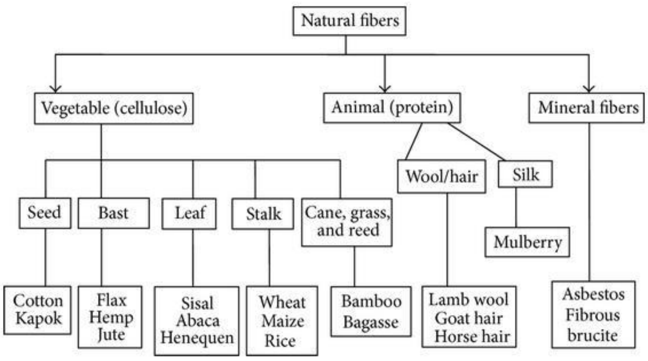

Fig.1 Classification of natural fibres

3.1 Flax Fibre

Fig.2 Flax Fibre

Flax fibers, shown in figure 2, can quickly absorb moisture from sweat, which provides coolness and comfort in wet weather when wearing these clothes. As regards the properties of the fibers, the flax fibers are amplified and their resistance is improved under humid conditions.

3.2 Sisal Fibers

Also explored were the impacts of different chemical treatments on the mechanical conduct of the compounds. Several studies have reported that sisal fibers can serve as potential reinforcement for polymer matrices as shown in Fig.3

Fig:3 Sisal fibre

IV. MANUFACTURING METHODS

Composite manufacturing includes the basic manufacturing methods used to produce : They can be manual installation mode Lay auto -tracking mode, Spray winding of the wire, vacuum casting, Pultration. Manual Lay-Up Manual installation involves cutting arms of their size using various portable and electrical devices. These parts are then impregnated with a wet matrix material, placed on the surface of the mold and then covered with a mounting agent and a coating of resin gel. The reinforced reinforcing material is then rolled

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manually to ensure uniform distribution and removal of trapped air. More reinforcing materials are added until the desired part thickness is constructed. Manual installation can also be carried out using pre-saturated reinforcing materials, called "prepregs". The use of the pre-primer eliminates the discrete treatment of the resin and improves the quality of the pieces by providing a more consistent control of the content of the reinforcement and the resin. Pre-cooling must be cooled before use to avoid premature treatment. Typical arrangement of manual lay process is shown in fig.4.

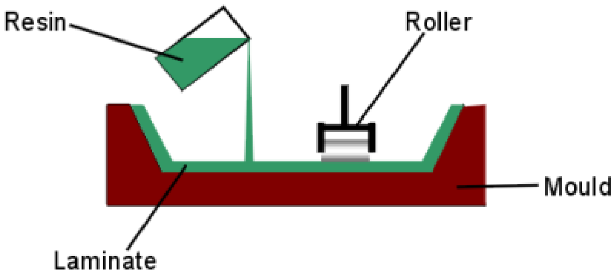

Fig:4 Manual lay process

V. TEST RESULTS

Several researchers mentioned in the literature survey reported test results obtained through their experimentations. Fig.4. and Fig.5 shows specifications of the specimen and test results for flat geometries and composite configuration is cited to compare and contrast the current results. Table 1 shows the comparison of mechanical properties of specimen one and two and the same was shown in fig.6.

Specimen Type: Flat

Width	(mm) : 22.9		
Thickness	(mm) : 6.3		
Cross Section Area	(mm)² : 144.27		
Initial Gauge Length	(mm) : 50	Final Gauge Length	(mm) :
Yield Load	(N) : 0	% Elongation	: -100
Ultimate Load	(N) : 3300		
Breaking Load	(N) : 3369	Young's Modulus (MPa)	: N/A

Yield Stress		Ultimate Stress		Breaking stress	
(KN/mm²)	: 0	(KN/mm²)	: 0.02287	(KN/mm²)	: 0.02335
(MPa)	: 0	(MPa)	: 22.87	(MPa)	: 23.35
(kgf/mm²)	: 0	(kgf/mm²)	: 2.33	(kgf/mm²)	: 2.38

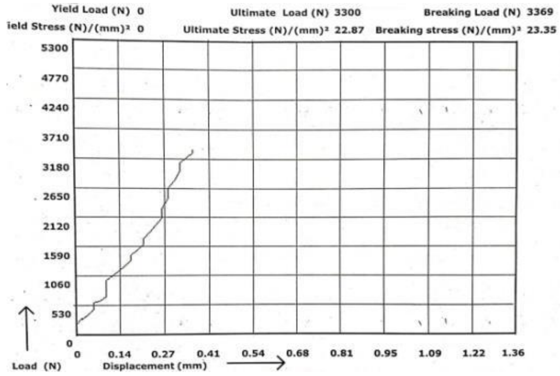

Fig.4: Result for Specimen 1

Specimen Type: Flat

Width	(mm) : 18.4		
Thickness	(mm) : 6.4		
Cross Section Area	(mm)² : 117.76		
Initial Gauge Length	(mm) : 50	Final Gauge Length	(mm) :
Yield Load	(N) : 0	% Elongation	: -100
Ultimate Load	(N) : 2630		
Breaking Load	(N) : 2797	Young's Modulus (MPa)	: N/A

Yield Stress		Ultimate Stress		Breaking stress	
(KN/mm²)	: 0	(KN/mm²)	: 0.02233	(KN/mm²)	: 0.02375
(MPa)	: 0	(MPa)	: 22.33	(MPa)	: 23.75
(kgf/mm²)	: 0	(kgf/mm²)	: 2.28	(kgf/mm²)	: 2.42

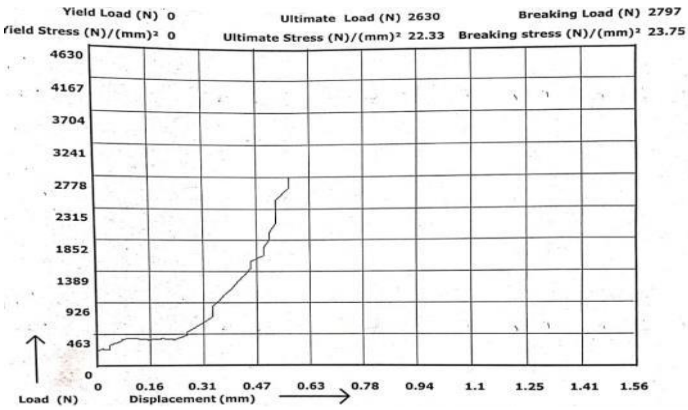

Fig.5: Result for Specimen 2

Table 1: Various Test Results

S.NO	Test Parameters N/mm^2	Specimen1	Specimen 2
1	Tensile Strength N/mm^2	22.87	22.33
2	Impact N/mm^2	14	16
3	Flexural strength N/mm^2	131.25	125.54
4	Compression Strength N/mm^2	276.81	318.73
5	Hardness, HRR	58	58
6	Water absorption %	0.42	0.36

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Fig.6: Comparison of test result

VI. CONCLUSION

The tensile, flexural, impact, stiffness and corrosion properties of sisal, flax and flax fibers were evaluated and the results were planned. Samples are prepared using a manual process that is tested to ASTM standards. The following conclusions are drawn. A maximum tensile strength of 14 MPa was observed in the epoxy-reinforced epoxy compound. The flax reinforced epoxy composite has maximum flex strength of 131.25 MPa compared to other fibers. On the other hand, sisal showed a higher resistance (58 HRB) The highest impact resistance (16 KJ / m2) of natural sisal fibers was displayed. From the overall observation, we can conclude that flax has the highest tensile and bending properties and the lowest wear rate compared to others. Therefore, it can be used as a support.

VII. REFERENCES

[1]. G. Kalaprasad et.al, Hybrid Fibre Reinforced Polymer Composites, International Plastics Engineering and Technology Vol 1. 1995, pp.87 &93.
[2]. GauravSainil et.al, A Review on Bio-composites based on Polypropylene Reinforced with Natural Fibers: Mechanical Properties, International Journal of Research in Advent Technology, July 2016.
[3]. N.R.Neelakandan et.al, Journal of reinforcement plastics and Composites, Vol 15, 1996.
[4]. J.Gracia et.al, Long Carbon Nanotubes Grown on the Surface of Fibers For Hybrid Composites, AIAA JOURNAL, Vol. 46, 2008.
[5]. Sabu Thomas et.al, Journal of COMPOSITE Materials, Vol 31, 1997.
[6]. Olusegun David Samuel, Assessing Mechanical Properties of Natural Fibre Reinforced Composites for Engineering Applications Journal of Minerals and Materials Characterization and Engineering, 2012.
[7]. Gourav Gupta et.al, Application and Future of Composite Materials Vol. 5, Issue 5, May 2016.
[8]. G.Venkatachalam et.al, Evaluation of tensile strength of hybrid fiber (jute/gongura) reinforced hybrid polymer matrix composites, IOP Conference Series: Materials Science and Engineering, (2015) PP 1,6.
[9]. MehranTehrani et.al, Hybrid Composites Based on Carbon Fiber/Carbon Nanofilament Reinforcement, Materials 2014.
[10]. AhmatCalik et.al, Bio composite material mechanical and chemical properties Rev.adv.mater (2018) 84-88.
[11]. M.S.EL-Wazery et.al, Mechanical Properties of Glass Fiber Reinforced Polyester Composites International Journal of Applied Science and Engineering 2017. 14, 3: 121-131.
[12]. AlexandreLandesmann et.al, Mechanical Properties of Glass Fiber Reinforced Polymers Members for Structural Applications, Materials Research.2015;18(6)
[13]. T.Prabhuram et.al, Hybrid Composite Materials, Frontiers in Automobile and Mechanical Engineering (FAME), November 2010.
[14]. M.P.Ansell et.al, Jute-reinforced polyester composites, Journal of material science 2015.
[15]. VinodP.Veedu et.al, Multifunctional composites using reinforced laminae with carbon-nanotube forests, Article in Natural materials, 2006.
[16]. Paul A Fowler et.al, Review Biocomposites:Technology, Environmental Credentials And Market Forces, (2006).
[17]. Velmurgan.R et.al, “Mechanical properties of glass/palmyra fiber waste sandwich composites” Indian Journal of Engineering & Material Sciences, Vol.12,2005.
[18]. Mustafa Kemal Yalinkilic, “Biological, Physical, and mechanical proprieties of particleboard manufactured from tea leaves” Journal of Composite Materials 48(8) • March 2014.
[19]. Gourav Gupta et.al Application and Future of Composite Materials, International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 5, Issue 5, May 2016.
[20]. GauravPandey et.al, A Review on Bio-composites based on Polypropylene Reinforced with Natural Fibers: Mechanical Properties, International Journal of Research in Advent Technology, Vol.4, 2016.