RESEARCH ARTICLE OPEN ACCESS

A STUDY OF EXPERIMENTAL INVESTIGATION OF PHYSICAL CHARACTERISTICS OF VARIOUS PROPORTIONOF SISAL FIBER COMPOSITE

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Abstract:

Composite are material that comprise strong load carrying material (known as reinforcement) imbedded in weaker material (known as matrix). Natural fiber has been used to reinforce material for over 3,000 year. Many types of Natural fiber have been investigated for use in plastic including flux, hemp, jute, straw wood fiber, rice husk, wheat, barley, oats, rye, cane (sugar and bamboo), grass reeds, ramie, oil palm empty fruit bunch, sisal, coil, water hyacinth, pennywort, kapok, paper-mulberry, banana fiber, pineapple leaf and papyrus. Natural fibers are increasingly used in automotive and packaging materials. Among these Natural fibers in this work sisal fiber is chosen as reinforcement because of its high strength and ground shell is chosen as particulate. In this phase composite sheet are prepared of varying composition as per ASTM standards.

Keywords **— Reinforcement, Matrix, Sisal fiber, Reinforced Polymer Composite, Ground Shell.**

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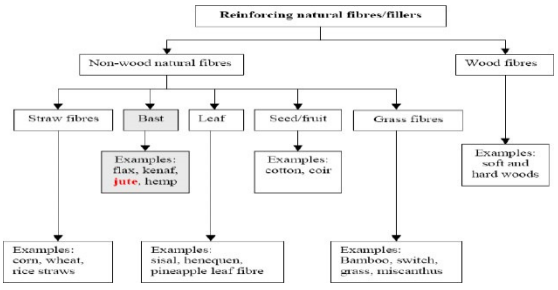
I. INTRODUCTION

Over the last thirty years composite materials, plastics and ceramics have been the dominant emerging material. The volume and number of applications of composite materials have grown steadily, penetrating and conquering new markets relentlessly. Modern composite materials constitute a significant proportion of the engineered materials market ranging from everyday products to sophisticated nice application. While composite have already proven their worth as weight-saving materials, the current challenge is to make them cost effective. It is essential that there be an integrated effort in design, material, process, tooling, quality assurance, manufacturing, and even program management for composite to become competitive with metals.

High performance FRP can now be found in such diverse application as composite designed to resist to explosive impact, fuel cylinders for natural gas vehicles, windmill, blades, industrial drive shafts, support beams of highway bridges and even paper marking roller. Composite properties (e.g. stiffness, thermal expansion etc.) Can be varied continuously over a broad range of values under the control of the designer.

II. CLASSIFICATION OF NATURAL FIBER



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III. LITERATURE SURVEY

NILSON, L reinforcement of concrete with sisal and other vegetable fibers discussed about Sisal fiber is obtained from the leaves of the plant Agave sisalana, which was originated from Mexico and is now mainly cultivated in East Africa, Brazil, Haiti, India and Indonesia. It is grouped under the broad heading of the "hard fiber" among which Sisal is placed second to Manila in durability and strength.

BARKAKATY, B.C. some structural aspects of sisal fiber. Journal of Applied polymer Science discussed about the characteristics of the sisal fiber depends on the properties of the individual constituent, the fibrillar structure and the lamellae matrix. The fiber is composed of numerous elongated fusiform fiber cells that taper towards each end. The fiber cells are linked together by means of middle lamellae, which consists of hemicellulose, lignin and pectin.

GRAM, H.E Durability of Natural Fiber in concert discussed about a Sisal fiber in cross-section is built up of about 100 fiber cells. The cross-section of Sisal fiber is neither circular nor fairly uniform in dimension. The lumen varies in size but is usually well defined. The longitudinal shape is approximately cylindrical. Physically, each fiber cell is made up of four main parts, namely the primary wall, the thick secondary wall tertiary wall and the lumen.

Padmavati & Naidu (1998) [4] have discussed the chemical resistance and tensile strength of Sisal fiber (*Agave Veracruz*) It was noted that Sisal fibers were more resistant to concentrate HCl compared to other acids.

PARAMASIVAM. T, ABDULKALAM A.P.J. On the study of Natural fiber Composite Incorporation of sisal fiber into thermosetting plastic have been investigated the feasibility of developing polymer based Composite using Sisal fibers due to the low cost of production of Composite and amenability of these fiber to winding, laminating and other fabrication processes. It was found that the fabrication of these Composite was fairly easy and cost of production was quite low. Winding of cylinders with longitudinal or helical and hoop reinforcement was successfully carried out.

IV. SISAL FIBER

Sisal fiber is one of the most widely used natural fibers and is very easily cultivated. It is obtain from sisal plant. The plant, known formally as Agave sisalana. These plants produce rosettes of sword-shaped leaves which start out toothed, and gradually lose their teeth with maturity. Each leaf contains a number of long, straight fibers which can be removed in a process known as decortications.

Properties of Sisal Fibre

- ❖ It is recyclable.
- ❖ Sisal Fiber are obtained from the outer leaf skin, removing the inner pulp.
- ❖ It's available as plaid, herringbone and twill.
- ❖ Sisal Fiber are Anti-static, does not attract or trap dust particles and does not absorb moisture or water easily.
- ❖ The fine texture takes dyes easily and offers the largest range of dyed colors of all natural fibers.
- ❖ It exhibits good sound and impact absorption properties.
- ❖ Its leaves can be treated with natural borax for fire resistance properties.

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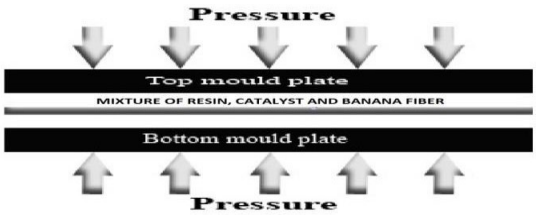
V. FABRICATION OF COMPOSITE

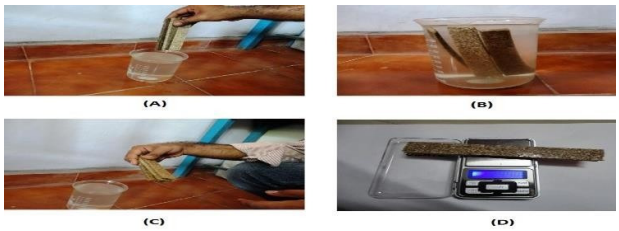
Hand Lay Up Technique

In this method the fiber are cut into small sizes by using scissors or Hack -Saw blade. The fiber is cut into size of 5mm. Three fibers are cut in similar manner. The bottom portions of the mould box are fixed with screw and its surface is covered with OHP sheet. Then the middle portion is fixed. The inner sides of the hollow portion are applied with a coating in order to avoid rough surface on the sides of the composite.



VI. EXPERIMENTAL ANALYSIS

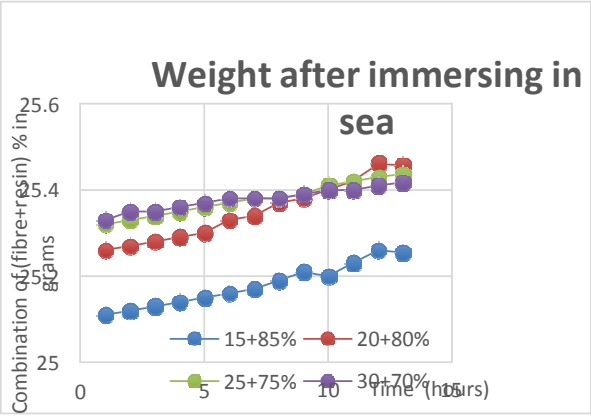
The specimen used for the water absorption test was cut from the laminate sheet. Sample was cut into flat shape (150×20×5) mm dimension. Such specimen was collected from each of the banana fibre composite. Three different water (sea water, distilled water and bore water) were collected separately in a beaker of 900 ml capacity, in such a way that the specimen completely gets immersed in the water.



Weight of Unsaturated Specimen

S. No.	Weight before immersing in Sea Water				Weight before immersing in Distilled Water				Weight before immersing in Bore Water			
	Combination of (fiber + resin) (%) in gram				Combination of (fiber +resin) (%) in gram				Combination of (fiber +resin) (%) in gram			
	(15+85)%	(20+80)%	(25+75)%	(30+70)%	(15+85)%	(20+80)%	(25+75)%	(30+70)%	(15+85)%	(20+80)%	(25+75)%	(30+70)%
1	25.10	25.25	25.30	25.32	25.10	25.25	25.30	25.32	25.10	25.25	25.30	25.32

Water Absorption in sea water



From the above graph it is noted that the 30% fiber and 70% mixture Composite sheet have less water absorption when compared to other composition

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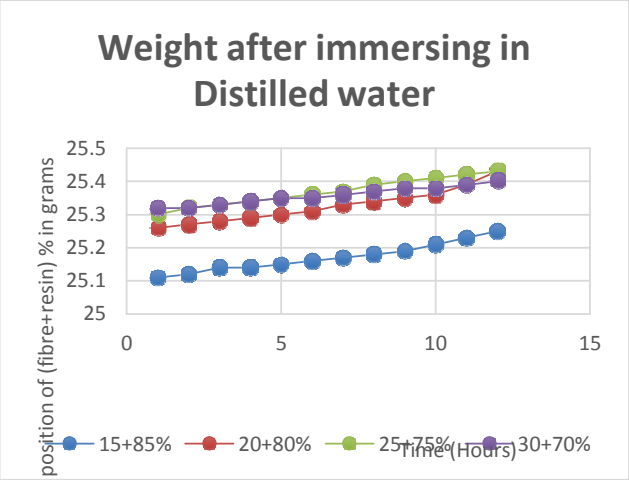
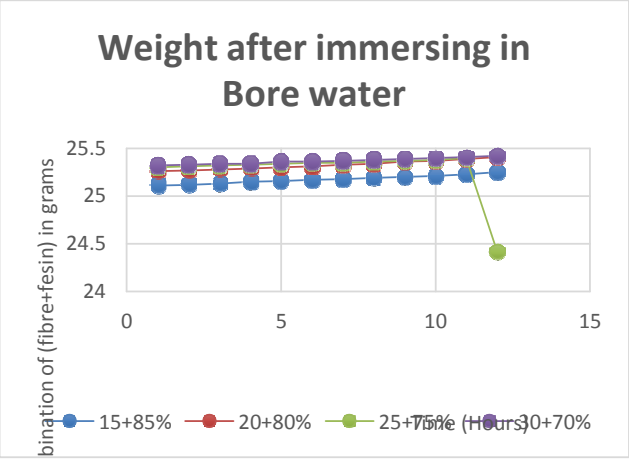
Water Absorption in Distilled water



From the above graph it is noted that the 30% fiber and 70% mixture Composite sheet have less water absorption when compared to other composition.

Water Absorption in Bore water



As similar to the other water absorption test, from the above graph it is noted that the 30% fiber and 70% mixture Composite sheet have less water absorption when compared to other composition.

Weight of Each Specimen after Immersing in Three Different Water

Time (hrs)	Weight after immersing in Sea Water				Weight after immersing in Distilled Water				Weight after immersing in Bore Water			
	Combination of (fiber + resin) (%) in gram				Combination of (fiber +resin) (%) in gram				Combination of (fiber +resin) (%) in gram			
	(15+85)%	(20+80)%	(25+75)%	(30+70)%	(15+85)%	(20+80)%	(25+75)%	(30+70)%	(15+85)%	(20+80)%	(25+75)%	(30+70)%
1	25.11	25.26	25.32	25.33	25.11	25.26	25.30	25.32	25.11	25.26	25.30	25.32
2	25.12	25.27	25.33	25.35	25.12	25.27	25.32	25.32	25.12	25.27	25.31	25.33
3	25.13	25.28	25.34	25.35	25.14	25.28	25.33	25.33	25.13	25.28	25.32	25.34
4	25.14	25.29	25.35	25.36	25.14	25.29	25.34	25.34	25.15	25.29	25.33	25.34
5	25.15	25.30	25.36	25.37	25.15	25.30	25.35	25.35	25.16	25.30	25.34	25.36
6	25.16	25.33	25.37	25.38	25.16	25.31	25.36	25.35	25.17	25.31	25.35	25.36

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7	25.17	25.34	25.38	25.38	25.17	25.33	25.37	25.36	25.18	25.33	25.35	25.37
8	25.19	25.37	25.38	25.38	25.18	25.34	25.39	25.37	25.19	25.34	25.36	25.38
9	25.21	25.38	25.39	25.39	25.19	25.35	25.40	25.38	25.20	25.36	25.37	25.39
10	25.20	25.40	25.41	25.40	25.21	25.36	25.41	25.38	25.21	25.37	25.38	25.40
11	25.23	25.42	25.42	25.40	25.23	25.39	25.42	25.39	25.23	25.39	25.40	25.41
12	25.26	25.45	25.43	25.41	25.25	25.43	25.43	25.40	25.25	25.41	25.42	25.42

VII CONCLUSION

This project mainly deals with the casting of composite sheet using hand layup technique. Thus the composite sheets are fabricated with different composition of fiber and resin mixture. Also the water absorption tests done in the fabricated work sheets. The result also show that the 30%sisal and fiber mixture combined with 70% resin gives less absorption than all the other fabricated sheets with different composition. In the phase other mechanical properties are going to analyse with this composite sheets as per the standard.

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