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TENSILE STRENGTH EVALUATION ON GLASS AND SISAL FIBER TYPES OF COMPOSITES MATERIAL

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ABSTRACT

A composite is a structural material that consists of two or more combined constituents that are combined at a macroscopic level and are not soluble in each other. One constituent is called the reinforcing phase and the one in which it is embedded is called the matrix. The reinforcing phase material may be in the form of fibers, particles, or flakes. The matrix phase materials are generally continuous. The present investigation of Sisal (Agave sisalana) and Glass fibers are used for fabricating the composite specimen. The Sisal, Isothalic polyester resin and the catalyst Methyl Ethyl Ketone Peroxide (MEKP) are utilized to produce the composite. The accelerator used for the investigation is Cobalt Napthanate and is added as 1% with the resign and the catalyst.

INTRODUCTION

Sisal fibers are extracted from the leaves of sisal plant. The fibers are extracted from hand extraction machine composed of either serrated or non-serrated knives. The peel is clamped between the wood plank and knife and hand-pulled through, removing the resinous material. Proper drying is important as fiber quality depends largely on moisture content. Artificial drying has been found to result in generally better grades of fiber than sun drying.Hoi-yan Cheung et al. (2008) have studied the Natural fiber-reinforced composites, a comprehensive review on different kinds of natural fiber composites will be given. Their potential in future development of different kinds of engineering and domestic products has been discussed in detail.

Georgios Koronis et al. (2013) have investigated in Green composites, A review of adequate materials for automotive applications. The renewable materials for matrix and reinforcement are screened accordingly in the order to identify which holds both adequate strength and stiffness performance along with affordable cost so as to be a promising proposal for a green composite.

Balaraman et al. (2007) have presented a novel method for fabrication of fiber reinforced plastic laminated plates. Various difficulties encountered in hand lay-up process and remedial measures to overcome them are described in detail. In addition, some of the important mechanical properties of such plates have been investigated and reported. The natural fiber reinforced composite materials have been used as dielectric materials in microchips, parts, connectors, switches, circuit boards investigated by Singha (2013). In this present study the sisal has been utilized to prepare the natural composite and the tensile properties were analyzed with the SEM fracture surface. The hand layup method for producing composite is given in Fig.1.The fabricated sisal fiber composite is shown in Fig.2

EXPERIMENTAL WORK

Preparation of composite specimen: The composite materials used for the present investigation is fabricated by hand layup technique. Mat typed sisal, glass fibers of 330 x 330 mm were used to prepare the specimen. The composite specimen consists of total four layers in which glass and Kenaf layers are bottom and top of the specimen. Second and third layers are filled by sisal and jute. The layers of fibers are fabricated by adding the required amount of polyester resin. Initially the glass fiber and sisal fiber are dried in sun light to remove the moisture. The glass fiber is mounted on the table.

The glass fiber is then completely filled with polyester resin. The resin got mixed with glass fiber, which may tend to dry up within 15-20 min. before the resin gets dried, the second layer of natural fiber sisal is mounted over the glass fiber. The polyester resin applied is distributed to the entire surface by means of roller. The air gap formed between the layers during the processing are gently squeezed out. The processed composite is pressed hard and the excess resin is removed and dried. Finally these specimens are taken to the hydraulic press to force the air gap to remove any excess air present in between the fibers and resin, and then kept for several hours to get the perfect samples. After the composite material get hardened completely, the composite material is taken out from the hydraulic press and rough edges are neatly cut and removed as per the required dimensions (300 x 300 x 3).These composite materials are taken out from the hydraulic press and rough edges are neatly cut and removed as per the required dimensions (300 x 300 x 3).

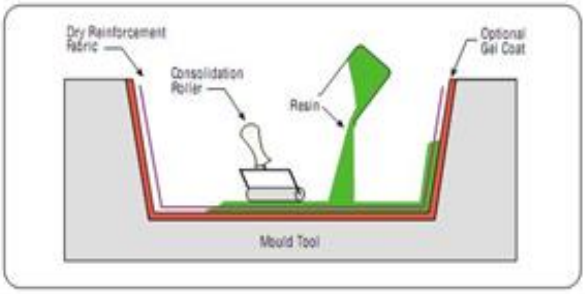

Fig.1. Hand layup method. **Fig.2. Fabricated sisal fiber composite.**

Mechanical testing: The hybrid composite material fabricated is cut into required dimension using a saw cutter and the edges finished by using emergy paper for mechanical testing. The tensile test specimen is prepared according to the ASTM D638-03 standard (240 x 25 x 3). A tensile test involves mounting the specimen in a machine and subjecting it to the tension.[5-6] The testing process involves placing the test specimen in the testing machine and applying tesion to it until it fractures. The test is performed on the universal testing machine and the surrounding temperature is 35ºC. the tensile force is recorded as a function of the increase in gauge length. During the application of tension, the elongation of the gauge section is recorded against the applied force. The tensile test is performed on the Universal Testing Machine (UTM). The fabricated specimen for tensile test is presented in Fig.3. The experiments arerepeated for several times and the average values are used for discussion.

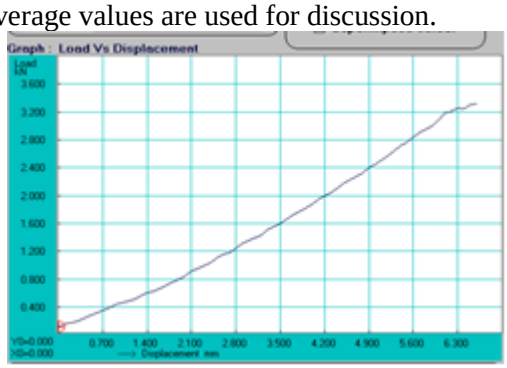

Fig.3. The tensile test specimen. **Fig.4 Load Vs Displacement graph.**

RESULTS AND DISCUSSION

The Notched and Unnotched tensile specimens of the hybrid composite are tested in universal testing machine (UTM) and the specimen are left to break till the ultimate tensile strength occurs. Stress Vs strain curve is plotted for the determination of ultimate tensile strength.The sample graph is generated direcltly from the machine for tensile test with respect to load and displacement for Glass – sisal fibers is presented in Fig. 4. The obtained average tensile strength of notched specimen is 18.33 MPa and for unnotched specimen is 23.33 MPa respectively.Ku andWang. The frcture surface of the tensile specimen were analysed by Scanning Electron microscopy to understand the nature of fracture. The brittle fracture was obtained in glass fibers area and the Sisal fiber are teared. The boundary around the sisal fiber was not damaged and it shows the good bonding strength between the glass fiber and sisal fibers.The formation of vacuoles are identified in fracture surface with cracks. The air gaps are clearly visible as shown in the SEM photograph. Ajithand Cristaldi. These air gaps reduce the strength of the composite the fiber distribution and orientation are also visible is in the figures.The fiber-matrix adhesion, dispersion and orientation of fibers, fiber agglomeration, and presence of air voids these are the influential factors for reduction of strength of the fiber reinforced composite.The Table 1. Shows the results of tensile test. The Fig.5 shows the fracture surface. (SEM)

Table 1.The results of tensile test.

Sample	Tensile strength in (MPa) (Unnotch)				Tensile strength in (MPa) (Notched)			
	1	2	3	Avg.	1	2	3	Avg.
Glass + Sisal	17	18	20	18.33	22	23	25	23.33

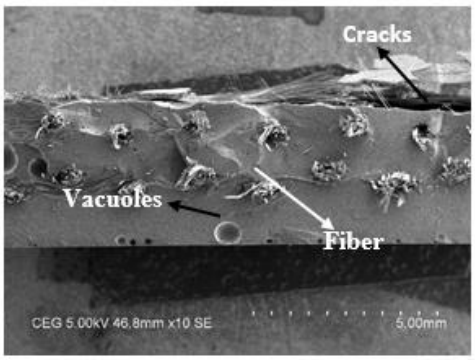

Fig.5. The Fracture surface (SEM)

CONCLUSION

- The Sisal and Glass fibers composite were fabricated.
- The obtained average tensile strength of notched specimen is 18.33 MPa and for unnotched specimen is 23.33 MPa respectively.
- The brittle fracture was obtained in glass fibers area and the Sisal fiber are teared.
- The formation of vacuoles are identified in fracture surface with cracks.

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