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Analysis of Water Absorption Behaviour of Natural Fibre Composite and its Importance

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Abstract - *Today's Environmental condition encourages the worldwide researcher and company to continuously work on the learning of plant or natural fiber reinforced polymer composite and cost efficient alternative to synthetic fiber reinforced composites. The accessibility to natural fibers and with simplicity in manufacturing have persuaded researchers to aim for locally existing low cost fibers and to investigate their possibility of the reinforcement intensions and up to that level so they can be able to satisfy the importance of detailing and the higher level of reinforced composite intended for different application program .*

Key Words: Water Absorption, Natural Composites, Importance of Composites Materials, Bio-Degradable.

1. INTRODUCTION

Now , human beings have understand that unless the nature is protected, natural sources will be reduced and green areas, which are the sources of fresh water, air and a fresh environment will reduce. Composite materials that are produced by using petroleum base fiber materials such as carbon fiber and glass fiber are majorly used and especially in automotive, space and aviation industries because of their high strength, corrosion resistance and low density properties. To lessen the usage of chemical fibers, the research on the ecological fibers are urgent so that to save the planet. To substantially increase the applications of the environmental friendly and Bio-Degradable materials, not only new materials should be find but also their all characteristic properties must identify and upgraded accordingly there alternative material.

High structural strength, glass fiber reinforced plastics and other materials were developed in the early 1940 -1950's and the application of reinforced plastics composites, the glass fiber provides strength and stiffness while the plastic matrix provides the temperature capabilities of the composite. Initially the glass fibers were incorporated in a polyester matrix which could withstand temperature up to 200^{0}C. These materials were started to applied in vehicle bodies, appliances, boats etc., and due to their light weight and mitigate of production. Intricate composites parts can be made by injection molding. Polymer matrices are usually thermosets such as epoxies.

2. MATERIALS

During This process, there will be required different kinds of materials like sponge gourd, wood and some other natural fibres containing materials for performing this test and Analysis about their properties .The reinforcement materials used in this study are a commercial sponge gourd fiber of Mediterranean variety and woven type glass fiber. The glass fiber roller is made of a double woven-ply with fiber arrangement of 0° to 90° with respect to the roller axis.

It is standard method to use the same matrix while evaluating the properties of natural fiber with chemical fiber. Therefore, epoxy resin was used as a matrix to make the composite specimens. Luffa, which is shown in Fig. 1, firstly has a form of a fruit which is covered with green peel and hanging on the plant. Once the ripening period of the fibers inside the fruit is over, then the outer green layer becomes dry. When the dry layer is removed as it is shown in Fig. 1 the fibrous structure is emerging. There are about few pieces of fruit in each sponge gourd plant and about 40 pieces of the core in each fruit, as can be seen from Fig. and that can be used as seed.

Fig – 1. Luffa

Fig – 2. Luffa for testing

3. INVESTMENT REQUIREMENTS

The investment requirement in this field is not much it costs lesser as compared other used technology which we are using. As it requires lesser amount of investment so without worrying about higher investment we should have to implement it anywhere we can use it wherever it is possible .In localities these things are majoirly available so with less investment we can get these material easily available and with lesss skill labour we can grow and manufacture it because it requires some basic knowledge and the who are working in different machines he can be trained and put into that work . As it is a natural composite material so cuttting or removing excesss material and converting it into desired shapes the cutting tool we will use here it will erose less as compared to others materials.

4. ANALYSIS

Impact tests are conducted to determine the natural frequencies and modal damping levels (loss factors) of the composite structures. For this purpose, a few frequency response functions for various impact and response points of the test samples in the free-free boundary conditions are measured. As shown, the test samples are excited using a modal hammer and the response to the excitation is measured using an accelerometer. The frequency response functions with minimal mass loading effects are used to identify the natural frequencies and loss factors.

In a modal identification methodology, the line-fit method is proved and it is quite successfull for evaluating the damping levels on measured frequency response functions and it is widely used in the literature for this purpose. Therefore, modal loss factors are identified using line fit method in this study .Overall, the natural frequencies and loss factors of the glass and luffa specimens are listed in Table 1.

where f_1 is measured resonance frequency ($f_1 < 200$ Hz), f_2; measured resonance frequency ($f_2 > 200$ Hz), d_1; measured modal damping on f_1 and d_2; measured modal damping on f_2. The damping (d_{200}) values are calculated by the Eq. (2) to compare the damping properties of glass and sponge gourd composite materials. According to the standard [19], resonance frequencies that are greater and smaller than 200 Hz ($f_2 > 200 > f_1$) should be used to calculate d_{200} values.

As given in Table 2, the results demonstrate that the damping of sponge gourd fiber composite is very high than glass fiber composite materials. Natural fiber composite materials having a significant edge over the chemical fiber composites in damping characteristics.

Table -1: Natural frequencies and Loss factor

SI NO.	GFC		LCFC	
	Frequency (Hz)	Loss factor (5)	Frequenc y (Hz)	Loss factor (5)
1	299.5	0.004	152.0	0.007
2	803.2	0.005	419.0	0.013

3	1583.1	0.006	859.0	0.012
Avg.		0.005		0.012

Table -2: Vibration test of GFC and LCF

SI No.	Frequency (Hz)		Damping (%)		Damping (d_{200})	
	GFC	LCFC	GFC	LCFC	GFC	LCFC
1	189.0	149.0	0.4	0.7	0.43	0.79
2	306.0	426.0	0.5	1.2		
3	782.0	856.0	0.6	1.5		

5. . DETERMENATION OF THE WATER ABSORPTION

For determining the water absorption of the luff we have to take the single slide of it and we need to soaked in water and start observing and analyzing its structural changes in it, first we will take it single layer and we change as per our required analysis and we need to observe changes in its width , how much time it takes to absorb some quantity of water and we observe all aspects possible, So Here every aspects is covered in this table.

No. of layers used	Immersion Time 't' (hrs)	Weight of the Sample	Percentage of weight gain (%M)	Thickness at time 't' H(t)	Thickness Swelling TS (t)
Single Layer	0	11.961	0	0.59	0
	12	13.106	1.86319470	0.591	0.17649152
	24	12.938	2.17367627	0.592	0.37598305
Double Layer	0	25.523	0	0.59	0
	12	24.934	3.43820881	0.591	0.32711863
	24	26.051	4.11408157	0.592	0.64067796

6. CONCLUSION

The main aim of this analysis is to obtain another Bio-degradable composite material that will replace the use of petroleum-based materials which is currently used majorly. As determined that the natural sponge has the ability that can be implement as an substitute and sustainable material for various engineering applications such as packaging, acoustic and vibration isolator, and impact energy absorption. According to obtained results while experimenting, damping characteristic of natural fiber composite materials is higher than glass fiber composite materials. Also, the damping properties of sponge gourd fiber more effective than flax fiber as natural reinforcement. Henceforth, we can say that the output which is very significant to find alternative Bio-Degradable material. These results demonstrate that plant based fibers can replace petroleum based fibers as a reinforcement in applications that the structures are exposed to vibration excitation, and in applications where the absorption of vibration has major importance.

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