Investigation of Thermo Mechanical Properties of Natural Waste Based Hybrid Composites

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1. INTRODUCTION

Due to the low cost of the alternate materials the present era is focusing on these materials. Some other properties represented by these alternate materials are their machinability and their variety applications. Also these alternate materials shows similar properties to that of the artificial material These alternate materials have better properties than their parent material in all aspect. Natural fibers such as bagasse, coconut coir, sisal, pineapple leaf fiber, animal hair, chicken feather etc as reinforced material in the composite when compared to the other manmade fiber the natural fiber based composite present their advanced properties with their bio degradability. so we can said that natural fiber based hybrid composites are environment friendly and biodegradable these material now emerging as the potential alternate hybrid in engineering composite. Polymers are used in every place of society such as automotive, civil engineering medical equipment etc. Polymers are easily shaped by extrusion, injection molding, vacuum forming or foaming. It is durable, environmentally resistant, tough and light. Here bagasse as a natural fiber and chicken feather used in practical form reinforced in polymer. Sugarcane bagasse extracted...
from the sugarcane. In sugar industry. Bagasse having high tensile strength contains about 40% cellulose, 30% hemicelluloses, and 15% lignin which are modified by creating quionones in lignin portion of the fiber and reacting with the furfural alcohol to increase their adhesiveness. Chicken Feathers having good thermal resistance are made from protein keratin there are two forms of microcrystalline keratin in the feathers. The chicken feather posses toughness and insulation. Both the chicken feather and bagasse are going to be wasted in million of tone rally bagasse is used in Furness and rarely chicken feather is used in textile industry. Here these two natural fiber used with epoxy thermoset polymer for making hybrid composite. Epoxy is a thermoset polymer which is widely used for making composite material because of their easily availability and their curing in normal temperature and pressure with 55% humidity.

2. FABRICATION

Fabrication of composite materials is accomplished by a wide variety of techniques, including:

- Vacuum bag molding
- Woodworking application
- Pressure bag melding
- Autoclave moulding
- Resin transfer moulding (RTM)
- Hand layup technique

Composite fabrication usually involves wetting, mixing or saturating the reinforcement with the matrix, and then causing the matrix to bind together (with heat or a chemical reaction) into a rigid structure. The operation is usually done in an open or closed forming mould, but the order and ways of introducing the ingredients varies considerably. Hand Lay-up/Spray up is one of the cheapest and most common processes for making fiber composite products.

2.1 Sugarcane Bagasse

The main chemical constituents of bagasse are hemi cellulose and lignin. Hemi cellulose and cellulose are present in the form of holocellulose in bagasse, which contributes more than 70 % of the total chemical constituent present in bagasse. Another important chemical constituent present in bagasse is lignin. Lignin acts as a binder for the cellulose fibers and also behaves as an energy storage system.

2.2 Chicken Feather

The mechanical performance of feathers were therefore, controlled more by shape than by material properties The fracture toughness of β-keratin has proved to be very high, around 10 KJm. The mechanical properties of feather fiber are related to the structure of keratin. Moving from calms to tip, the keratin molecules become more aligned than at the bird’s skin before returning to a state of higher disorder towards the rachis tip.
2.3 Treatment of Fiber

Bagasse after extraction of sugarcane juice bagasse fiber is cleaned in fresh boiled water then dried in sun rays.

The chicken feather fiber collected from the local area is washed several times with water then soaked in 5% NaOH concentrated water for 30 minutes. The soaked Chicken feather then washed with detergent water followed by pure water then is dried in sun rays. A clean chicken fiber free from dirt and impurities are obtain.

A matrix comprising AY-105 epoxy resin and HY-951 hardener. The Ratio of epoxy (AY-105) and hardener (HY-951) is 10:8 as per manufactures. %. Using a Mould of Dimension 650×450×10 mm³ for composite preparation by Hand Layup technique. Wax is applied on both the inner faces of mould to prevent bonding of matrix with the mould surfaces. For the 450x300x100 mm³ composite sheet two wooden beet frame was prepared of 5mm thickness each. Prepare bagasse fibre +chicken feather epoxy resin mixture by the percent of weight 14% bagasse,2%of chicken father and remaining 84% of epoxy system. So there was mixture of 1400gm epoxy system (800gm epoxy + 640gm hardener) and 20gm of chicken feather was prepared. Bagasse was reinforced longitudinally between these mixtures. So there was desired dimension of sheet (450x300x10 mm³) prepared.

3. SPECIMEN PREPARATION

Impact specimen were cut as per ASTM D256 as shown in figure 8. Three specimen were cut of each test in order to obtain an average value.
4. TESTING AND RESULT

4.1 Impact Test

To obtain the impact strength of bagasse fiber & Chicken feather composite material Izod test is performed as per standard ASTM D256. The mean value impact strength of this composite material is found to be 64 J/m. Which shows better impact strength than plain epoxy sheet and natural fiber reinforced composite.

4.2 Hardness Test

Hardness test is performed on Digitally hardness testing machine with model RBHT, M scale, 100 kgf load capacity, 1/4’’ ball indenter. The hardness of bagasse fiber & chicken feather composite 62.70 (Mean Value) is more than hardness value of natural fibers composite.

4.2 Water Absorption Test

Water absorption test conducted in which specimen is immerged in the for 24 hours at room temperature under normal condition and each 4 hours their weight would be measured. Since the epoxy do not make hydrogen bond so that there is less possibility to increase their weight but natural fiber absorbed some amount of water initially but after some hours it is in variant in weight.

Initial weight of specimen was 20gms and after 24 hours it reached to a weight of 20.70gms. After that the specimen weight shows that there is no increase in weight.
5. CONCLUSIONS

- There is improvement in Izod impact strength of Composite by adding sugarcane bagasse fibre and chicken feather 64(J/m) as compared to the epoxy resin.
- The hardness (62.70) of composite sheet which is made by composite reinforcement method is better as compared to particulate reinforcement.
- The composite absorbed only 0.70 Gms water in 24 hours and got saturated.

REFERENCES


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