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FABRICATION AND CHARACTERIZATION OF COMPOSITE FROM SUGARCANE BAGASSE AND WASTE PLASTIC FOR DOMESTIC THERMAL INSULATION

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Abstract: On this contemporary age the composite materials are become the first material for any engineering production because composite materials have several specific properties like high strength to weight ratio, low cost, and ease of fabrication, tensile strength, compressive strength, Impact strength, high resistance to thermal which does not realize in pure material or non-composite material. Because of its vast application, A engineer should skills to fabricate and teste a material. In this project, you'll be using two waste materials i.e. bagasse and waste plastic to produce a composite. The composite can be used for the purpose of heat insulation which we can apply in our rooftops or any place where we can reduce the heat transfer. The main aspect of our project is to provide something useful out of waste materials**.**

Index Terms **– Sugarcane Bagasse, Fibres, Composites, Thermal properties, Thermal analysis, Waste plastic.**

I. INTRODUCTION

In the continuing quest for improved performance, which may be specified by various criteria including less weight, more strength and lower cost, currently used materials frequently reach the limit of their usefulness. Thus material scientists, engineers and scientists are always striving to produce either improved traditional materials or completely new materials. Composites are an example of the latter category. Within the last forty to fifty years there has been a rapid increase within the production of synthetic composites, those incorporating fine fibers in various plastics (polymers) dominating the market. With the increasing global energy crisis and ecological risks, scientists all over the world are shifting their attention towards alternative solution to synthetic fiber. Since 1990s, natural fiber composites are emerging as realistic alternative to glass-reinforced composites in many applications. Natural fiber composites are claimed to offer environmental advantages such as reduced dependence on non-renewable energy/material sources, lower pollutant emissions, lower greenhouse gas emissions, enhanced energy recovery and end of life biodegradability of components. Such superior environmental performances are important driver of increased future use of natural fibre composite. The most widely used sentence is that the following one, which has been stated by Jartiz "Composites are multifunctional material systems that provide characteristics not obtainable from any discrete material. They are other cohesive structures which are made by physically combining two or more compatible materials which are different in composition and characteristics and sometimes in form". Composites contains one or more discontinuous phases embedded during a continuous phase. The discontinuous phase is typically harder and stronger than the continual phase and is named the 'reinforcement' or 'reinforcing material', whereas the continual phase is termed because the 'matrix'.

II. LITERATURE STUDY

A detailed comprehensive literature review on natural filler reinforced polymer material, and sugar cane bagasse fiber reinforced polymer material is presented including different sort of polymer, filler dimensions, applications, etc.

Jayaramudu, Agwuncha, Ray, Sadiku, and Rajulu et. al. studied with a natural Polyalthiacerasoide woven fabrics mixing with epoxy composite. The woven fabrics extracted from bark of the tree to form hybrid composites. The hand lay-up technique was wont to fabrication of hybrid composite at temperature. The surface modification of woven fiber was done by the process of alkali treatment. The microstructure and morphology studied was completed using Fourier transforms infrared spectroscopic (FTIR) and scanning electron microscopic methods respectively. The FTIR analyses represent the least value of hemi-cellulose and lignin contents of alkali treated woven fabric. The hybrid composite suggested for various applications in building and construction industries as panels for partitioning, flooring, storage tanks and table taps, etc.

Barnasree, Kumar, and Bhowmik were studied wood dust particle reinforced in epoxy based composite for analysis of mechanical behavior. The sundy wood dust particle are used as reinforcement and LY 556 epoxy is used for resin. The six different percentage of filler particle utilized in study. Tensile and flexural test were administered using UTM and sample size supported ASTM Standard. The different design parameters like as filler content and speed for loading with tensile and flexural strength using GRA were optimized. Optimization by GRA has the advantage of selecting best and worst options. GRG shows that test run number 13 is the best suited and test run number 3 is the least important. Epoxy composite with 10 filler contents at corresponding speed of 1 mm/min shows best performance and on the other hand with 0 filler content at the speed of 3 mm/min shows the worst performance.

III. Material Description

Composite Material

Materials like Iron, Steel are better in tension but poor in compression, similarly Wood, forged iron is best in compression but poor in tension. To gain the advantage of having more such properties in one material we combine two or more materials in some arrangement. These types of materials are called composite materials.

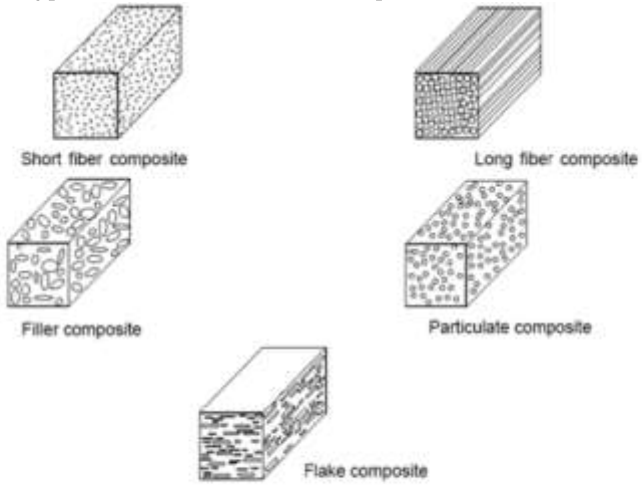

Fig.1 Types of Composites

Bagasse

Bagasse is that the residue fiber remaining when sugar cane is pressed to extract the sugar. Bagasse consists of fibre and pith, the fiber is thick walled, coarse, stiff and comparatively long. Bagasse may be a plentiful lignocellulosic waste typically found in tropical countries that process sugarcane. It is used either as a fuel for boilers by the sugar factory or as a staple for the manufacture of pulp and paper products.

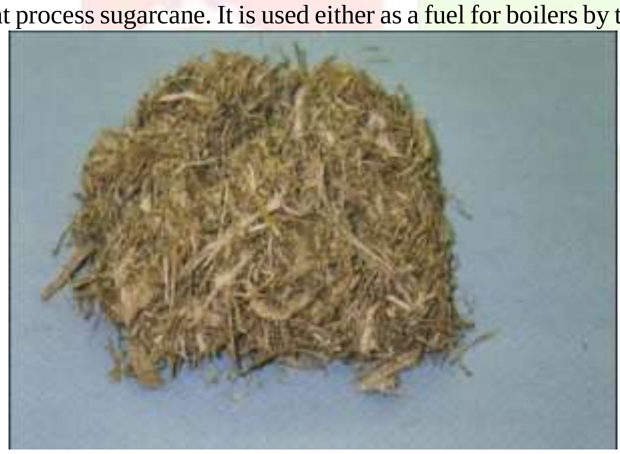

Fig.2 Sugarcane Bagasse

Currently, bagasse sugarcane, a waste of the sugar industry, is especially burned as fuel in sugar mill boilers. The low cost, low density and acceptable mechanical properties of bagasse fiber make it an ideal candidate to be considered for value-added applications such as reinforcement in plastic composites. The advantages of incorporating natural fiber as reinforcement in plastic composites are associated with their mechanical and thermal properties at reasonable cost Different treatment techniques enhance the adhesion and compatibility between fibers and matrix, hence improving the mechanical properties of the composite.

Waste Plastic

On the opposite hand, different waste plastics are often used like Plastic bottles (Polyethylene Terephthalate), Plastic bags (Polyethylene), Toys or Pipes (Polyvinyl Chloride), Straws or Medicine bottles (Polypropylene), Egg cartons or cups or bowls (Polystyrene) etc.

Fig.3 Waste Plastic

Fibre Reinforced Composites

Fiber reinforced composites are widely successful in many applications where there was a requirement for top strength materials. There are thousands of custom formulations which offer FRPs a wide variety of tensile and flexural strengths. When compared with other traditional materials like metals, the mixture of the composite is high strength and lower weight that has made FRC a particularly popular choice for improving a product's design and performance.

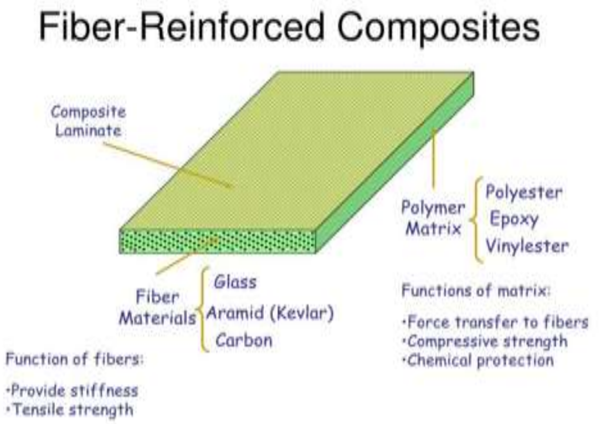

Fig.4 Fiber Reinforced Composites

Epoxy Resin Composition

Fig.5 Epoxy Resin & Hardener

Epoxy is the most essential components for the cured end products of epoxy resins. Also as a colloquial name for the epoxide functional group. Epoxy resins are family of poly-epoxide. resins are a class of reactive prepolymers and polymers which contain epoxide groups. Epoxy resins may be reacted (cross-linked) either with themselves through catalytic homopolymerisation, or with a wide range of co-reactants including poly-functional amines, acids (and acid anhydrides), phenols, alcohols and thiols. These co-reactants are often mentioned as hardeners or curatives, and therefore the cross-linking reaction is usually mentioned as curing.

IV. METHODOLOGY

1. To fabricate the composite, firstly we have collected Bagasse from our locality. Then we have washed it thoroughly so that no sugar is left out. After proper washing is done we have dried the Bagasse nearly a day to remove any moisture present in it. Then we have performed alkali solution treatment to kill bacteria present in it.

2. Then on the other side we have collected waste plastic bottles and we have to melted it to liquid form in a furnace.

3. We made a square box with one side open, using wood or Cast iron with dimension 100*100*20mm. This box will be used as a mold for fabricating the composite. Then we poured a layer of melted plastic into the mold and after that added another layer of chopped Bagasse fibers upon it. Then poured another layer of molten plastic upon the Bagasse fiber layer giving it a sandwich structure.

4. After this applied equal pressure throughout the mold so that both the material mixes together to form an effective composite material. Then waited for few hours so that the mixture in the mold dries down and your composite is ready for testing purpose.

5. Then made a few sample specimens for performing various tests. Then performed a tensile test using an ATM machine to find ultimate tensile strength, breaking strength, maximum elongation, and reduction in area. From these measurements determine Young's modulus, Poisson's ratio, yield strength, and strain-hardening characteristics. Then performed the compressive test in the same machine to find out ultimate compressive strength, breaking strength etc. After that performed the flexural test, impact test and wear test on the composite material with the standard specimen and note down respective results.

6. Compared the results with respect to the different specimen to realize how good your composite in different loading condition.

7. At the end we determined the thermal conductivity of your composite to know how good thermal insulator is it.

V. CONCLUSION

Composites are most promising materials for components of current and future engineering structures, with a significant demand at present in aircraft and aerospace industries. Modal analysis is that the study of the natural characteristics of structures. Understanding both the natural frequency and mode shape helps to style any structural system for noise and vibration applications. In this paper analysis of free vibration of cantilever beam for the composite as well as steel material are carried out.

It is seen that the different resins have different influence on the hardness and tensile strength of the composite materials.

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