UTILIZATION OF ENERGY CANE AND SUGARCANE BAGASSE FOR DEVELOPMENT OF TEXTILE VALUE ADDED PRODUCTS

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ABSTRACT

The sugarcane is widely cultivated and extracted in Brazil when its main derivative, left tons of bagasse that is accumulated in areas as dumps. Researchers and several engineers are trying to develop techniques for construction using materials such as sugar cane bagasse to be reused in a beneficial way for society, in order to reduce costs and bring innovation. We tested the physical characteristics of water absorption and thickness swelling of the panels after 2 and 24 h of immersion in water. The mechanical properties were characterized by performing bending (moduli of elasticity and rupture), compression (moduli of elasticity rupture), internal bonding test. Thus, it is important to note that there is also a consequence that covers the social aspect. A composite material is made by combining two or more materials to give a unique combination of properties, one of the phases is known as reinforcement (in this case fibers) and the other as a matrix which holds the fibers in place. While composites have already demonstrated that it has a high Strength to weight ratio i.e. it is a weight saving material, but the challenge is to make them cost effective. Natural fibers have attracted researchers for their characteristics such as low cost, ease of availability, high strength to weight ratio, high tensile strength, low thermal expansion, bio-degradability etc. The availability of natural fibers in India such as cotton, Sugarcane, Sisal, Pineapple, Banana, Ramie, Bamboo, pulp, Jute, Coir, etc. attracts attention on the development of natural fiber composites. The present work focuses on the development of a polymer matrix composite using Sugarcane bagasse fibers and to study its mechanical behaviour under external loads. The specimens are prepared according to the ASTM standards and testing for mechanical properties such as tensile, flexural and impact energy.

Keywords: *ASTM Standard, Energy cane bagasse, Natural fiber Composite.*

1.INTRODUCTION

Sugarcane grass is a renewable, natural agricultural resource because it provides sugar, besides myriad of products/co-products with ecological sustainability. The solid fibrous part (bagasse) is the major by-product of sugarcane industry. Sugarcane bagasse, one of the largest cellulose based agro industrial by-products and fibrous residue left after the sugarcane, is crushed in the factories of the sugar and alcohol industry, and is widely available renewable source. About 54 million tons of dry bagasse is produced annually throughout the world. For a long time bagasse has been used as fuel for factory. Now a day it is used as a biofuel and as a renewable resource in the manufacture of pulp and paper products and building materials. Bagasse is also used as a source of renewable power generation and for the production of bio-based materials. Bagasse is a by-product of sugar milling and important fuel resource for that industry. It is the dry pulpy fibrous material that remains after crushing sugarcane or sorghum stalks to extract their juice. It is used as a biofuel for the production of heat, energy, and electricity, and in the manufacture of pulp and building materials. The word comes from baggage (French) and bagazo (Spanish), meaning refuse or trash. It originally referred to the material left after pressing olives, palm nuts, and grapes. The word eventually came to be used in the context of processing of plants such as sugarcane and sugar beets. Today, it usually refers to by-products of the sugarcane mill.

2.OBJECTIVES

- To collect and characterize the sugarcane and energy cane bagasse to understand the physical and chemical properties.
- To develop bio-composite using the bagasse as fiber and bio-resin as matrix by compression moulding technique.
- To study the effect of material proportion, pressure and time on mechanical performance of the developed composite.

3.BAGASSE

Bagasse is another by-product of sugar industry. It is the heterogeneous fibrous residue that remains after sugarcane stalks are crushed for sugar extraction. Typically, from processing 100 tons of sugarcane in a factory, 30–34 tons of bagasse is obtained of which 22–24 tons is used in processing and 8–10 tons is saved. Bagasse is similar in component to wood except that it has high moisture content. Thus, it is currently used as a biofuel and in the manufacture of pulp and paper products, filler for building materials and as a substrate for growing mushrooms.

4.TYPES OF BAGASSE

- Sugarcane Bagasse
- Energy cane bagasse

5. SUGARCANE BAGASSE

Sugarcane (Saccharum spp.) is a well known feedstock rich in sucrose which has been exploited globally in sugar production for centuries. Dry matter of Saccharum spp. is composed of sugars, mostly sucrose, and fiber, cellulose, hemicelluloses, and lignin. The species Saccharum officinarum is noted for its capacity to divert an exceptionally high proportion of photo assimilates to sucrose and store it in the culms. Sugarcane stands as one of the most dependable biomass crop due to its high productivity. However, the positive and significant contribution of sugarcane to the energy matrix can be further augmented with "**energy cane**," a distinct form of that plant selected for total biomass production rather than for sucrose and some surplus fiber.

6. ENERGY CANE BAGASSE

An energy cane field looks the same as a conventional sugarcane field. However on closer observation one can immediately perceive at least three strikingly different characteristics: a narrower leaf blade, a thinner stalk, and a more profuse tillering. Energy cane (EC), a hybrid of commercial and wild sugarcane (SC), is a renewable cellulose resource (Kim and Day, 2011). EC has a higher fiber content, better cold tolerance, and higher yield of cellulose compared with traditional sugarcane (Qiu et al., 2012). Both bagasse from SC and EC (designated as SCB and ECB, respectively) have been previously utilized as raw materials to produce cellulose fibers (Feng et al., 2018).

7. COMPOSITES

A composite material is a material which is produced from two or more constituent materials. These constituent materials have notably dissimilar chemical or physical properties and are merged to create a material with properties unlike the individual elements.

Composites tend to have the following characteristics:

High strength; high modulus; low density; excellent resistance to fatigue, creep, creep rupture, corrosion, and wear; and low coefficient of thermal expansion (CTE).

8. TYPES OF COMPOSITES:

- Fiber Reinforced Composites.
- Fiber Orientation.
- Fiber Volume Fraction.
- Particle Reinforced Composites.
- Sandwich Panels.
- Metal Matrix Composites.
- Ceramic Matrix Composites.
- Polymer matrix composites (PMCs).
- Metal matrix composites (MMCs).
- Ceramic matrix composites (CMCs).
- Carbon matrix composites (CAMCs).

9. COMPOSITES MANUFACTURING METHODS:

There are three types of composite manufacturing processes:

- Open Moulding
- Closed Moulding
- Cast Polymer Moulding
- Compression Moulding

9.1 COMPRESSION MOULDING METHOD:

Compression molding is a manufacturing process in which composite materials are sandwiched between two matching molds under intense pressure and heat (from 250° to 400° F) until the part cures. This technique is used to rapidly cure large quantities of complex fiberglass-reinforced polymer parts. Compression molding features fast moulding cycles and high part uniformity. The process can be automated. In addition, labor costs are low and it provides design flexibility and nice surface finishes.

PROCESS:

The mold set is mounted in a hydraulic or mechanical moulding press and the molds are heated from 250° to 400° F. A weighed charge of moulding material is placed in the open mold. The two halves of the mold are closed and pressure is applied. Depending on thickness, size, and shape of the part, curing cycles range from less than a minute to about five minutes. After cure, the mold is opened and the finished part is removed. Typical parts include automobile components, appliance housings and structural components, furniture, electrical components, and business machine housings and parts.

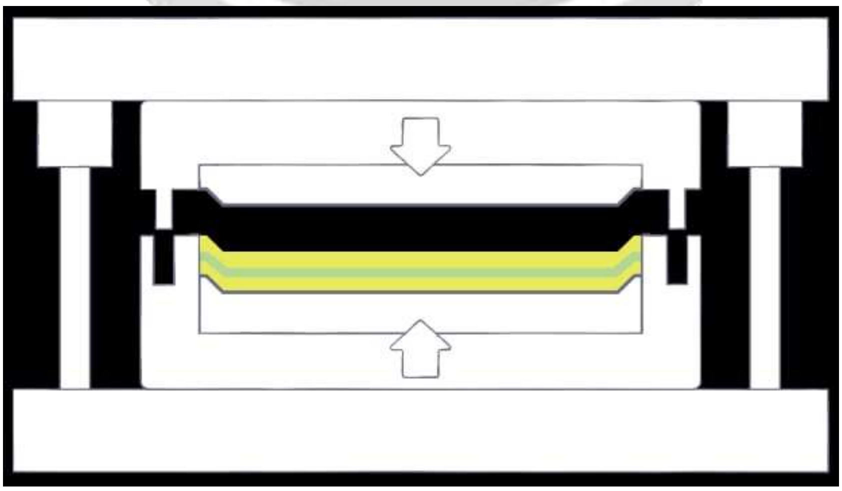

Figure 1.1 Compression Moulding Method

9.2 NATURAL FIBER COMPOSITES:

In general, depending upon the nature of the constituents, bio-based composites can be classified either as partly eco-friendly or green. Green composite implies that all its constituents are obtained from renewable resources, potentially reducing the carbon dioxide emissions and the dependence on petroleum-derived materials. While partly eco-friendly means that one of the constituents, either fiber or matrix, is not obtained from renewable resources. The performance of the natural fiber composites depends directly on the fibers counting, length, shape, arrangement and also the interfacial adhesion with the matrix.

Natural fiber reinforcement may be divided in accordance with the length, dimension and orientation. This can either be in the form of fiber or particle. The fiber itself is characterized as continuous or discontinuous (i.e., chopped) depending on its length-to-diameter (l/d) ratio.

9.3 APPLICATIONS OF NATURAL COMPOSITES

The application of natural fiber reinforced polymer composites and natural-based resins for replacing existing synthetic polymer or glass fiber reinforced materials in huge. Automotive and aircrafts industries have been actively developing different kinds of natural fibers, mainly on hemp, flax and sisal and bio resins systems for their interior components. High specific properties with lower prices of natural fiber composites are making it attractive for various applications. The applications of natural fibers are growing in many sectors such as automobiles, furniture, packing and construction. This is mainly due to their advantages compared to synthetic fibers, i.e. low cost, low weight, less damage to processing equipment, improved surface finish of moulded parts composite, good relative mechanical properties, abundant and renewable resources.

Natural fibers are used in various applications such as building materials, particle boards, insulation boards and also in replacement of plywood.

10. RESINS

Resin is a highly versatile product, as it has a number of uses. It can be used as an epoxy. It can also be used to be molded and formed into a desired shape or structure. Resin also has the ability to blend in and camouflage as the material it is adhering to or working in conjunction with. There are many different types of resin in use in the composite industry; the majority of structural parts are made with three main types, namely polyester, vinylester and epoxy.

10.1 EPOXY RESIN

Epoxy resin is a versatile form of resin, having a variety of uses. This makes it the go to resin for a large number of projects. It is also a very durable form of resin. They are all relatively inexpensive and easily obtainable, of all the types of resin, epoxy resin also has the widest selection of uses. The different type of epoxy resin is also all long lasting and are very easy to customize. Casting resin and coating resin are the types of Epoxy Resin.

10.2 APPLICATION

The application process for Epoxy Resin can be determine by the project you are tackling. The main process is to apply a few layers, allowing too dry in between each application. All types of epoxy resin dry relatively quickly. It is important to note that after the second coat is applied no more sanding should be done between the additional coats.

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