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Experimental Study on the Mechanical (Tensile Strength) Performance of Sugarcane Bagasse Fiber Reinforced Epoxy Composite

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***Abstract*: This paper presents an experimental study on the mechanical performance of sugarcane bagasse fiber reinforced epoxy composite. Tension properties of the composites were investigated in this research. Different weightage of short fiber were utilized to study their effects on the mechanical performance of the composites in terms of Tension properties to investigate its effect on the mechanical performance of the composites. Hand lay-up composite molding process was used to fabricate the composite samples. With addition of bagasse fibre, tensile strength is increased with increase in wt% of bagasse fibre then also increase the wt% of bagasse fibre tensile strength is decreased.**

***Keywords*: Composite, Sugarcane bagasse fiber, Tension**

1. Introduction

India endowed with an abundant availability of natural fiber such as Jute, Sisal, Coir, Pineapple, Bamboo, Ramie, Banana etc. has focused on the development of natural fiber and particulate composites primarily to explore value-added application avenues. Such natural fiber and particulate composites are well suited as wood substitutes in the housing and construction sector. The development of natural fiber and particulate composites in India is based on two pronged strategy of preventing depletion of forest resources as well as ensuring good economic returns for the cultivation of natural fibers.

The developments in composite material after meeting the challenges of aerospace sector have cascaded down for catering to domestic as well as industrial applications. Composites, the wonder material with lower weight; higher strength-to-weight ratio and stiffness properties have come a long way in replacing the conventional materials like metals, wood etc. The material scientists all over the world focused their attention on natural composites reinforced with Jute, Sisal, Pineapple, Coir, Baggase etc. primarily to cut down the cost of raw materials.

Composite is hybrid material which consists of two or more chemically distinct constituents. There is continuous phase which created by matrix and embedded by discontinuous phase, the reinforcement medium. The matrix phase is usually made up from fundamental material such as metals, ceramics and polymers. Meanwhile, the reinforcing phase is widely in the form of fibers, whiskers and particulates [1]. The reinforcing phase is usually stronger, lighter and stiffer than the matrix to enable the composites to possess better mechanical properties. Polymer matrix composites are utilized nowadays as they have good versatility, high performance and cost effective [2]. Epoxies are one of the most important matrices which are widely used for fiber-reinforced polymer due to its unique properties. Epoxy is relatively high strength, high modulus, low shrinkage, high chemical, heat and electrical resistance [3]. As the awareness has greatly increased the world responsiveness towards natural fibers, an investigation has been carried out to study natural fiber reinforcements. These natural fibers which have been utilized in reinforcement can be found in numerous applications in various fields such as automobile, furniture, packing and construction. Besides, compared to conventional reinforcing fibers, the advantages of natural fibers are found out to be low density, fully biodegradable, environmentally friendly, renewable, non-toxicity, low cost, high toughness, good insulation against heat and noise, good thermal properties, reduced tool wear, reduced dermal and respiratory irritation, ease of separation and lower abrasiveness [4].

Sugarcane is one of the major crops in tropical region which has a total plantation area of 34500 acres in Malaysia [4] while the amount of sugarcane produced is approximately 1.3 to 1.6 million tons annually [5]. Bagasse fibers gathered through the sugarcane milling process after the extraction of the sugar-bearing juice from sugarcane. Sugarcane bagasse fiber-reinforced composites are found to exhibit better specific mechanical properties, such as stiffness, flexibility, and modulus compared to those reinforced by glass fibers [6]. It can be perfect alternatives for reinforcing bio-composites as it is renewable and less expensive sources due to its abundance as well as low preparation cost of the fibers. [8]. The age of the fibers, the source of the fibers and different techniques of surface treatment of the bagasse fibers are the factors which will affect the mechanical properties of the sugarcane fiber. [9] Aspect ratio has a considerable effect on composite properties, hence it is important to conserve fiber length as much as possible during composite processing operations. Furthermore, the aspect ratio means an average length over diameter of the fibers is varied from plant species to species. [11]. They found that tensile strength and Young's modulus increase with an increase in the fiber length. Similar trend was reported by [12] in the case of short oil palm fiber with different lengths (2, 6, 10 and 14mm) into a natural rubber matrix. Tensile strength, elongation at break, and tensile modulus at 100% elongations were at a maximum when the length of the oil palm fiber was 6 mm. At higher fiber lengths, a decrease in the properties was found. This was due to the fiber entanglements prevalent at longer fiber length.[13]. They are generally organic polymer composites mostly filled with inorganic fillers, which combine the advantages of the inorganic filler material (i. e., rigidity, thermal stability) and of the organic polymer (i. e., flexibility, ductility, processability). There are different types of nanoparticles which have been developed and used in various areas due to their multifunctional properties, such as anti-bacteria, UV resistant, anti-wrinkle finishing and water repellent to fibers.

2. Results

Table 1
Tensile strength

Serial No.	Weight Fraction (gm)	Tensile Strength (MPa)
1	1gm	4.463
2	2gm	4.70
3	3gm	3.348

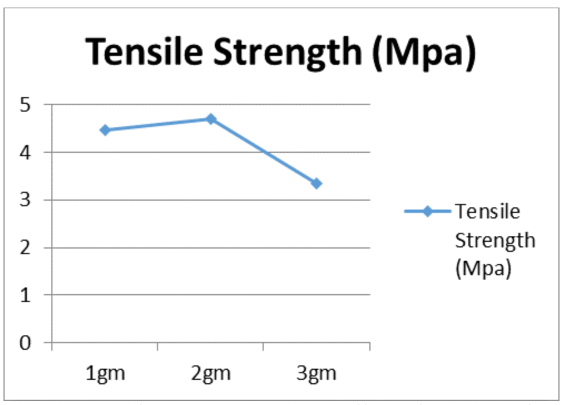

Fig. 1. Variation of Tensile Strength with different fiber weight fraction

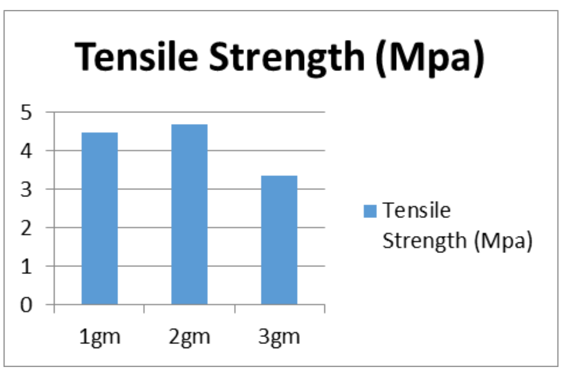

Fig. 2. Variation of Tensile Strength with different fiber weight fraction

Fig. 3. Specimen before testing

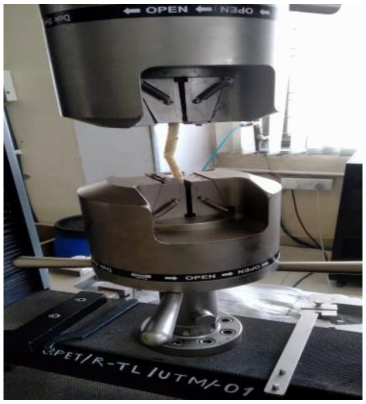

Fig. 4. Tensile testing machine

Fig. 5. Specimen after testing

3. Conclusion

The summarization of the findings from the study on the mechanical performance (Tension properties) of the sugarcane short fiber reinforced epoxy composites Among all the sugarcane short fiber composites, with addition of bagasse fibre, tensile strength is increased with increase in wt% of bagasse fibre then also increase the wt% of bagasse fibre tensile strength is decreased.

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