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Design and investigation of leaf spring by using composite and epoxy resin

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Abstract: The transport industry has quite an interest in the replacement of leaf spring with composite leaf spring due to high strength to weight ratio. the objective of the project is to find the effect of replacement of composite leaf spring made of bamboo fiber, coconut fiber, pineapple fiber and epoxy resin is carried out. Due to high strength to weight ratios, the automotive sector showed an increased interest in the composite fiber leaf spring as an alternative to steel leaf springs. Also, Composite materials in aeronautical, marine, and automotive industries are extensively accepted because of their outstanding mechanical properties, low density, and a production facility. The conventional leaf spring used is bulky so composite leaf spring should be used as a better alternative. Composite materials are extensively used in many engineering applications due to high strength and stiffness to weight ratio. The objective is to compare the stresses, deformations and weight saving of composite leaf spring with that of steel leaf spring. The design constraint is stiffness. The Automobile Industry has great interest for replacement of steel leaf spring with that of composite leaf spring, since the composite materials has high strength to weight ratio, good corrosion resistance.

KEYWORDS: composite fiber; replacement of steel spring; less weight; high mechanical properties;

INTRODUCTION

A composite material can be defined as a combination of two or more materials that results in better properties than those of the individual components used alone. In contrast to metallic alloys, each material retains its separate chemical, physical, and mechanical properties. The two constituents are reinforcement and a matrix. The main advantages of composite materials are their high strength and stiffness, combined with low density, when compared with bulk materials, allowing for a weight reduction in the finished part. The reinforcing phase provides the strength and stiffness. In most cases, the reinforcement is harder, stronger, and stiffer than the matrix.

The reinforcement is usually a fiber or a particulate. Particulate composites have dimensions that are approximately equal in all directions. They may be spherical, platelets, or any other regular or irregular geometry. Particulate composites tend to be much weaker and less stiff than continuous fiber composites, but they are usually much less expensive. Particulate reinforced composites usually contain less reinforcement (up to 40 to 50 volume percent) due to processing difficulties and brittleness. A fiber has a length that is much greater than its diameter.

The length-to-diameter (l/d) ratio is known as the aspect ratio and can vary greatly.Continuous fibers have long aspect ratios, while discontinuous fibers have short aspect ratios. Continuous-fiber composites normally have a preferred orientation, while discontinuous fibers generally have a random orientation. Examples of continuous reinforcements include unidirectional, woven cloth, and helical winding. while examples of discontinuous reinforcements are chopped fibers and random mat. Continuous- fiber composites are often made into laminates by stacking single Sheets of continuous fibers in different orientations to obtain the desired strength and stiffness properties with fiber volumes as high as 60 to 70 percent.

MATERIALS AND METHODS

This chapter describes the details of processing of the composites and the experimental procedures followed for their mechanical characterization. The materials used in this work are

- BAMBOO FIBER.
- COCONUT FIBER.
- PINEAPPLE FIBER.
- EPOXY RESIN.

2.1. BAMBOO FIBER

Bamboo has been one of the common materials in pre-industrial architecture in Asia and South American countries, employed as structural elements. The utilization of bamboo as construction component is motivated by its widespread availability in the tropical and subtropical climatic regions, its rapid growth and the combination of elevated mechanical strength and low specific weight. However, at the present time, even the most modern construction where bamboo is used rely on a craft approach, with the know-how of construction techniques restricted to a small group of researchers, engineers and architects.

Although bamboo has an immense potential, standardization and a definition of a correct construction practice still present some difficulties. Actually, there is an on-going research on bamboo with regards to special treatments leading to higher durability, improved connectors and mathematical modelling for the structural analysis of bamboo structures, along with the micro, macro- and nano structural properties shutter bamboo concrete slabs, application of bamboo segments as reinforcement of concrete beams, circular columns and pillars in quadratic form of concrete, double–layer spatial and plane truss bamboo structure and special joints between the bamboo elements, which can be easily used for plane and double-layer spatial structures.

2.2. COCONUT FIBER

Coconut fiber is extracted from the outer shell of a coconut. The common name, scientific name and plant family of coconut fiber is Coir, Cocosnucifera and Arecaceae (Palm), respectively. There are two types of coconut fibers, brown fiber extracted from matured coconuts and white fibers extracted from immature coconuts. Brown fibers are thick, strong and have high abrasion resistance. White fibers are smoother and finer, but also weaker. Coconut fibers are commercially available in three forms, namely bristle (long fibers), mattress (relatively short) and decorticated (mixed fibers). These different types of fibers have different uses depending upon the requirement. In engineering, brown fibers are mostly used. According to official website of International Year for Natural Fibers 2009, approximately, 500 000 tons of coconut fibers are produced annually worldwide, mainly in India and Sri Lanka. Its total value is estimated at $100 million. India and Sri Lanka are also the main exporters

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2.3. PINEAPPLE FIBER

Pineapple leaf fiber is one kind of fiber derived from plants (vegetable fiber) which is derived from the leaves of the pineapple plant. Pineapple which also has another name, that CosmosusAnanas, (including the family Bromeliaceae), in general this is a crop plant season (Doraiswarmy, 1993). Historically.

The pineapple leaf shape resembles a sword that taper at the ends with black and green colors on the edges of the leaves are sharp thorns. Depending on the species or type of plant, pineapple leaf length is between 55cm to 75cm by 3.1cm to 5.3 cm wide and 0.18cm thick leaves of up to 0.27cm. In addition, pineapple species, spacing and distribution of sunlight will affect the growth of leaf length and strength properties of the resulting fiber. Distribution of sunlight is not too much (partly hidden) generally will produce a strong fiber, refined, and similar to silk.

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3. RESULTS

3.1. TENSILE TEST

% of elongation = 5.82

3.2. HARDNESS TEST

Impression (hardness value in HRB) = 40.9 & 42.8

3.3. IMPACT TEST

Impact (in joules) = 8

4. DISCUSSION

4.1 Authors and Affiliations

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- Venkatesh.S3
- Vigneshwaran. K3

4.2 Identify the Headings

1.Iintroduction
2. Material and method

2.1. bamboo fiber
2.2. coconut fiber
2.3. pineapple fiber

3. result

3.1. tensile test
3.2. hardness test
3.3. impact test

4.3 Figures and Tables

Specifications	Values
Thickness (mm)	9 to 10
Width (mm)	12
Cross sectional area(mm$^{2)}$	120
Yield load (KN)	15.67
tensile load (kn)	23.84
Tensile stress (N/mm^2)	498.79
Initial gauge load (mm)	101.28
Final gauage load (mm)	107.61
% of elongation	5.82

Table 1: tensile test

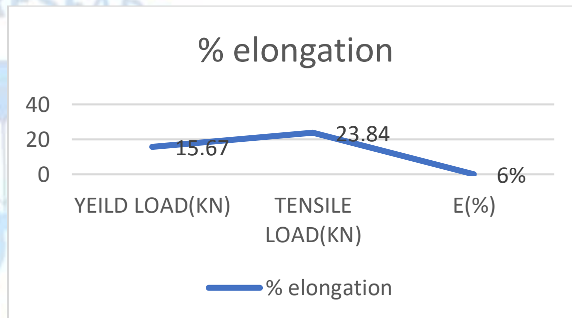

Figure 1: % of elongation

Identification	Impression (hardness value in HRB)
1	40.9 & 42.8

Table 2: hardness test

identification	Impact value in joules
1	8

Table 3: impact test

5. CONCLUSION

Traditionally natural fibers are used to make high strength ropes in South India. The results found that the mechanical properties have a strong association with the dynamic characteristics. Both of the properties are greatly dependent on the volume percentage of fibers. The composite having a bamboo and coconut volume of showed a significant result compared to conventional connecting rod. It has been noticed that the mechanical properties of the composite's material such as tensile strength, hardness and toughness etc.

REFERENCES

[1] A. Raveendra, Mohammed Abdul Mubashir, Design and Analysis of Leaf Spring for Heavy Weight Vehicles using Composite Materials, on December 22, 2018.

[2] Lakshmanan A1 , Kandasamy R2 , Selvaraj P3 , Dineshkumar R4 , Design and Analysis of a Heavy Vehicle Leaf Spring, July 2022.

[3] Ajahar Sayyad1, Rahul Kulkarni2, Alimoddin Patel3, Umesh Jadhav4, Design and Analysis of Leaf Spring by using Composite Material, Aug 2020.

[4] Prof.Pawar R.S. Design and Analysis of Composite Leaf Spring, Sep. – Oct. 2022.

[5] Bledzki, A. K., Faruk, O., Sperber, V. E., Cars from Bio-Fibres, Macromolecular Material Engineering, 2006, 291, 449–457.

[6] Mohantya, A. K., Misraa, M., Hinrichsen, G., Bio fibres, Biodegradable Polymers and Bio composites: An Overview, Macromolecules and Material Engineering, 2000, 276/277, 1-24.

[7] Bledzki, A. K., Gassan, J., Composites Reinforced with Cellulose Based Fibres, Progress in Polymer Science, 1999, 24, 221–274.

[8] Saheb, D. N., Jog, J. P., Natural Fiber Polymer Composites: A Review, Advances in Polymer Technology, 1999, 18 (4), 351363.

[9] Li, X., Tabil, T. G., Panigrahi, S., Chemical Treatments of Natural Fiber for Use in Natural Fiber-Reinforced Composites: A Review, Journal of Polymers and the Environment, 2007, 15, 25–33.

[10] P.F. Aubourg and W.W.Wolf, "ElephantGlass Fibers-Glass Composition Research," presented at Glass Division Meeting (Grossinger,NY), American Ceramic Society, Oct 1984