



“Development Composite Material By Using Natural Textile Fibre”

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Abstract: This study underscores the potential of natural fibre-reinforced composites, particularly those integrating bamboo, sisal, and aloe vera, as sustainable alternatives to synthetic materials. Through the incorporation of these fibres into an epoxy matrix, the mechanical properties of the resulting hybrid composites were notably enhanced, surpassing those of pure epoxy. The investigation involved assessing the mechanical properties via various tests, including tensile, water absorption, and delamination evaluations. The findings revealed that the hybrid composites displayed improved tensile strength and modulus, reduced water absorption, and enhanced interfacial bonding in comparison to pure epoxy. Notably, the aloe Vera-epoxy composite exhibited superior tensile properties compared to bamboo and sisal composites, attributed to the aloe vera fibre's higher content of cellulose, hemi-cellulose, and lignin. Moreover, the hybrid composite demonstrated enhanced resistance to delamination, attributed to its superior bearing capacity, improved bonding between fibres and the matrix, and higher tensile strength. In summary, this study suggests that these hybrid composites offer promise for diverse engineering applications, including structural components, automotive parts, and packaging materials, providing both mechanical performance and environmental sustainability.

I. Introduction

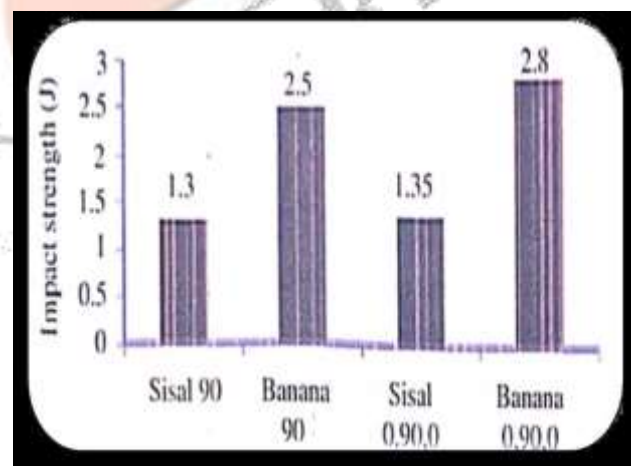
Synthetic fibres have led to numerous environmental concerns, including air, water, and soil pollution, as well as health risks. In response, natural fibres have gained significant attention as potential replacements for traditional synthetic composites. Composite materials combine different elements to enhance their properties, often resulting in materials that are stronger, lighter, and more cost-effective than conventional options. Composites typically consist of two main components: reinforcement and a matrix. Reinforcement, which can be in the form of fibres or particles, contributes strength and stiffness to the composite. Fibers, particularly continuous ones, are commonly used for their superior strength compared to particles. The matrix phase provides environmental protection and ensures proper fibre alignment. There are two types of fibres used in composite materials: green fibres and synthetic fibres. Green fibres, sourced from plants and animals such as jute, hemp, nettle, sisal, banana, coconut, hair, and wool, offer biodegradability and unique characteristics like low density and cost-effectiveness. These fibres are preferred for their eco-friendly nature and specific mechanical properties.

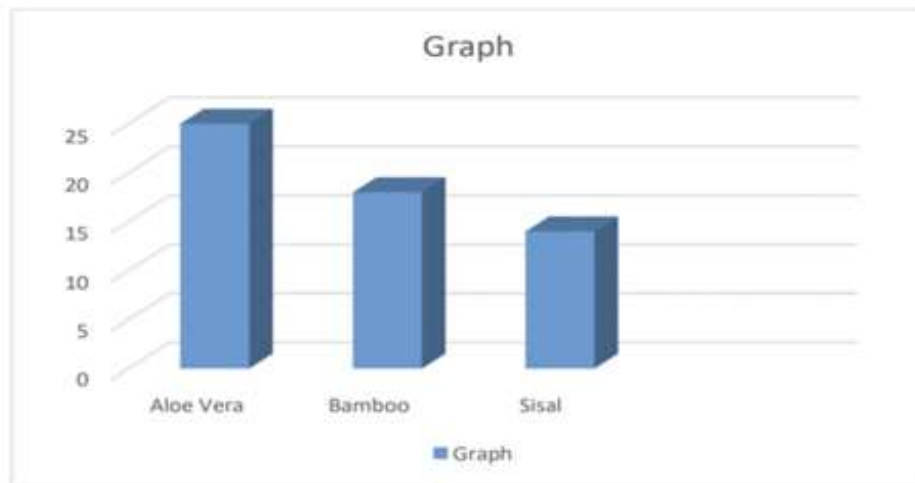
Overall, natural fibres present promising alternatives to synthetic materials in composite manufacturing, offering both environmental benefits and advantageous mechanical properties.

II. Literature Review

1. Vimal et al. (2015) studied mechanical properties of modified fibre reinforced epoxy composites. They used two types of fibre treatment- Sacculation and Phthaloylation with different concentrations. Fibre was treated one by one in a chemical solution and then found phthalicylated fibre has shown good flexural properties.
2. Gupta and Srivastava (2015) studied the dynamic mechanical properties and moisture absorption characteristic of hybrid sisal and jute fibre reinforced epoxy composite. After experimenting they obtained that the value of strong modulus increased with increase in the weight fraction of sisal fibres in the composites, and loss modulus value increased and then decreased with increase in temperature. The composite showed the lowest value of percentage moisture absorption and sorption coefficient.
3. Couture et al. (2016) used UD flax/PLA and UD flax-paper with a PLA matrix for fabrication of unidirectional composite. Compression moulding technique was used to develop composite. The mechanical properties of composites made with UD flax and UD flax-paper were compared. The tensile and flexural properties of the flax/PLA were obtained better than flax- paper/PLA. UD flax paper obtained high impact strength.
4. Seshanandan et al. (2016) studied the effect of Nano titanium oxide additives on the properties of hybrid jute-glass composites. Hand layup technique was used to fabricate the composite. Hybrid jute- glass FRP composites were manufactured with glass fibre chopped strand mat, woven jute mat, polyester resin and Nano titanium oxide. All mechanical properties were enhanced due to use of Nano titanium filler.
5. Rajesh et al. (2016) studied the vibration characteristics of Banana/Sisal hybrid polymer composite. Hybrid composite was prepared by the compression moulding method using short and random fibre orientation. From the experimentation, they found that chemical treatment.

III. Measurements and Graphs





Graph 1. Tensile strength graph.

Sr. No.	Speed (RPM)	Bamboo	Sisal	Aloe vera	Composite
1	500	1.003	1.026	1.008	1.007
2	1000	1.010	1.019	1.019	1.006
3	1500	1.033	1.008	1.041	1.015

Fig. Variation of delamination factor with speed at entry for 3mm drill

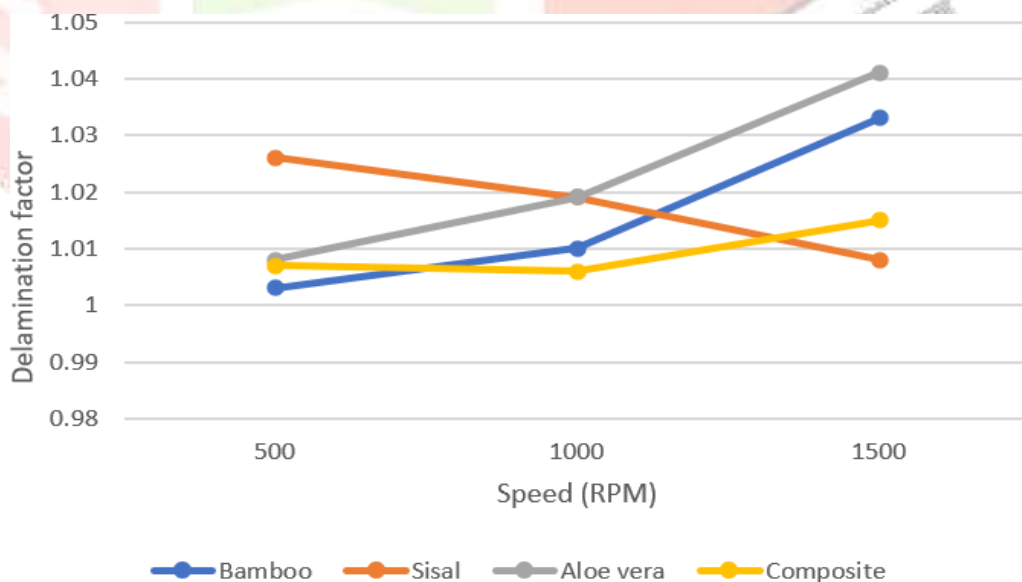
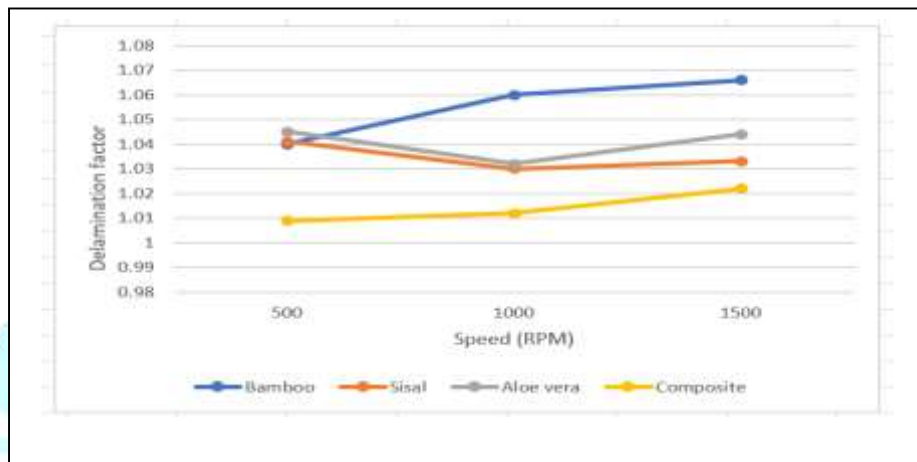


Fig. Delamination at entry for 3 mm drill.

Sr. No.	Speed (RPM)	Bamboo	Sisal	Aloe vera	Composite
1	500	1.040	1.041	1.045	1.009
2	1000	1.060	1.030	1.032	1.012
3	1500	1.066	1.033	1.044	1.022

Table .Variation of delamination factor with speed at exit for 3mm drill



Composite Name	Initial Weight (g)	Final Weight	Weight Difference	Water Absorption
	(g)	(g)	(g)	(%)
Aloe Vera	12.21	12.92	0.71	5.81
Bamboo	6.12	6.69	0.57	9.31
Sisal	6.92	7.90	0.98	14.16
Hybrid	8.09	8.78	0.69	8.56

Table. Water Absorption Test Results after 72 hr

IV. Problem Statement

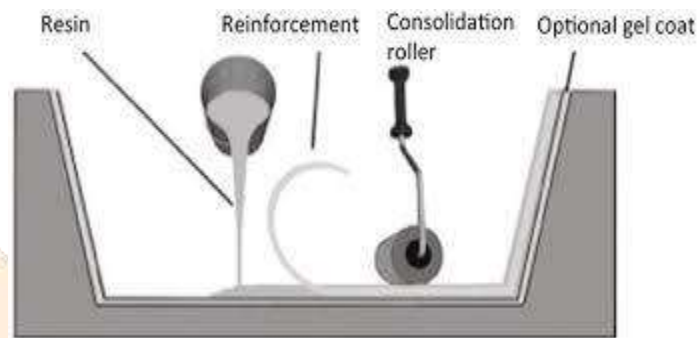
"Develop a biodegradable composite material that addresses environmental concerns by minimizing waste accumulation and enhancing sustainability. This material should integrate natural fibres or polymers with biodegradable resins, ensuring it decomposes harmlessly in various environments, including soil and water. Emphasize mechanical strength, thermal stability, and cost-effectiveness to enable widespread adoption in industries such as packaging, construction, and automotive. Additionally, consider end-of-life scenarios, ensuring easy disposal or recycling. The goal is to offer a viable alternative to traditional non-biodegradable materials, mitigating environmental impact while meeting performance and economic requirements."

V. Objective

- 1.To fabricate a hybrid composite using Bamboo. Sisal & Alovera fibre in varying proportion.
2. To study moisture absorption behaviour of developed composites.
- 3.To determine the tensile strength of developed composites.
- 4.To carry out delamination study of composites when subjected to drilling operation.

VI. Methodology

Hand Lay-up Technique



The hand lay-up technique is the oldest method of woven composite manufacturing, as shown in Fig. 3.1. The samples are prepared by following several steps. First, the mold surface is treated by applying a release agent to prevent the sticking of polymer to the surface. Then, a thin plastic sheet is applied to the top and bottom of the mold plate to achieve a smooth surface for the final product

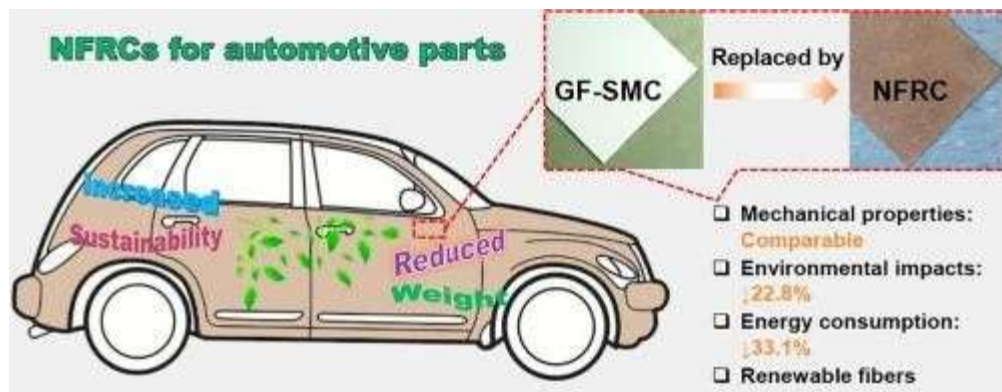
The layers of woven reinforcement are cut to the required shape and placed on the mold's surface. As mentioned earlier, the resin, mixed with other ingredients, is poured onto the surface of the reinforcement already positioned in the mold. A brush is used to uniformly spread the resin, and then additional mats are placed on the polymer layer. Pressure is applied using a roller to eliminate any trapped air bubbles and excess polymer. The mold is then closed, and pressure is released to obtain a single mat.

VII. Project Cost

Table No.1 Cost Estimation

SR.NO	ITEM	QTY in Meters.	AMOUNT(RS.)
1	Bamboo fiber	1	1,100
2	Sisal Fiber	1	890
3	Aloe Vera Fiber	1	980
		Total	8220

VIII. Future Scope:



The future of natural textile fibers looks promising, driven by growing sustainability concerns and demand for eco-friendly materials. Innovations in processing techniques and cultivation methods can enhance their performance and expand their applications in various industries like fashion, home textiles, and automotive. Expect to see more research into novel sources and improved processing methods to make natural fibers even more versatile and competitive in the market.

IX. Results and Conclusion

Natural fiber is biodegradable, eco-friendly, has good thermal insulation, and is a renewable raw material. Natural fibre has properties and good mechanical properties. But the strength of the natural fibre depends on the loading imposed on the fibre and Young's modulus of the fibre. It also depends on the fibre weight ratio, cultivation process, fibre extracting process from the plant, harvesting time, manufacturing process, and also depends on the fabrication methods of the natural fibre with polymeric matrices. Natural fibre composites are the combination of two different types of materials which create a new versatile material in the field of industrial, engineering, and technology.

Aloe Vera-epoxy composite absorbed more moisture as compared to Bamboo, Sisal, and Hybrid-epoxy composite because Aloe Vera fiber contains much quantity of cellulose, hemi-cellulose, and lignin than nettle fiber. The ultimate tensile strength of Aloe Vera, Bamboo, Sisal, and Hybrid epoxy. It was observed that the tensile properties of Aloe Vera epoxy composite are higher in comparison to other fiber composite materials.

X. Acknowledgement

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XI. References

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