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Roofing Material Using Bagasse And Polypropylene Plastic As A Composite

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ABSTRACT
The demand for economical and environmentally friendly materials has led to an increased interest in the use of natural fibers. This study investigates the potential of utilizing sugarcane bagasse, a waste product from the sugar industry, as a composite material combining with Polypropylene (PP) plastic, the composite material offers a range of advantages such as availability, cost-effectiveness, and favorable mechanical properties. Research involves the preparation of two samples with varying proportions of bagasse and Polypropylene plastic, where Sample A has 900g of Polypropylene Plastic and 100g of Bagasse and Sample B has 950g of Polypropylene Plastic and 50g of Bagasse, followed by a manufacturing process and mechanical testing. The results indicate that both samples exhibit satisfactory tensile strength and flexural strength, with Sample A showing slightly higher tensile strength and bending strength compared to Sample B. Moreover, Sample A demonstrates superior impact resistance. The composite material composed of bagasse and PP plastic presents a promising solution for eco-friendly and economical roofing materials, contributing to sustainability efforts by utilizing waste materials and reducing environmental impact.

Keywords: *Bagasse. Polypropylene. Plastic. Roofing Material. Tensile. Flexural. Impact*

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I. INTRODUCTION

In the face of pressing environmental concerns and the urgent need for sustainable solutions, there is a growing movement towards reusing waste materials to minimize the impact on our planet. This research paper aims to explore the concept of waste reuse by investigating the potential of utilizing sugarcane bagasse and polypropylene as alternative materials for synthetic composite fibers in roofing applications. With the overconsumption of resources and improper waste disposal posing significant challenges, repurposing waste materials offers an effective way to promote resource conservation and reduce waste generation.

Sugarcane bagasse, a fibrous residue from sugarcane stalks, and polypropylene, a durable plastic, offer unique properties that make them promising composite material for sustainable roofing materials. By evaluating the mechanical properties of composite materials made from bagasse and polypropylene plastic, this study aims to contribute to the development of more environmentally friendly roofing options, aligning with the goals of environmental conservation and a circular economy.

II. METHODOLOGY

The methodology employed in this research project follows a systematic approach to achieve the objectives of evaluating the potential of sugarcane bagasse and Polypropylene (PP) plastic as composite materials for roofing applications.

The first step in the methodology involves the preparation of the raw materials. Sugarcane bagasse, a residue from the sugarcane industry, is subjected to thorough washing to remove impurities and contaminants. The bagasse is then dried to eliminate excess moisture, ensuring the stability and durability of the fibers. After drying, the bagasse is carefully cut into small fibers, making it easier to integrate into the roofing material. On the other hand, the Polypropylene plastic used in this study is obtained through recycling processes. The recycled Polypropylene plastic is converted into granules, which will be a key ingredient in the composite material.

To evaluate the performance of the composite material, two samples, Sample A and Sample B, are prepared with different proportions of bagasse and PP plastic.

Table 1.1 proportion of Sample A and Sample B

Sl. No.	Samples	Proportion
1	Sample A	PP Plastic **900 g** Bagasse **100 g**
2	Sample B	PP Plastic **950 g** Bagasse **50 g**

After preparing the samples, the next step in the methodology involves the manufacturing process. The samples are subjected to a series of manufacturing steps, including extrusion, cooling, drying, pelletization, molding, pressing, and sheet formation. Extrusion is used to melt and mix the bagasse fibers and PP plastic granules, creating a homogenous mixture. The mixture is then cooled and dried to solidify the material. Pelletization is performed to convert the solid material into small pellets, facilitating handling. Molding is carried out using suitable molds to shape the material into the desired form, and pressing ensures proper compaction and consolidation. Finally, sheets of the composite material are formed and ready for further analysis.

The final step in the methodology is the mechanical testing of the manufactured composite material. Tensile strength, flexural strength, and impact analysis are conducted to assess the mechanical properties of the material. Tensile strength testing measures the material's ability to withstand tension forces, while flexural strength determines its resistance to bending. Impact analysis evaluates the material's ability to withstand sudden impacts or shocks.

III. ANALYSIS AND RESULTS

Results of Polypropylene Plastic

We conducted the mechanical property test that is flexural, impact and tensile strength for polypropylene plastic. The results are as follows:-

Table 1.2 Test results of Polypropylene Plastic
Average Results

Mechanical Properties	Results of Polypropylene Plastic
Tensile Strength	35.265
Flexural Test	43.2758
Impact analysis	1.93

On averaging all the mechanical property results, the below table 1.3 shows the average values of Flexural Strength, Tensile Strength, and Impact Test of Sample A (900g of PP Plastic and 100g of Bagasse) and Sample B (950g of PP Plastic and 50g of Bagasse) with the comparison to Polypropylene material to conclude which is the best proportion for roofing material

Table 1.3 Average Test results of Roofing Material

Material	Flexural Strength (N/ Sq Mm)	Tensile Strength (N/ Sq Mm)	Impact (J)
Polypropylene	43.2758	35.265	1.93
Sample A (900g PP+100g baggase)	43.2758	22.49	1.042
Sample B (950g PP+50g baggase)	36.142	22.434	0.87

- Sample A and B and were tested under various loading conditions to determine the improved mechanical properties so that it could be used as the rooftop material at various places.
- Typical tensile strength of a roofing polypropylene material is 35.265 N/sq mm as a result in our study the tensile strength of the Sample A and Sample B is nearly equal to 22.5 N/sq mm and both the material has no much difference in the tensile strength but sample A shows a slight difference with increase in its tensile strength compared to Sample B.
- The Typical Flexural Strength of Polypropylene material is 43.2758 N/sq mm as a result the Sample A and Sample B has strength of 43.2 and 36.142 N/sq mm respectively and Sample A has nearly equal strength as standard therefore it has more bending strength compared to Sample B.

- Impact Strength for a standard Polypropylene is 1.93 J as a result in our study it's 1.042 J and 0.87 J for Sample A and Sample B respectively therefore Sample A has more impact resistance compared to Sample B.

IV. DISCUSSION AND CONCLUSION

- Roofing sheets of lower weight can be produced with this developed composite material. The composite built is strong in compression, tension and bending too compared to the standard polypropylene value.
- Proper distribution of polymers and bagasse as a composite over the entire volume has resulted in higher mechanical strength of the composite.
- After material was kept as a roofing material for over 20 days in the environment there was no any changes in the material, as material has not degraded. It is water resistant and has good thermal resistance as the color of the material has not changed.
- The Sample A has more tensile, flexural and impact Strength compared to Sample B. Therefore more Bagasse proportion has increased the strength of the material compared to other proportion with less Bagasse.

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