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Cooling Roof Shield Header For CarIs Developed Using Natural Fiber

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ABSTRACT

The viability of enhancing interior car cooling using natural materials such as cotton, vetiver, bamboo, and Tencel fabric. The application of these materials presents a viable path toward enhancing thermal comfort within the car in the quest for ecologically responsible automotive solutions.

In-car comfort could be significantly increased by combining these textiles with vetiver, an aromatic and cooling herb, and cotton, a popular natural material. By implementing these cooling herh and sustainable materials, the car industry will be able to offer drivers a more enjoyable and eco-friendly driving experience. In keeping with thesustainability objectives of the car industry, these natural materials offer cooling benefits that can onlybe fully realized with proper ventilation, shading, and maintenance.

keywords: Bamboo fabric, Tencel fabric, Cotton, Vetiver (*Chrysopgon zizanioides)* Car interior header, Heat resistant test, Flexibility test, Tensile strength.

1. INTRODUCTION

This comprehensive preface to the Automobilities special issue looks at many facts of the automotive industry and car cultures. A key element of interior design that affects the vehicle's interior security, comfort, and style is the interior header. It not only finishes the interior and adds a polished look, but it also has vital safety features and helps insulate against the weather. The bamboo fabric is a natural material obtained from the bamboo tree. Its thermoregulatory properties help keep cool during hot weather and Tencel fabric, made from several types of wood pulp, this fabric absorbs moisture naturally and releases it outside, creating a cooling effect. Cotton fiber comes from the cotton plant, which allows air to flow through easily. Its natural hollow fibers are soft, cool, breathable, and absorbent, leaving a cooling effect. Vetiver fiber is obtained from the roots of the Vetiver grass plant. These roots are a waste product, but they have excellent cooling properties and are great for hydration. Many car interiors struggle with efficient air circulation and ventilation, leading to a stagnant environment, particularly during long drives. The material used in the headliner can impact thermal comfort.

2. MATERIALS AND METHODS

2.1 SELECTION OF FABRIC:

BAMBOO FABRIC

Bamboo fabric, sourced from Tirupur, is a breathable, stretchy, and durable option with natural cooling properties. it wicks moisture away, feels smooth, and is compatible with organic cotton, linen, and viscose.

Plate.1 Bamboo fabric

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TENCEL FABRIC

Tencel fabric, derived from eucalyptus and tree wood pulp, is an eco-friendly, softer, and breathable fabric. It wicks moisture away, feels delicate, and can withstand multiple washes without losing softness. It is biodegradable, reducing its environmental impact.

Plate.2 Tencel fabric

2.2 SELECTION OF FIBRE:
COTTON FIBRE

Cotton, a widely used natural fiber in the textile industry, is grown in Punjab, Haryana, Rajasthan, and Uttar Pradesh. Its high thermal conductivity and durability make it suitable for various textile

applications, ensuring long-lasting products withstand wear and tear.

Plate.3 Cotton fibre

VETIVER

Vetiver, a plant native to Kerala, Karnataka, and Tamil Nadu, has medicinal properties and a pleasant scent. Its earthy and woody aroma can be infused into textiles, creating a soothing atmosphere. Vetiver fibers can withstand high temperatures, making them suitable for heat-resistant applications.

Plate. 4 Vetiver (*Chrysopogon zizanioides*)

2.3 DESIGN AND DEVELOPMENT OF CAR INTERIOR HEADER
Method
1. Measuring
2. Patten making
3. Cutting
4. Stitching

Measuring
Accurate measurements of the car interior header using an inch of tape are crucial for automotive projects like headliners and aftermarket accessories. Place the tape measure above the windshield and note any irregularities for a precise fit and professional-looking result.

Plate.5 Measuring Car Header

PATTEN MAKING
A well-made headliner pattern is crucial for automotive upholstery and customization, serving as a template for cutting new headliner material. This pattern enhances the aesthetics and comfort of the

vehicle's interior, ensuring a perfect fit with the vehicle's ceiling.

Plate.6 Patten making

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CUTTING

Precision cutting is crucial in car interior work, particularly in header and customization. Specialized tools like fabric shears and utility knives are used to cut headliner material to fit vehicle ceiling shapes, ensuring a professional finish that enhances aesthetics and comfort.

Plate.7 Cutting

STITCHING

Stitching is crucial for car interior upholstery, binding materials like fabric and fiber, and improving the visual appeal. Hidden stitch is commonly used for headers, while topstitching adds a decorative touch. The type of stitching depends on the headliner's design and performance requirements.

Plate.8 Stitching

2.4 FINISHING

DIAMOND CROSS STITCH

Diamond cross-stitches are a unique design element in car interiors, creating a diamond-shaped pattern on seat covers, headrests, and door panels. They can be made from leather, fabric, or synthetic materials, allowing for color, texture, and aesthetic customization.

Plate.9 Diamond cross stitch

CAR INTERIOR HEADER

Plate: 10 cooling roof shield header

2.5 EVALUATION OF PRODUCT

Thermogravimetric Analysis

Thermogravimetric analysis is a thermal analysis techniques used to measure the mass change, thermal decomposition and thermal stability of material. Thermal gravimetric analysis was conducted using TGA Q500 machine. Samples weighing approximately 5 mg were subjected to pyrolysis in nitrogen environment to a maximum temperature of 100 °C at a heating rate of 20 °C/min. The weight loss was recorded in response to increasing temperature, with final residue yield on set of degradation temperature and number of degradation steps reported.

Flexible Test

The flexibility test was performed to determine the effect of STF addition on the fabric flexibility by using the Shimadzu AGS-J universal test machine. The test rate was adjusted to 20 mm/min and the test was maintained until the force of 6N was achieved. Bending at the end of the sample is measured, bending angle (α) is calculated by dividing this extension by to target edge (10 cm). The bending angle is reported as a measure of target flexibility, with larger angles indicating greater flexibility. Tests were repeated three times for all prepared composites and the average values were taken.

Tensile Strength

The tensile strength of a material is the maximum amount of tensile stress that can be applied to it before it ceases to be elastic. Tensile strength is measured in units of force per unit area. The unit is newton per square meter (N/m^2), kilogram (force) per square centimeter (kg/cm^2), or pounds per square inch.

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3. RESULT AND DISCUSSION

3.1 THERMOGRAVIMETRIC ANALYSIS (TGA)

Color	Pale white
Specimen size	50 g
Immersion time	1 hrs
Temperature	25 °C, 50 °C, 100 °C
Weight loss	49 g, 46 mg, 45 mg
% of Weight loose	2 %, 5 %, 10 %

The roof header results better absorbent of low and highest temperature properties. At the temperature of 4° C shows 50 % of absorbance at the 100° C shows 75 % absorbance heat. The roof shield header suggested for car and another usage.

3.2 FLEXIBLE TEST

Name of the sample	**Bending at edge of the sample (mm)**	**Bending angle**	**% of flexibility**
Roof header	45	25	70 %

The above table achieved g70% of flexibility as of 25 bending angles with bending at edge of 45mm. thus it results as product have good flexibility.

3.3 TENSILE STRENGTH (ASTM D5034 AND D5035)

Name of the sample	**Breaking elongation**	**% of Tensile strength**
Roof Header	2 %	98 %

The above table shows he tensile strength of 98% with the breaking elongation of 2%.

4. CONCLUSION

The automobile industry has seen a remarkable evolution over the years, marked by innovation, technological advancement, hence this cooling roof shield proved to be remarkably durable and resilient during the inspection, demonstrating its capacity to retain structural integrity even under thermal stress. This suggests that the cooling roof sheet has excellent heat-resistant qualities, which makes it a good option for locations that experience prolonged periods of high heat. Its strong performance in the Tensile Strength test further highlights its dependability and adaptability for usage in a range of climates, providing long-term advantages like increased durability and extended service life. Therefore, our results provide compelling evidence for the usefulness and efficacy of using cooling roof sheets as an excellent way to reduce heat-resistant.

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