Development And Testing of Table Coasters Using Bamboo Fabric, Jute Fabric and Rubber Fabric

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***Abstract*—The increasing demand for sustainable and durable household products has driven research into eco-friendly alternatives for everyday items. This project focuses on the development and testing of table coasters made from bamboo fabric, jute fabric, and rubber fabric. The primary objective is to evaluate these materials based on key performance parameters, including water absorption, heat resistance, durability, and aesthetic appeal. To achieve this, coasters were fabricated using standardized processes, ensuring consistency in size, thickness, and finish. Various laboratory tests were conducted to assess their functional efficiency. Water absorption tests determined the ability of each material to prevent liquid seepage and protect table surfaces. Heat resistance analysis evaluated their capacity to withstand high temperatures without deformation or damage. Durability testing involved repeated use simulations to measure wear and tear over time. Additionally, friction tests were performed to assess the grip strength of each material, ensuring the coasters remain stable on different surfaces. The experimental results provide a comparative analysis of the three materials, highlighting their strengths and limitations. Bamboo fabric exhibited superior moisture absorption and aesthetic appeal, making it a viable option for decorative coasters. Jute fabric, known for its natural texture and biodegradability, performed well in durability but showed moderate water resistance. Rubber fabric excelled in heat resistance and grip but had limitations in aesthetic variety. Overall, this study offers valuable insights into the selection of sustainable materials for table coasters, promoting eco-friendly choices in household products. The findings contribute to the growing body of research on biodegradable and reusable materials, paving the way for innovative and sustainable product development.**

***Index Terms*—Sustainable materials, table coasters, water absorption, heat resistance, durability, eco-friendly products.**

I. INTRODUCTION

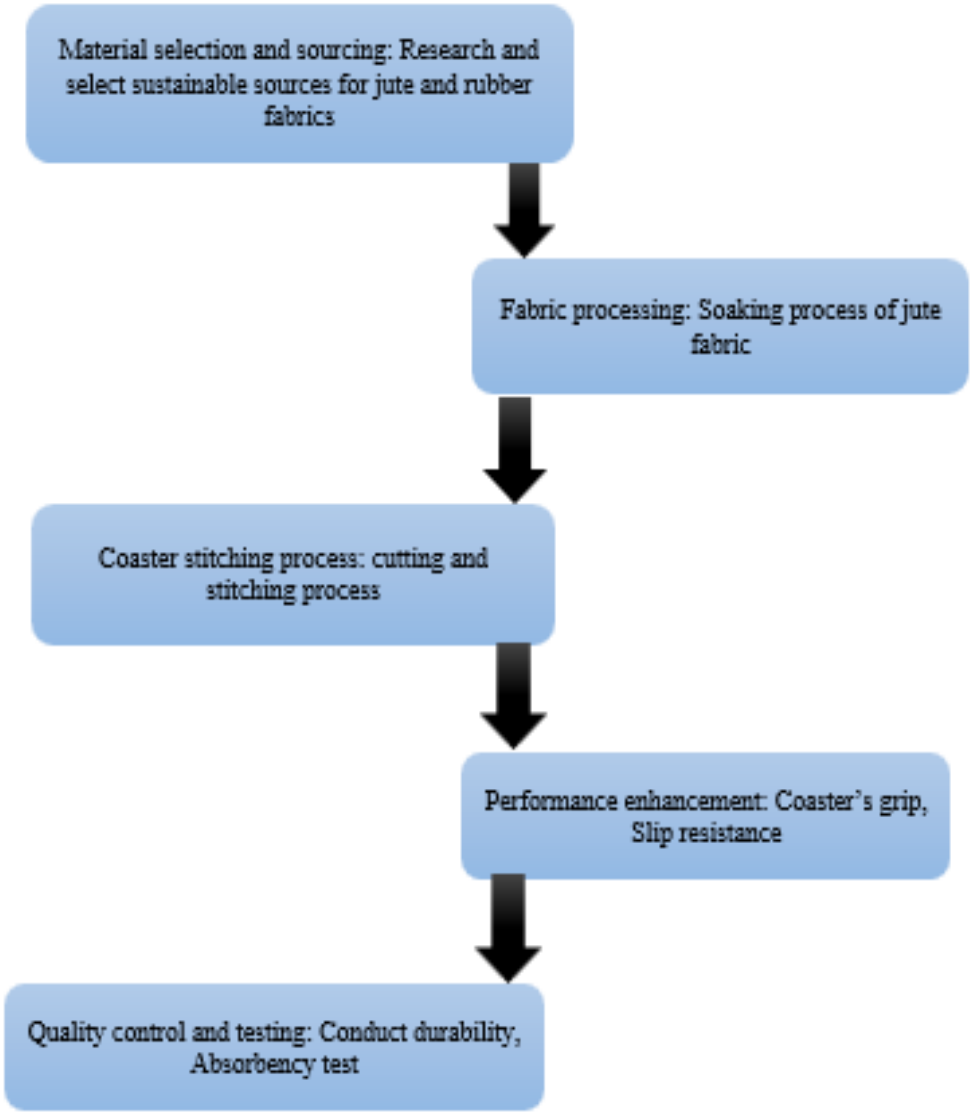
Table coasters serve as protective barriers that prevent damage to surfaces caused by heat, moisture, and stains from beverages. With the rising global emphasis on sustainability, there is a growing need for eco-friendly alternatives to conventional plastic or synthetic coasters. This project focuses on the development and testing of table coasters using three environmentally friendly materials: bamboo fabric, jute fabric, and rubber fabric. The goal is to assess their performance based on key factors such as water absorption, heat resistance, durability, and grip. Bamboo fabric is recognized for its high moisture absorption capacity, antibacterial properties, and soft texture, making it a promising option for coasters. Jute fabric, a widely available and biodegradable material, offers a natural, rustic appearance and durability but requires evaluation for water resistance and heat retention. Rubber fabric, known for its flexibility and non-slip characteristics, provides excellent surface grip and heat insulation, ensuring the stability of coasters on different table surfaces. The study involves the fabrication of coasters using these three materials, followed by a series of standardized laboratory tests. Water absorption tests will determine the effectiveness of each material in preventing liquid seepage. Heat resistance experiments will evaluate the ability of the coasters to withstand high temperatures without degradation. Durability tests will assess their long-term usability under repeated use, while friction tests will measure

their stability on different surfaces. By comparing the properties of these materials, this study aims to identify the most suitable fabric for eco-friendly coaster production. The results will contribute to the development of sustainable household products, reducing dependence on synthetic materials while promoting environmental conservation. By comparing the properties and performance of these materials, this research aims to identify the most suitable fabric for eco-friendly coaster production.

II. OBJECTIVES

- Reduce waste through biodegradable and compostable design
- Minimize carbon footprint with sustainable materials and production
- Conserve natural resources with renewable materials like bamboo and jute
- Improve durability against heat, water, and daily wear
- Enhance grip and slip resistance with rubber fabric
- Increase absorbency to effectively absorb spills and moistur

III. METHODOLOGY



BAMBOO FABRIC

Evaluating bamboo fabric involves examining its properties, sustainability, processing methods, and supply chain factors. This fabric is favored for its softness, breathability, antibacterial qualities, and eco-friendliness. There are three primary types: bamboo linen (mechanically processed), bamboo rayon or viscose (chemically processed), and bamboo lyocell (produced through a closed-loop system). Bamboo linen is the most sustainable option, though it is often rough and more expensive. In contrast, bamboo rayon is softer and more affordable but relies on chemical treatments that can be harmful to the environment. Bamboo lyocell offers a balanced alternative, utilizing non-toxic solvents in a sustainable closed-loop process.

When sourcing bamboo fabric, it is crucial to prioritize suppliers who are ethical and sustainable, ensuring they adhere to responsible farming practices and hold certifications such as OEKO-TEX, GOTS, or FSC. The primary producers of bamboo fabric are found in China, India, Indonesia, and Vietnam. Important factors to consider include the material's durability, breathability, resistance to shrinkage, and overall quality. Additionally, businesses should evaluate cost factors like bulk pricing, transportation logistics, and potential supply chain risks. Choosing a reliable supplier involves testing samples, confirming eco-friendly production methods, and ensuring compliance with sustainability standards. By carefully weighing these considerations, businesses can obtain high-quality bamboo fabric that fulfills both environmental and functional needs.

Bamboo fabric is a revolutionary textile that offers numerous advantages. As a highly renewable and sustainable resource, bamboo minimizes environmental impact while delivering outstanding comfort and durability. Its natural fibers produce a soft, breathable, and moisture-wicking material, making it ideal for clothing, home textiles, and craft projects. Additionally, bamboo fabric features excellent thermal regulation, helping to keep you cool in the summer and warm in the winter. With its natural antibacterial and antifungal properties, it is particularly suitable for individuals with sensitive skin.

BAMBOO FABRIC

JUTE FABRIC

Evaluating jute fabric involves assessing its durability, sustainability, processing methods, and supply chain aspects. Jute is a natural fiber recognized for its strength, biodegradability, and environmental benefits. It is mainly used to produce sacks, ropes, carpets, and eco-friendly textiles. Jute fabric is classified into various grades based on fiber quality; higher grades are finer and more appropriate for textiles, while lower grades are typically used for industrial purposes.

Jute cultivation is an environmentally friendly and sustainable practice that requires less water and fewer pesticides than many other crops. The jute plant has a relatively short growth cycle, enabling multiple harvests each year. Furthermore, jute fibers are biodegradable, compostable, and carbon-neutral, which helps minimize the environmental impact of textile production.

The jute production process consists of several stages: harvesting, retting, stripping, carding, spinning, and weaving. Jute fibers can be transformed into various fabrics, such as hessian, sacking, and carpet backing. These jute fabrics are known for their durability, breathability, and absorbency, making them ideal for a wide array of uses, including home decor, furniture, bags, and packaging materials.

In recent years, jute has emerged as a popular sustainable and eco-friendly material, especially in the textile and fashion sectors. Numerous fashion brands and designers are now integrating jute into their creations, resulting in distinctive and sustainable clothing and accessories. Additionally, jute is being

utilized in various other fields, including geotextiles, insulation, and paper manufacturing.

Overall, jute is an exceptional natural fiber that combines strength, durability, and sustainability. Its versatility, environmental benefits, and visual appeal make it an ideal choice for a diverse array of applications, ranging from textiles and fashion to packaging and construction.

JUTE FABRIC

RUBBER FABRIC

Choosing and sourcing rubber fabric requires evaluating its composition, durability, flexibility, and appropriateness for different uses. This composite material blends rubber with textiles like polyester, nylon, or cotton to improve strength, elasticity, and resistance to wear. Its waterproof, elastic, and abrasion-resistant qualities make it popular in various fields, including industrial applications, fashion, medical products, and automotive components.

Rubber fabrics come in various types, including natural rubber fabric, which is made from latex and is known for its high elasticity and biodegradability. In contrast, synthetic rubber fabrics like neoprene, silicone, and nitrile rubber offer superior resistance to heat, chemicals, and environmental conditions. Choosing the right fabric depends on specific properties needed, such as tensile strength, UV and chemical resistance, and flexibility. Testing methods, including stretchability, durability, and waterproofing assessments, are employed to ensure the fabric meets industry standards.

It is used as base of the table coasters, this rubber fabric as the properties like slip resistance, water proofing, heat resistance, and shock resistance.

It is used as the middle layer of a table coasters, and it as the properties like absorbency, durability, heat resistance and ecofriendly.

Rubber fabric is a composite textile made by bonding rubber with other materials such as cotton, polyester, nylon, or spandex to enhance strength, elasticity, and durability.

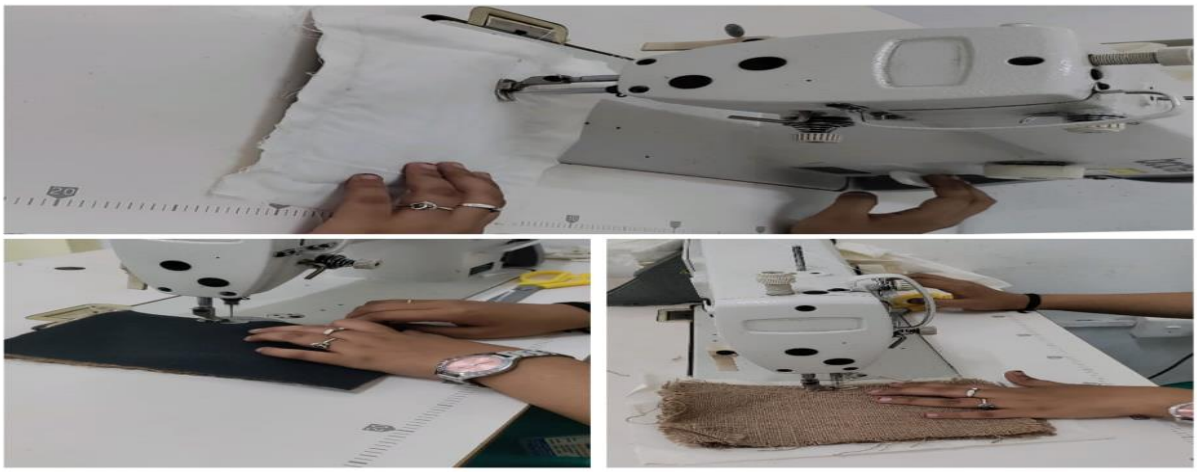
It is widely used in industrial applications, fashion, medical equipment, automotive interiors, and protective gear due to its waterproof, flexible, and abrasion-resistant properties. The selection of rubber fabric depends on factors such as tensile strength, elasticity, temperature resistance, and chemical resistance.

RUBBER FABRIC

IV. TABLE COASTERS CUTTING AND STITCHING PROCESS

The process of creating table coasters involves careful cutting and stitching to ensure functionality, durability, and visual appeal. It begins with selecting appropriate materials, such as jute for its eco-friendly, rustic texture—though it may require a backing to prevent fraying—and bamboo fabric for its breathable, sustainable qualities. Rubber or silicone sheets are commonly used as backing materials to enhance grip and water resistance. Decorative elements like embroidery, prints, or applique can be added, and edges are often finished with bias tape or piping. Measuring typically involves marking standard coaster dimensions (such as 4x4 inches or 10x10 cm) on the fabric and backing using chalk or fabric markers, followed by precise cutting with scissors or rotary cutters. In stitching, layers are either sewn directly or turned inside out for a cleaner finish, with techniques like straight stitching,

overlocking, or zig-zag stitching used to secure and prevent fraying. Decorative stitching is added beforehand if embellishments are desired. Final touches include trimming excess material, pressing with an iron, and optionally binding the edges for a refined look. Performance can be further enhanced by selecting materials like silicone, rubber, or cork for improved grip, using textured or rubberized bottoms to prevent slipping, and opting for heavier coaster designs that stay in place better—especially on rough or matte table surfaces where slip resistance is naturally improved.



STITCHING PROCESS

PERFORMANCE ENHANCEMENT:

TABLE COASTERS GRIP:

1. Material: Coasters made from silicone, rubber, or cork generally provide a better grip than those made of plastic or metal.
2. Bottom Surface: Many coasters feature textured or rubberized bottoms to help prevent slipping.
3. Weight: Heavier coasters are more effective at staying in place than lighter options. 4. Table Surface: Coasters tend to grip more securely on rough or matte surfaces than on smooth, glossy ones.

SLIP RESISTANCE:

Slip resistance is the capacity of a surface or material to avoid slipping when it comes into contact with another surface, particularly under varying conditions like moisture, pressure, and friction. This concept is crucial in areas such as flooring, footwear, table coasters, industrial safety, and product design.

QUALITY CONTROL AND TESTING

CONDUCT DURABILITY TEST

A durability test assesses a material, product, or component's ability to endure wear, pressure, environmental factors, and prolonged use. These tests are crucial in sectors like manufacturing, construction, electronics, and consumer goods to guarantee reliability and longevity.

ABSORBENCY TEST

An absorbency test evaluates a material's ability to absorb and hold liquids. This test is frequently applied in various fields, including textiles, paper, medical products, construction materials, and consumer items such as coasters and sponges.

V. RESULT AND DISCUSSION

ABSORPTION TEST:

The measurement of static water absorption of terry fabrics was carried out using Bureau Veritas Consumer Product services BV S1008 internal testing method. The samples were conditioned and cut in to 10 cm x 10 cm and their mass evaluated. The samples were kept in water for five minutes at room temperature. After that the samples were hanged for three minutes to remove excess water. Then, mass of the wet samples were measured. The amount of water absorbed by the terry fabric samples were calculated by taking the difference between the wet and dry mass. The percentage of water absorption was calculated by the following formula.

Where: Sw = water absorbed, mw – Product wet mass, md – Product dry mass.

SW= 224.1- 99.1/ 224.1 X 100=55.77 %

DURABILITY TEST:
Color Fastness to Crocking/Rubbing Test

S. No	Sample Code	Size of the Materials	% of Absorption
1	Product (100X100 cm)	sample	55.77 %

- Scope: This testing is used to determine the colour fastness of Table Mat to water.
- Sample collection: Random sampling
- Sample size: 40 cm full width fabric
- Atmospheric condition: 70° to 90° F
- Conditioning timing: Minimum 1 hour
- Apparatus used: Perspirometer, Air oven, Aluminium container, grey scale for assessment.

Testing Procedure:

- Cut the specimen to the size of 15 cm X 20 cm
- Sandwich the specimen between the standard covering fabric and stitch all the four sides.
- Take distilled water in 1:50 ratio and fully wet the sandwiched specimen for 30 min.
- Now place the wetted sample between two plastic plates and place all plastic plates one above the other.
- Now transfer the plates on bottom metal plate of the perspirometer.
- Place the top metal plate and adjust the load with the help of thumb screws.
- Then keep the loaded instrument in the air oven for 4 hours at a temperature of 38+- 1° C
- After 4 hours remove the sample specimen from the instrument and remove the stitching
- Compare the test specimen with the original sample for change in colour compare with scale also.
- Compare the standard covering cloth with the fresh sample

S. No	Mat Color	Specimen size	Immersion time	Temperature	Crocking test	Soap	Wash water	Heating at 100^0 C
1	Black white	40mmX100 mm	1 hrs	Room temparature	Good	Good	Excellent	Good

VI. RESULTS

The Crocking test and Heat effect might be more important intended to given product. Standards test for color fastness to water wash and Crocking test and Heating test. Results were findings that table Mat is not fading and crocking while doing above tests. The test report finds given Table mat heaving more durability.

VII. SUMMARY AND CONCLUSION

Bamboo, jute, and rubber fabrics each bring distinct advantages when used for table coasters. Bamboo fabric coasters are highly absorbent, effectively preventing condensation rings; however, they may slide on smooth surfaces unless paired with a non-slip backing. They are also durable and naturally resistant to mold and bacteria, making them an excellent eco-friendly choice. Jute fabric coasters offer moderate absorbency and a rustic look, but they can hold onto moisture and may wear out more quickly with frequent exposure to liquids. While they provide a decent grip, a rubberized backing may be necessary for improved slip resistance. In contrast, rubber fabric coasters excel in slip resistance and durability, making them perfect for stability on smooth surfaces. Although they are water-resistant and easy to clean, they do not absorb moisture as well as bamboo or jute. In summary, bamboo fabric is ideal for high absorbency, jute fabric provides a natural aesthetic with moderate performance, and rubber fabric offers superior slip resistance and durability.

ANNEXURE

DEVELOPED TABLE COASTERS

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