The Indian Journal of Home Science 2023: 35(2)

EXAMINING THE FEASIBILITY OF REGENERATED BAMBOO FABRIC AND ITS BLENDS FOR HOME FURNISHINGS

Radhika Suppiah[1]and Dr. M.R.Thilakam[2]
[1]Ph.D. Research Scholar,Professor, and HoD[2],
Resource Management Department
Avinashilingam Institute for Home Science & Higher Education for Women,
Coimbatore, Tamil Nadu – 641043
(1) radhika.dec1@gmail.com(2) dr.m.r.thilakam57@gmail.com
(1)2022-TN-1183-LF (2)93/T.5/LF

ABSTRACT

Modern bamboo fiber is lauded for being a novel, green, environmentally friendly textile material with significant medical potential. Bamboo fibers are unique due to their ability to absorb moisture, anti-bacterial, and elasticity properties. Thus, it may be utilized effectively in the manufacturing of apparel and home furnishings. This investigation seeks to assess the viability of regenerated bamboo fabric and its blends for home furnishings. In accordance with market availability, regenerated bamboo woven and knitted fabrics were predominantly selected for this analysis. The fabrics used in this research were bamboo woven (100%), bamboo cotton lycra (67/28/5), and bamboo cotton fleece (68/32). These materials were selected for the study because they are part of a new and emerging category of textiles that are not already accessible in the local market. Fabrics performance properties have been determined by a number of tests, including those for flammability, absorbency, abrasion resistance, fabric thickness, drape measurement, stain resistance, pilling, tensile strength, and bursting strength. The results of the tests show that such fabrics have the necessary performance qualities to develop different home furnishing applications, which might have great potential to establish a new market in domestic and global levels. The purpose of this research is to determine whether bamboo-based materials have been used to make home furnishings.

Keywords: Feasibility, Regenerated bamboo, woven and knitted fabrics, home furnishings

INTRODUCTION

Regenerated bamboo is a recently introduced as a cellulose fiber for clothing and household furnishings (Gericke, and Pol 2010). Over the years, bamboo has been used for a variety of applications, including construction, decoration, slope management, and high-performance composites. Exceptional properties of bamboo fiber make it suitable for textile production. The regenerated bamboo fabric has extraordinary tensile strength, UV protection, antibacterial and biodegradable properties, high moisture absorption, softness, sheen, and high flexibility under flexible compressive loads. (Rathod, 2014). Regenerated bamboo cellulose filaments that are moisture-absorbent, breathable, and quick-drying offer superior comfort for a variety of applications. Micro-cracks and micro-holes dominate bamboo fiber's cross-sectional structure. This property contributes to fiber-reinforced materials' moisture absorption and permeability. Intimate apparel, such as sweaters and swimwear, and domestic textiles, such as blankets and towels, are increasingly fabricated from bamboo. Clothing made from bamboo fiber is absorbent

and comfortable. It has a pleasing luster and a vivid color (Chidambaram, 2012). Currently, intimate apparel, hygiene and sanitary products, nonwovens, and home furnishings utilize regenerated bamboo fiber.

Ramakrishnan et al. (2015) notify that bamboo textiles are in high demand due to their antibacterial properties, biodegradability, high hygroscopicity, suppleness, and UV protection. Regenerated bamboo is a cellulose fiber recently introduced to the apparel and household textile markets. Nevertheless, bamboo viscose is more expensive than other cellulose fibers. In addition to superior comfort and traction, it is advertised as having antimicrobial properties. (Gericke and Pol, 2010).

JUSTIFICATION

In India, bamboo textiles are still in the process of being developed and are only available in a few locations. Fabrics made from bamboo that has been regrown are unavailable on the local market.The availability of bamboo textiles on the market was not discussed in any of the reviews, despite the various benefits that these textiles offer. In addition to this, there is a lack of understanding among consumers regarding the exclusive fabric. Therefore, the objective of this study is to determine the viability of regenerated bamboo blend fabrics for home furnishings. This study investigates the performance characteristics of regenerated bamboo blend fabrics to ascertain their feasibility for use in home furnishings. The following objectives were upheld for the duration of this investigation:

OBJECTIVES

1. To analyze the performance characteristics of fabric constructed from regenerated bamboo fabrics.

2. Determine the feasibility of regenerated bamboo fabric and its blends for home furnishings.

MATERIALS AND METHODS

For the purpose of this study, regenerated bamboo and its blend materials were utilized. These blended fabrics were bamboo cotton fleece (68/32) and bamboo cotton lycra (67/28/5). The selection of the samples was made after considering all of the accessible possibilities on the market. Fabrics used for home textiles need to have characteristics such as resistance to light, resistance to seam slippage, resistance to pilling and stains, resistance to sponging, resistance to flame, and preservation of appearance. (Kashyap, 2015). The key qualities of furnishing fabric were used as a basis for conducting an analysis and carrying out measurements to determine the characteristics that are required for home furnishings. In addition to the drape measurement, other features of woven and knitted bamboo fabrics that are evaluated include water absorbency, flammability, and abrasion resistance, fabric thickness, bursting strength, tensile strength, and pilling properties.

The **fabric weight** (GSM) and **blend compositions** are tested through the (IS: 1964, IS: 667)method. And using a Martindale Abrasion tester, samples of woven and knitted regenerated bamboo blends were tested for their **abrasion resistance**. ISO 12947-2 method was used for the test. The **fabrics absorbency** was evaluated using a drop test in seconds. The **pilling preference** of fabrics

was tested using ISO: 10971(part):2011 Reaffirmed 2021) method at R.H.65.5% ± 2% and temperature 27degrees C±2%. The **thicknesses of fabrics were** tested in accordance with the ASTM D1777
(Reapproved 2019) standard at: R.H. 65%±2% and Temp, 21 Degree C±1Degree C for both woven and knitted regenerated bamboo and its blend fabrics**. The flammability test** was carried out using the vertical flammability ASTM D 6413 method.

The **bursting strength** of bamboo cotton fleece and bamboo cotton lycra was measured by using ISO 13938 – 1: 2019 method. Mullen Burst Strength Tester was used for measuring bursting strength. The **tensile strength** of bamboo woven (100%) tested using the strip method specified in ISO 13934:1999(2013), the sample was evaluated at R.H. 65.5% ± 2.5% and Temp. 21degree C ± 1.1%.ISO 105 – X12 unit, and the grading method used to determine the **color fastness** of all selected fabrics. And also the **stain resistance** of all samples tested by using AATCC Red 40 stain scale method. Grade was used to evaluate the samples. The most common method for evaluating the performance of textile materials during use and processing is the strength test. The **drape measurement** of bamboo woven 100% measured R.H.65% ± 2% and Temp.21 degrees C ±1. The sample was conducted in accordance with the BS 5058 – 1973 method. According to the various test methods, the fabric performances are found to assess the feasibility of regenerated bamboo and its blend fabrics for home furnishings.

Bamboo woven Bamboo cotton fleece Bamboo cotton Lycra

Figure 1: Selected fabrics

RESULTS AND DISCUSSION

The blend composition of the fabrics presented in Table 1; these are the specifications of the fabrics that were utilized in this investigation. As stated in Barker's (2007) the term "blending" is used by the manufacturers of yarn to describe the series of processes that are required in order to convert two or more different types of staple fibers. This has led to the blending of fibers in order to reduce

the overall cost of the product and achieve a balance in terms of its physical properties, such as its look, tensile strength, ability to retain moisture, level of comfort, and ability to recover from creases. The table 1 shows that the blend compositions of selected fabrics for home furnishings.

Table1: Blend Composition of Selected Fabrics

Type of fabrics	Blend composition in percentage
Bamboo woven	100% Bamboo
Bamboo cotton fleece (Knitted)	Bamboo 65.10, Cotton 34.90
Bamboo cotton lycra (Knitted)	Bamboo 66.71, Cotton 28.41 Lycra - 4.88

According to Table 1, bamboo cotton fleece is composed of 65.10 percent bamboo and 34.90 percent cotton fiber, whereas bamboo cotton lycra consists of 66.71 percent bamboo, 28.41 percent cotton, and 4.88 percent lycra.

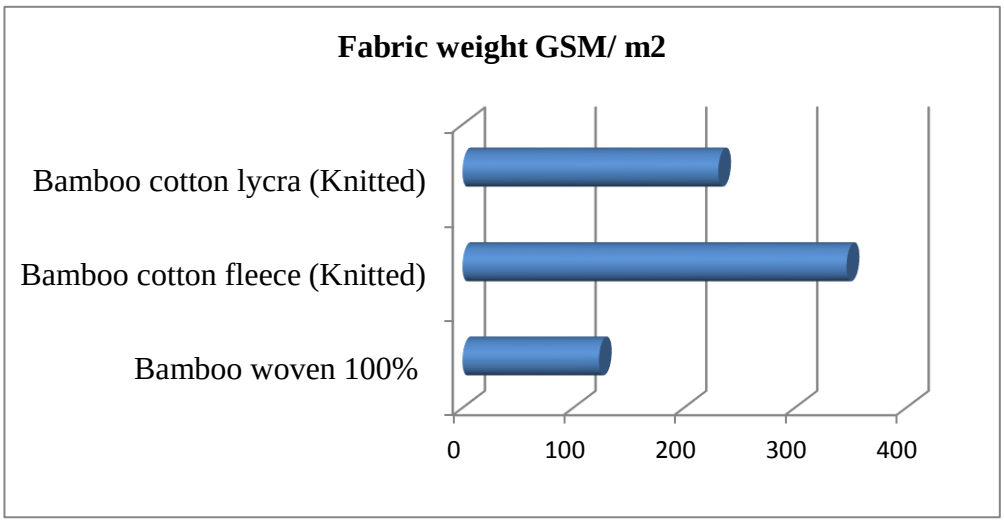

Figure2: Weights of the Selected Fabrics in GSM /m2

The figure 2 shows that, weight of the selected fabrics. The test result indicates that the weight of bamboo woven (100%) is 123.29 GSM, bamboo cotton fleece 346.59 GSM and bamboo cotton lycra is 231.10 GSM. The fabric weight influences the fabric's feel, i.e., the qualities that contribute to the fabric's warmth, fluffiness, drape, and comfort. It is expressed as either gram (ounces per square yard) or grams per linear meter and is calculated as the mass of fabric per unit area (ounces per linear yard). According to Kothari (1999), it is also expressed in terms of linear meters per kilogram with the specified width of the fabric. Rathod, (2014) indicate that the fabric weight of bamboo/cotton blends is greater than that of 100% bamboo fabric. The results of this study also designate that bamboo cotton has a higher GSM value than the other materials examined.

Table 2 shows the outcomes of tests for physical properties such as drape measurement, pilling rate, fabric thickness, and abrasion resistance of bamboo woven 100% and bamboo blends knitted fabrics such as bamboo cotton lycra and bamboo cotton fleece.

Table2: Physical Properties of Selected Fabrics

Tests	Bamboo woven (100 %)	Bamboo cotton fleece (Knitted)	Bamboo cotton Lycra (Knitted)
Drape measurement	58.32(Mean Drape Coefficient, %)	-	-
Pilling rate	4	4	2
Fabric thickness (mm)	0.26mm	1.35mm	0.64mm
Abrasion resistance	2	2	2

Mean Drape Coefficient (%) for regenerated bamboo woven fabric is 58.32 knitted fabrics are relatively floppy, so garments constructed from them tend to contour the body. Woven fabrics are more rigid than knitted fabrics, so they are used to create tailored clothing that hangs away from the body and conceals its contours. Curtains, and tablecloths, must have a good drape and aesthetic appearance. Good draping enables a fabric to be draped over a surface without wrinkling or tearing. The drape of a fabric is measured to determine its ability to drape in graceful curves (Wang and Hurren, 2008).The low value of the drape coefficient indicates that the fabric has good drape or a low percentage of the drape coefficient indicates that the fabric has good drape. (www.textileadvisor.com/2020/04/testing-of-drape-coefficient-of-fabric.html). The drape measurement test result indicates average drapery ability for use as home furnishings. This examination was conducted with RFD material. The co-efficient may change after the fabric has been dyed.

Sumon (2010) define pilling as bundles or balls of tangled fibers that are held to the fabric's surface by one or more. The rate of pilling for bamboo woven and bamboo cotton fleece is 4. Knitted bamboo cotton lycra is 2. According to ACT requirements, there must be at least three for upholstery fabrics. (Jamshaid et al, 2021). Except for bamboo cotton lycra, all of the bamboo-regenerated fabrics that were evaluated for pilling performance were deemed satisfactory by the test results. Hence it is appropriate for furnishing applications.

Bamboo woven fabric is 0.26mm in thickness whereas the thickness of bamboo cotton fleece is 1.35mm and bamboo cotton lycra is 0.64mm. It is observed that bamboo cotton fleece has a greater thickness. During rubbing, a 9kpa pressure was applied to the fabric for abrasion resistance of selected fabrics. 2000 cycles rub, was utilized for all samples. The abrasion resistance of regenerated bamboo blend fabrics yielded the expected result, with a rate of 2. Wang et al, (2009) mentioned that bamboo fiber has tremendous water and moisture absorbency, as well as better in pilling and abrasion resistance.

Table 3 shows the tensile strength of bamboo woven and bursting strength of both knitted fabrics which are selected for test.

Table 3: Fabric Strength of Selected Fabrics

Tests	Bamboo woven100 %	Bamboo cotton fleece (Knitted)	Bamboo cotton Lycra (Knitted)
Tensile strength	Warp strength 34.55, Weft strength 27.21,	--	--
Elongation	Warp elongation 16.54, Weft elongation 18.40	--	--
Bursting strength(kgs/sq.cm)	--	9.15	7.31

The results of the tensile strength test indicated that the cloth had warp strength of 34.55 kilograms and weft strength of 27.21 kilograms. The elongation of its warp was 16.54 percent, and the elongation of its weft was 18.40 percent. According to the Joint Industry Fabric Standards and Guidelines (2010), all woven fabrics are required to have a tensile strength of at least fifty pounds. The warp and weft values of woven bamboo cloth are both higher than 50. According to the performance specifications provided by ASTM, upholstery textiles are not required to meet any minimum or maximum elongation requirements. Table 3 reveals that bamboo cotton fleece has a higher bursting strength than bamboo cotton lycra. This is one of the observations that can be made from this data. The Table 4 represents the water absorbency, color fastness and stain resistance of selected fabrics.

Table 4: Water Absorbency, Colour Fastness and Stain Resistance of Selected Fabrics

Tests	Bamboo woven (100%)	Bamboo cotton fleece (Knitted)	Bamboo cotton Lycra (Knitted)
Water absorbency (mm)	Drop spreads up to 19mm diameter in a circle within 5 seconds	Drop spreads up to 7 mm diameter in a circle within 4 seconds	Drop spreads up to 7 mm diameter in a circle within 1minute
Colour fastness rate	4 -5	4 -5	4 -5
Stain resistance Rate	5	4	4

According to Manjit (2009), absorbency is the capacity of a substance to absorb moisture. The rate at which a fabric collects moisture and releases it through evaporation has a significant impact on health and comfort. The normal absorptive capacity of textile fibers varies, however absorbency can be improved through fabric manufacturing or finishing, as stated by Mohanram (2007).

The absorbency of regenerated bamboo and its blend fabrics are displayed in Table 4. The absorbency of the fabrics was evaluated using a drop test. Wetting and time affects moisture management properties of textile fabrics. In accordance with the test technique, the results indicate that a bamboo woven fabric drop spreads up to 19 mm diameter in a circle within five seconds, a bamboo cotton fleece drop spreads up to 7 mm within four seconds, and a bamboo cotton lycra drop spreads up to 7 mm during one minute. All samples have absorbency within the range of 30 seconds,

which implies a slow wetting time according to Hu et al (2005). Cellulosic fibers are generally perceived as comfortable mainly due to their excellent ability to absorb water (Gericke and Pol, 2010). The results indicate that bamboo cotton fleece absorbs more water than bamboo woven and bamboo cotton lycra. This investigation indicates that all samples had a high-water absorption rate. This performance attribute demonstrates the fabric's comfort and suitability for home furnishings. This research reveals that all samples are suitable for usage in furnishing applications.

A colour fastness test was conducted to determine the fabric's ability to retain its colour when exposed to various environmental factors. All of the samples fall within the range of 4-5. According to Jamshaidet al.(2014) the range from 1 very low colour fastness to 8 very high colour fastness. The outcome of the test indicates that all samples exhibit comparable levels of colour fastness. According to ASTM standards, these grades are recommended for use in furnishings. The stain resistance tests were conducted for all selected samples. Both the knitted fabrics received a heavy coffee stain. The stain resistance rate of both fabrics is 4. Due to its end use as a curtain, heavy dust is employed for bamboo woven (100%) fabric. The test result reveals a grade of 5. According to the AATCC Red 40 stain scale, grade 10 indicates no stain, while grade 1 is severely stained. Without dye the samples demonstrated average results; however, dying the fabric may increase its stain resistance.

Flammability of fabric refers to their burning behaviour and particularly to the ease of ignition and continued burning after ignition. Table 5 shows that the flammability results of the samples.

Table 5: Flammability of Selected Fabrics

Test	Bamboo woven (100%)	Bamboo cotton fleece (Knitted)	Bamboo cotton Lycra (Knitted)
Flammability (In second)	After flame 27.7, Afterglow 11.8	After flame 57.2, After glow 22.2	28.0 (Flammability in second)

The burn time, after glow time was determined by the vertical flame test method. The high amount of smoke and afterglow time indicates the hazard. Test results shows the flame time and glow time of all samples were within 60 seconds. The regenerated bamboo fabrics which are taken for this study could be used for home furnishing applications as the flammability results adhere to the standards.

CONCLUSION

The test results showed that regenerated bamboo fabrics such as bamboo fabric, bamboo cotton fleece, and bamboo cotton lycra have qualities suitable for usage in home furnishings. Therefore, the study concluded that these materials might be used for home furnishings. Particularly crucial to the durability of home furnishings is the fabric's breaking strength, abrasion resistance, flammability, water absorbency, pilling, drape measurement, and fabric thickness. The results of the tests show that bamboo cotton fleece has excellent performance characteristics and is hence highly recommended for usage as an upholstery fabric. The test results also showed that the bamboo100%woven had sufficient drapability, tensile strength, and color fastness grade, all of which are key quality attributes for curtains. Consequently, one may confidently suggest this fabric for use as window coverings. For a fabric to be considered ideal, it must meet several criteria, including being

soft to the touch, strong enough to last, easy to care for, and comfortable to use. Because of its antibacterial properties and the fact that it is a natural fabric, the regenerated bamboo fabric is soft, comfy, and completely safe to use. The cloth is also biodegradable and harmless to the environment. Therefore, it is appropriate for usage in indoors. Blending different fabrics is a common technique used to improve both the functional and aesthetic properties of textiles. According to the performance characteristics of regenerated bamboo blend fabrics are suitable for home furnishings.

REFERENCES

- Amran, N., Ahmad, M.R., Yahya, M.F.(2015). Some Studies on the Moisture Management Properties of Cotton and Bamboo Yarn Knitted Fabrics, Advanced materials Research, 1134, 225-230.
- Gericke, A& Pol, V. (2010).A comparative study of regenerated bamboo, cotton and viscose rayon fabricsPart 1: selected comfort properties.Journal of Family Ecology and Consumer Sciences, 38(2), 63-67.
- Rathod, A&Kolhatka, A. (2014). Analysis of Physical Characteristics of Bamboo Fabrics. International Journal of Research in Engineering and Technology, 3(8), 21-24.
- Chidambaram, P., Govindan, R., Chandramouli, V., & Koushik.(2013). A Study of the thermal properties of bamboo knitted fabrics. Springer, 111, 101-105.
- Erdumlu, N&Ozipek, B.(2008). Investigation of Regenerated Bamboo Fiber and Yarn Characteristics. Fibers and Textiles in Eastern Europe, 16(4), 43-47.
- Jamshaid, H., Zahid, B., Rajput,A.W., Hussain,S.,Hussain,U. (2021).Performance Evaluation of Upholstery Fabric Developed from Recycled Fibres. Fibres and Textiles in Eastern Europe, 5(149), 46-49.
- Hong, C., Haitao, C., Ge, W., Zixuan, Y., & Sheldon, Q.S.(2015). Tensile properties of bamboo in different sizes. The Japan Research Society, 61, 552-561.
- Kalpana, M&Kashyap, R.(2015). Bamboo fiber: An Approach toward Sustainable Development. International Journal of Science and Research, 4 (4), 1080-1082.
- Marilyn, W.(2009). Sustainable Textiles: The Role of Bamboo and a Comparison of Bamboo Textile Properties. Journal of Textile and Apparel, Technology and Management, 6(2), 2-4.
- RadhaKashyap. (2015). Sustainable Fibers and Fabrics used in Home Textiles. International Journal for Scientific Research & Development, 3(9), 902.
- Ramakrishnan, G., Umapathya, P., &Prakashb, C. (2015). Comfort properties of bamboo/cotton blended knitted fabrics produced from rotor spun yarns. The Journal of the Textile Institute,106 (12):1371-1376.
- Wang, Y. P., Lu, M. X., Huang, H.Y., Gao, X.S., Wang, G., Cheng, H.T. (2009). Test and evaluation for performances of fabric from natural bamboo fibre. Wool Textile Journal, 37(4), 1-5.
- Woven & Knit Residential Upholstery Fabric Standards & Guidelines. (2010). Joint Industry Fabric Standards and Guidelines.https://ahfa.us/downloads/standards/Fabric-Standards-and-Guidelines.pdf.
- https://www.textileadvisor.com/2020/04/testing-of-drape-coefficient-of-fabric.html.