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CHARACTERIZATION OF BLENDED BURI AND JUTE FIBERS AS TEXTILE MATERIAL

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Abstract: Blending natural fibers has emerged as a pivotal strategy in advancing sustainable textile production, aiming to enhance fabric performance while mitigating environmental impacts. The purpose of this study was to characterize the blended Buri and Jute fibers as Textile Material. Experimental method of research was applied for the characterization while the Developmental method was employed in the weaving of the fibers. A sensory evaluation sheet was used to determine the acceptability of the sensory attributes. The plant materials used in this study are mainly the petioles of Buri palm and the stem of Jute plant.The statistical tool used was the mean which was used to determine the level of acceptability of Textile from Blended Buri and Jute Fibers as Textile material. There were twenty-five experts who evaluated the product composed of dress shop owner, and fashion designers. The product had undergone a series of testing as to its qualities. It was tested that Blended Buri and Jute Fibers has its breaking elongation was significantly greater elasticity compared to existing blended textile fibers. As to the result of its burning test, the textile from blended buri and jute fibers was like a blended purple nutsedge (*Cyperus rotundus)* and lady's finger textile *(albelmoschus esculentus)* wherein it burns but does not melt. It shrinks from the flame. It has the odor of charred meat. The residue was black, hollow irregular bead that resembles a gritty black powder, and it was verbally interpreted as highly combustible. In the water absorption test, the result implies that the textile from a blended buri and jute fibers resulted from 44 percent of absorbency, it was like a fabric blend of 65% polyester and 35% of cotton absorbed the 12.5% amount of water. It was verbally interpreted as least absorbent. The textile from a blended buri and jute fibers in terms of washability test, result showed that there was ten (10) minutes duration of soaking on the three trials and had the same reaction to detergent wherein the textile became slightly dark and intact. The textile from blended buri and jute fibers was "Very Acceptable", considering its hand feel, rib irregularity, color shade, and plug presence. As to the evaluators comments, feedback, and suggestions, the product was unique, aesthetically pleasing and has desirable tactile qualities for consumers. Furthermore, the local government must support locally made products.

Keywords: Buri fiber, Jute fiber, blended textile, sustainable textile

I. INTRODUCTION

Background of the Study

In recent years, the textile industry has been challenged to adopt more sustainable and eco-friendly practices due to increasing environmental concerns and growing awareness of the harmful effects of synthetic fibers. As a result, natural and biodegradable materials have gained significant attention as viable alternatives. Among these, Buri and Jute have emerged as a promising raw materials due to their abundance, renewability, and excellent fiber properties.

Buri, a palm native to the Philippines, is traditionally used for handicrafts and furniture, but its strong, coarse fibers possess the potential to be utilized in textile applications. Jute, on the other hand is already widely recognized as one of the most versatile natural fibers, known for its strength, durability, and biodegradable qualities. Blending natural fibers has been a strategic approach to enhance the properties of textile materials. For instance, studies on jute-cotton blends have demonstrated improved physical characteristics include moisture regain and air permeability, compared to pure jute fabrics (Rahman et al., 2018).

The researcher's idea of blending buri and jute fibers seeks to harness the unique strengths of both materials to create a textile that is not only sustainable but also functional, affordable, and adaptable in various sources. This study aimed to characterized blended buri and jute fibers as textile material by evaluating their mechanical and physical properties. Specifically, it evaluated the level of acceptability of the textile based on its sensory attributes.

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1. determine the mechanical properties of blended buri and jute fibers as textile material in terms of breaking elongation and tensile strength;
2. determine the physical properties of blended buri and jute fibers as textile material in terms of rate of burning, water absorption, and washability.
3. determine the level of acceptability of textile from blended buri and jute fibers in terms of hand feel, irregularity of ribs, color shade, and presence of plugs.

II. METHODOLOGY

This study utilized a combination of experimental and developmental research methods to explore the potential of blending buri and jute fibers as textile material. The developmental method of research is defined as a systematic process for designing, developing, and evaluating products and processes to ensure they meet internal consistency and effectiveness criteria (Laing et al., 2016). In this context, the study focused on the creation and evaluation of a new textile material derived from the combination of buri and jute fibers. The primary aim was to design a textile that could serve as a sustainable and viable alternative to traditional materials in the market. This method provided a structured approach to developing the fiber blend, ensuring that the final product met the desired quality and performance standards.

Alongside this, an experimental design was implemented to determine the most significant factors influencing the quality characteristics of the textile product. As Moreb (2017) highlighted, experimental research is key to identifying and analyzing the critical variables that affect the properties of materials, particularly in textiles. The experimental aspect of the study involved systematically testing the mechanical and physical properties of the buri and jute fiber blend to assess its suitability as textile material. By employing these two research methods, the study aimed to not only create an innovative product but also to understand the underlying factors that influence the material's performance.

Locale of the study and respondents

All observations in the characterization though experimentation was done in the three trials, while the finished product was evaluated by 25 dress shop owner/fashion designers/dressmakers in the locality based on sensory evaluation.

Research Instruments

An evaluation sheet served as the research instruments of the study. Mean was used to determine the level of acceptability of Blended Buri and Jute fibers as textile material.

Data Analyses and Procedure

The Statistical tool used was the mean which was used to determine the acceptability of Textile from Blended Buri and Jute Fibers. There were twenty-five experts who evaluated the product composed of dress shop owner/fashion designers/dressmakers.

III. FINDINGS AND DISCUSSION

Mechanical Properties of Blended Buri and Jute Fibers as Textile Material in terms of Breaking Elongation

The data presents the elongation break on the first trial of blended buri and jute fibers. More so, it was discovered the blended fibers in the first trial were 48.57 percent and a fracture length of 91.44 millimeters. The second trial was 19.71 percent with a fracture length of 142.75mm. The third trial yielded 18.16 percent with a fracture length of 145.54 mm and with the same diameter of 177.8 millimeters for each trial and with the computed mean of 28.81 percent. The results further showed that the blended buri and jute fibers are very elastic than other blended fibers which is reflected on page 53 (Rating Scale for Breaking Elongation of Blended Buri and Jute fibers.

The result supported recent studies, which have echoed the importance of investigating natural fiber blends for sustainable textile applications. According to (Chattopadhyay et al., 2017), fiber blends that combine coarse and soft natural fibers often lead to enhanced mechanical behavior, especially in breaking elongation and tensile strength. Similarly, (Kandasamy et al., 2019) confirmed that incorporating jute with other plant-based fibers significantly improved the elastic behavior and durability of the composite material. (Islam et al., 2021) further highlighted the increasing demand for natural fibers in the textile sector, stating that “blends involving jute demonstrated superior stretch and recovery properties compared to single-fiber composites.” Additionally, (Sarkar and Roy, 2022) emphasized that breaking elongation is a critical property in ensuring fabric comfort and durability, especially for wearable applications.

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Mechanical Properties of Blended Buri and Jute Fibers as Textile Material in terms of Tensile Strength

Based on the result of the test conducted, the blended buri and jute fibers had the diameter distribution across the fiber (top, middle, bottom), the average cross-sectional area, the applied tensile load, and the resulting tensile strength. The recorded tensile strengths were 61.11 MPa, 98.61 MPa, and 70.33 MPa across three samples, corresponding to applied loads of 29.43 N, 34.33 N, and 39.24 N, respectively. All values fell under the "very durable" category, as per the defined legend, which tensile strength values were greater than 40.21 MPa, indicating exceptional durability.

The fiber diameters varied slightly across the length, with trial averages of 0.783 mm, 0.666 mm, and 0.843 mm. These values directly affected the cross-sectional areas and, consequently, the tensile strength calculations (Tensile Strength = Load/Area). A smaller cross-sectional area under the same or greater load generally resulted in higher tensile strength, which was evident in the second trial (area = 0.3482 mm^2, strength = 98.61 MPa), which the fiber experienced the highest strength despite not having the highest load. This reflected the efficient load-bearing capacity and strength-to-size ratio of the blended material.

The consistent categorization of all trials as "very durable" suggested that blending buri and jute fibers created a synergistic enhancement of mechanical properties, particularly tensile durability. This finding was crucial for their potential use in textiles requiring high structural integrity and resilience.

The findings indicated that the blending of buri and jute fibers could significantly improve tensile strength, making the composite material suitable for industrial and commercial textile applications. Since tensile strength is a key indicator of a textile's durability and resistance to tearing and stress during use and washing, the result supported the feasibility of these natural fibers as alternatives to synthetic or conventional materials. Their high mechanical performance also implied potential in producing eco-friendly and sustainable textiles, aligning with global trends in green manufacturing. The high tensile strength and low diameter variability also suggested that these fibers could be incorporated into composite fabrics or technical textiles used in bags, mats, or reinforcements.

The enhanced breaking elongation observed in blended natural fiber yarns implies their potential for applications in textiles where elasticity and strength are crucial. The improved mechanical properties can lead to the development of sustainable and eco-friendly textile products, aligning with global trends toward environmentally responsible materials. The result supported studies on mechanical performance of natural fiber blends, such as jute combined with other fibers. (Shahid et al., 2016) investigated the physical properties of jute blended yarns and found that blending jute with polyester improved the yarn's strength and elongation characteristics. Their study reported that jute-polyester (80/20) blended yarns exhibited higher strength and more evenness compared to 100% jute yarns.

Similarly, (Biswas et al., 2023) explored the blending of jute with ramie fibers and observed significant improvements in tensile properties. The introduction of ramie fibers into the jute yarn structure increased both tenacity and extensibility, indicating enhanced mechanical performance of the blended yarns. These findings suggested that blending jute with other natural fibers could enhance mechanical properties such as breaking elongation, making them suitable for textile applications requiring flexibility and durability.

Physical Properties of Blended Buri and Jute Fibers as Textile Material in terms of Rate of Burning

The data presents the burning behavior of blended buri and jute fibers, focusing on the rate of burning as a measure of combustibility. It showed that in the first trial measured 1.09^2 in the textile from a blended buri and jute fibers was burned 17.2 seconds producing blackish color of dust and with a burning rate of 0.63 in^2/seconds. The second trial measured 1.09^2 and the textile from the blended buri and jute fibers burned 16.8 second with blackish color of dust and with a burning rate of 0.64 in^2/seconds. The third trial which measured 1.09^2, yielded the textile from plant-based fibers of blended buri and jute after 16.7 seconds with the blackish color of dust and with a burning rate of 0.65 in^2/seconds. For the burning rate mean was 0.64 in^2/seconds. As to the result of its burning test, the textile was comparable to silk and wool fabric wherein it burns but does not melt. It shrinks from the flame. It has odor of charred meat. The residue was black, hollow bead that resemble a gritty black powder. It is self – extinguishing i.e it burns itself out (fabriclink

The consistent classification across all trials suggested that the blended buri and jute fibers exhibited high level of flammability. This behavior was likely influenced by the inherent properties of the constituent fibers. Jute, a lignocellulosic fiber, is known for its flammable nature due to its high cellulose content. Likewise, buri fibers, derived from the Corypha palm, also possess combustible characteristics. The combination of these fibers without any flame-retardant treatment resulted in a textile that ignited and burned at a moderate rate.

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The result supported (Li et al., 2022), who demonstrated that treating jute fabrics with a chitosan-sodium alginate gel significantly improved flame retardancy, achieving a limiting oxygen index (LOI) of 27% and reducing the heat release capability by 50%. This treatment also resulted in a damaged length of less than 5 cm in vertical combustion tests, indicating enhanced fire resistance.

Physical Properties of Blended Buri and Jute Fibers as Textile Material in terms of Water Absorption

The result showed that on the first trial, the initial mass was 0.07 grams, and the final mass was 0.45 grams, and it has 38 percent of water absorbed on the textile. In the second trial, the initial mass was 0.05 grams, and the final mass was 0.50 grams and for its water absorbed was 45 percent. In the third trial, the textile weighed for its initial mass of 0.07 grams and the final weighed was 0.58 grams and 51 percent for its water absorbed. When it sums up its water absorbency was 44 percent. Therefore, a textile from blended buri and jute fibers was "Moderately Absorbent" as shown on table of page 54 (Rating scale for Water Absorption of Blended Buri and Jute fibers).

The variability in water absorption across trials can be attributed to the structural and morphological differences in fiber orientation and blend uniformity. Jute, known for its high cellulose content and capillary action, generally exhibits strong hydrophilic behavior. Buri fiber, derived from the Corypha palm, has relatively smoother and waxier surfaces, which may hinder water penetration to some extent. The blending of these two fibers produced a textile material with intermediate absorption characteristics, leaning more toward jute's absorbent nature while being somewhat moderated by the buri fiber's less porous structure.

The result implies that the blended buri and jute fibers was suitable for applications requiring moderate moisture management, such as home textiles (curtains, upholstery), eco-bags, or fashion items where excessive water retention might be undesirable. However, its moderate absorbency may limit its use in applications, which high absorbency was critical, such as bath towels or medical textiles.

Recent studies supported these observations. (Sarker et al.,2020) found that natural fibers like jute, when blended with less absorbent plant fibers, reduced the overall moisture uptake and offered a balance between water resistance and breathability, which is ideal for certain garment applications. Moreover, (Islam et al.,2019) emphasized that blending jute with hydrophobic fibers or those with lower porosity can modulate water absorption behavior while still retaining mechanical integrity and biodegradability.

Further enhancement of the textile's water absorption or resistance can be achieved through chemical or surface modifications. (Prasad et al.,2022) demonstrated that mild alkali or enzyme treatments increased the hydrophilicity of bast fibers, which may also be explored to tailor the performance of the buri-jute blend.

Moreover, the differences in water absorbency may be attributed to various factors, including fabric thickness and testing conditions. Variations in fabric thickness can affect the water absorbency of the sample, while changes in temperature, humidity, or testing procedures can influence the results. The differences in water absorbency across the three trials have implications for the use of this fabric in various applications. This test was conducted because moisture in clothing has been found to be the most significant factor contributing to discomfort. The presence of sweat would increase friction between fabric skin trigger a clingy sensation and eventually increase the level of fatigue felt by the wearer. This problem is even more severe for the clothing worn under extreme environmental conditions or at high activity level (Cabigon, 2022).

Physical Properties of Blended Buri and Jute Fibers as Textile Material in terms of Washability

Based on the result the observation of washability test applied to textile from blended buri and jute fibers using 2 grams of detergent powder. The result showed that in 10-minute duration of soaking on three trials, it had the same reaction to detergent, which the textile become slightly dark and intact. Washability is seen as one of the main obstacles of wider market success of e-textile products. There is no standardized method for wash testing of e-textiles and no protocols to comparably assess the washability. Thus, different e-textiles are deemed equally washable by their developer with very different ranges of reliability after repeated washing (Rotzler et.al, 2021). Likewise, most fabrics, such as cotton and polyester, degrade with each cycle. Elasticity changes, dye fades, and overall resilience diminished. There is also a different impact on the functionality. Conductivity and electrical resistance can both be determined with a multimeter. For many garments, it is expected for them to last from 50 to 100 washes. This standard is often high for e-textile solutions, which can last closer to 10 to 50 wash cycles, depending on the technology. (Cited by Cabigon, 2022).

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Acceptability of Textile from a Blended Buri and Jute Fibers in terms of Hand Feel, Irregularity of Ribs, Color Shades, and Presence of Plugs

The data presents the acceptability of textile from a blended buri and jute fibers in terms of hand feel, Irregularity of Ribs, Color shades, and Presence of plugs. There were twenty-five (25) experts who evaluated the product. Generally, the textile from blended buri and jute fibers was computed overall mean of 4.21 corresponded to a "very acceptable" rating, indicating a strong level of user satisfaction with the physical aesthetics and performance of the material. Specifically, the hand feel received the mean score of 4.18, interpreted as "acceptable." This suggested that while the fabric was perceived as generally comfortable, it might still lack the softness or smoothness expected in commercial apparel textiles, which was consistent with the coarser texture inherent to jute and buri fibers. Irregularity of ribs, a feature often associated with weaving inconsistencies, scored 4.11, also interpreted as "acceptable." This indicated that the fiber alignment and yarn consistency were sufficient, but not perfect, possibly due to the integration of two naturally occurring fibers with varying coarseness and tensile strengths.

The color shades of the textile were rated the highest with the mean of 4.36, corresponding to a "very acceptable" rating. This suggested successful dye affinity and consistency in coloration, reflecting effective dyeing procedures even with natural fibers. The presence of plugs, or foreign fiber inclusions or knots, scored 4.21, also "very acceptable." This outcome implies that while some plugs were likely observed, their presence did not detract significantly from the material's usability or appearance.

The findings indicated that the blended buri and jute textile demonstrated a strong potential for practical application in textile industries aiming for sustainable and biodegradable alternatives. The very acceptable scores for color shades and plugs showed that the production and finishing techniques were effective, ensuring consumer appeal and product reliability. Meanwhile, the slightly lower, though still acceptable, ratings for hand feel and rib irregularity pointed to areas that may be improved through softening treatments, better yarn blending techniques, or loom calibration. As noted by (Haider et al.,2022), using softening agents and surface modification improved natural textile feel and rib uniformity without compromising biodegradability. Furthermore, the researcher should use fiber Decorticator Machine to have equal thickness and length of fibers.

IV. CONCLUSION

Based on the results of the study, several key conclusions were drawn:
The blended buri and jute fibers demonstrate acceptable breaking elongation and tensile strength, meeting the required standards for market competitiveness, suggesting that the blend has adequate strength and flexibility for use in textile applications.

The rate of burning, water absorption, and washability of the textile blend show favorable results, with the material demonstrating adequate fire resistance, moisture retention, and durability after repeated washing, indicating that the blend is safe, comfortable, and has long-term usability, making it a viable alternative to traditional textiles.

Textile from blended buri and jute fibers was “Very Accepptable”, considering its hand feel, rib irregularity, color shade, and plug presence. As to the evaluators comments, feedback, and suggestions, the product was unique, aesthetically pleasing and has desirable tactile qualities for consumers. Furthermore, the local government must support locally made products.

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