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Development and utilization of kerson (*Muntingia calabura*) plant for fabric production

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Abstract: Fiber is one of the essential elements in fabric and textile structure. Natural fibers were given a lot of respect over synthetic ones in terms of sustainability. The demand for natural fibers is constantly increasing due to their being environmentally friendly, hygienic, comfortable character, thermal insulation, breathability, and softness. This study focused on the development and utilization of the Kerson (*Muntingia calabura*) plant fiber for fabric production. It aimed to identify the processes involved in fiber extraction, assess the physical properties of the fabric, and evaluate its acceptability among tailors, dressmakers, teachers, and students. The fibers were processed using the Retting Method and tested for strength and durability at the DOST-PTRI. Results showed that while the fiber had moderate strength, the addition of cotton improved its tensile properties. Evaluation by respondents indicated high acceptability in terms of usefulness, durability, and appearance, with usefulness receiving the highest scores. One-way ANOVA and Tukey post-hoc tests revealed significant differences between the assessments of tailors and teachers, suggesting that teachers were more critical in evaluating the fabric. Overall, the study concluded that Kerson plant fiber has the potential for sustainable fabric production, though further improvements in texture and strength are recommended.

Keywords: Kerson plant fiber, Fabric production, Physical properties, Acceptability, Sustainable textiles

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INTRODUCTION

Fiber is one of the essential elements in fabric and textile structure. Fiber is a long thread that can be converted into yarn to be woven to form a fabric. Fabric is a piece of cloth used in making clothes. There are two types of fibers: natural and synthetic fibers. Natural fibers are obtained from plants and animals, while synthetic fibers are artificial or man-made fibers developed through technological and chemical treatment (Morton & Hearle, 2008).

Meanwhile, the development of textile industries meets the increasing demand for textile materials (Karunamoorthy et al., 2021). Fiber crops are considered one of the country's most important agricultural products in textile production. Varieties of fiber include abaca, cotton, maguey (*Agave cantala*), pineapple, ramie, snake plant, fiber plant, and sisal plant. The demand for natural fibers is constantly increasing due to their environmentally friendly, hygienic, comfortable character, thermal insulation, breathability, and softness (Yasin et al., 2019).

According to Textile World Asia, the Philippines has been working to promote local production and use of textiles made using abaca, piña, and other indigenous fibers. The 2004 Tropical Fabrics Law mandates the use of Philippine tropical fabrics, which are classified as those containing natural fibers produced, spun, woven, or knitted and finished in the Philippines (Legarda, 2022). Although it has plenty of raw materials, the Philippines lacks manufacturers able to process plant fibers into textiles, and reportedly, it is working to develop new processing methods. The country is looking for partners to produce its tropical fabrics commercially and is hopeful that such new business opportunities will help strengthen its textile and apparel industry (Pinoyentre, 2010).

The global rise in demand for natural fibers stems not only from their performance characteristics but also from increasing consumer consciousness regarding the sustainability of materials used in the textile industry (Zimniewska et al., 2020). Natural fibers, such as those sourced from the *Sansevieria trifasciata* and other native plants, reduce non-biodegradable waste caused by synthetic textiles (Matthys et al., 2021). In countries like the Philippines, the revival of traditional textile industries by using locally sourced natural fibers is also tied to cultural heritage preservation (Prasad et al., 2015; Ramos et al., 2020). This provides economic opportunities for rural communities while supporting efforts in environmental conservation.

Pinoyentre (2010) mentioned that the Philippines is one of the world's largest producers of fiber crops. These crops are used to make different products sold in local and international markets. The raw materials we get from fiber crops are valued for their strength and durability. These fiber crops provide us with materials used in making clothes, linen, bags, nets, slippers, doormats, and mats. Demands for fiber crops today are increasing in local and foreign markets. Due to high technology, the production and processing of fiber crops have been made easy and accessible. Thus, growing demands for fiber crops are easily met.

Natural fibers offer several advantages over synthetic alternatives, such as reduced carbon footprint and the potential for complete biodegradability, making them crucial for future sustainable manufacturing (Grewal et al., 2022). Moreover, the mechanical properties of natural fibers, including tensile strength, moisture absorption, and thermal properties, have been shown to compete well with synthetic fibers when processed appropriately (Shanmugam et al., 2019; Song & Huang, 2007). Therefore, local industries should invest in the cultivation and processing of fibers like *Muntingia calabura*, which have untapped potential for broader commercial use (Sulaiman et al., 2021).

Legarda (2022) mentioned that implementing the law will help jumpstart efforts to build up the tropical fabrics industry while giving a much-needed boost to the agricultural and industrial sectors, as well as to local and indigenous weavers and artisans. It will also create diversity in the textile and fashion industry, giving Filipino fashion designers and garment manufacturers more choices in textiles to use. The promotion of tropical fibers such as *Muntingia calabura* aligns with international trends favoring organic and biodegradable materials in fashion and textile production (Kim et al., 2020).

As the Department of Science and Technology's lead agency in textile research and development, the Philippine Textile Research Institute promotes the use of indigenous resources. It supports the development of technical competence in the local textile and allied industries (PTRI, 2021). This is why the researchers conducted this study to discover more about *Muntingia calabura* (Aratiles), how the fiber will be extracted, and how it can be made into eco-friendly textiles. Aside from this, it supports the development of native products in the Philippines (Abidi et al., 2020).

Kerson plant (*Muntingia calabura*), known as aratilis or aratiles in the Philippines, is also known by various names, including datiles in Bicolano and manzanitas and cereza in Ilocano. In English, aratilis is known as Jamaican cherry, Panama berry, and strawberry tree; in Spanish, bolania, yamanza, and memizo; in Indonesian, kersen; and Vietnamese, trungca (Salazar & Dizon, 2021). The tree originated in tropical America and was introduced to the Philippines during the Spanish era, where it quickly spread and became well-adapted (Manikandan et al., 2019).

The province of Isabela in the Philippines is home to different fiber-yielding plants, some of which were used by the people as clothing in the olden times. Recently, Sansevieria trifasciata fiber for textile application was developed by Apalla (2020) of the Isabela State University-Ilagan Campus. This natural fiber is hoped to support, promote, and encourage the growth and development of other native products in the Philippines, particularly in the

province of Isabela (Abidi et al., 2020). The product has a unique property, which makes it capable of withstanding pressure without any fiber degradation. The developed fabric's breaking strength revealed that it has the potential to be used in manufacturing goods.

Due to its great strength, cost-effectiveness, and renewable source, fabric developed from *Sansevieria trifasciata* fiber has potential use in the clothing industry. The indigenous knowledge of fiber processing reflects the resourcefulness of the Isabelino people (Legarda, 2022).

Statement of the problem

This study aimed to develop Kerson (*Muntingia calabura*) Plant Fiber for fabric production, specifically answering the following questions:

1. What are the processes involved in developing Kerson plant (*Muntingia calabura*) fiber into fabric?
2. What is the physical property of the Kerson plant (*Muntingia calabura*) fiber and fabric as tested at the DOST-PTRI according to its strength (in total degradation scheme)?
3. What is the level of acceptability of the developed fabric in terms of appearance, strength and usefulness?
4. What is the level of acceptability of fabric products made from Kerson plant fabric as evaluated by the following different groups of respondents, namely: tailors/dressmakers; garments/dressmaking teachers; and garments fashion and design students.
5. Is there a significant difference in the evaluation of the developed fabric from the Kerson plant fiber among the three groups of respondents in terms of appearance, strength, and durability?

METHODOLOGY

Research Design

The study used experimental and descriptive research methods. The experimental method was utilized to determine the acceptability of the developed Kerson Plant fabric. The data-gathering procedure was started after the experiment was conducted. Kerson (*Muntingia calabura*) samples were collected and prepared. The plant bark was peeled off to separate the fiber, then soaked in a water solution (retting method) to loosen the texture of the fabric and remove unwanted materials. The fibers were then brought to the Department of Science and Technology-Philippine Textile Research Institute (DOST-PTRI) for the physical testing and processing of fabric through weaving.

Locale of the study and Respondents

This study utilized the nonprobability purposive sampling method to choose the participants for the survey. The following criteria were considered in selecting participants: (1) a consumer who has/had experience in the field of the textile industry, (2) a consumer who had taken up formal education in the field of garments, and (3) a distinctive consumer/ well-known boutique owners/fashion designers/dressmaking-tailoring shop owners and workers. The participants must satisfy at least one criterion mentioned above to be part of the sample. Three groups of consumers were chosen: ten (10) students who are officially enrolled in garments at the Isabela State University City of Ilagan for the S.Y. 2021-2022, ten (10) Dressmaking and Tailoring Teachers of Department of Education, and ten (10) selected Tailors, dressmakers, and Textile Industry Workers in the city of Cauayan City.

Research instrument

The research instrument used in the study is a survey. The participants included tailors, dressmakers, teachers, and students who evaluated the acceptability of the developed fabric made from the Kerson plant (*Muntingia calabura*) fiber. The survey assessed the fabric's appearance, strength, and usefulness. Specific criteria were used to select participants, such as experience in the textile industry and formal education in garments. Three groups of respondents were involved: students, dressmaking teachers, and tailors.

Data analysis procedure

The study used both descriptive and inferential statistical tools. Descriptive statistics were employed to summarize the data, specifically using means to determine the level of acceptability for each criterion (appearance, strength, and usefulness) across the three groups. The inferential analysis involved a one-way ANOVA to examine if there were significant differences in the evaluations provided by the different groups of respondents (tailors, teachers, and students). A Tukey post-hoc test was then conducted to identify which groups differed significantly from each other in their evaluations.

FINDINGS AND DISCUSSIONS

Level of acceptability of the developed fabric according to tailors/dressmakers workers

The data shows the level of acceptability of the developed fabric from the Kerson plant according to the group of industry workers, tailors, and dressmakers. They have stated that fabric has high acceptability in terms of its appearance, durability, and usefulness, as indicated by the means 4.40, 4.77, and 4.93, respectively. The appearance of the fabric suggested the lowest level of acceptability, while usefulness registered the highest level of acceptability.

The result implies that the developed fabric can be used in various ways, as perceived by tailors, dressmakers, and textile industry workers. According to Guttierez (2017), entrepreneurs and designers have been incorporating natural fibers in everything from bags and laptop cases to shirts, skirts, and even gowns. Natural fibers possess characteristics of nature, aesthetic sense, elegance, and comfort (Song and Huang, 2007). Furthermore, there is a great advantage if natural fibers are used in textiles from the point of view of comfort, feel, and biodegradability (Doke and Sivakumar, 2003).

Level of acceptability of the developed fabric according to teachers in dressmaking and tailoring

The dataset displays the level of acceptability of fabric developed from the Kerson plant in terms of appearance, strength, and usefulness as assessed by the group of tailoring/dressmaking teachers. They indicated that appearance has a mean of 3.90 and description of acceptable, while both durability and usefulness are highly satisfactory, as supported by the means of 4.47 and 4.90, respectively. It suggests that among the three criteria, appearance has the lowest level of acceptability.

The result implies that the developed fabric is moderately appealing to the Dressmaking and Tailoring Teachers.

Level of acceptability of the developed fabric according to students

The result shows the level of acceptability of the fabric developed from the Kerson plant in terms of appearance, durability, and usefulness as evaluated by the group of students. It shows that the fabric produced is highly acceptable in all criteria indicated as suggested by their corresponding mean levels. Also, appearance registered the lowest mean level of acceptability, which is 4.40, while usefulness indicated the highest mean level of acceptability, which is 4.93.

Level of acceptability based on the appearance of the developed fabric

The data shows the level of acceptability of the developed fabric based on its appearance. Both the students and tailors/dressmakers/textile industry workers groups indicated the same level of acceptability, which means 4.40, with the verbal interpretation of highly acceptable. It can be noted, however, that the teacher's group showed a lower level of acceptability of 3.90 with the verbal interpretation of acceptable. This can be attributed to the fact that tailoring/dressmaking teachers are more critical and meticulous in evaluating a fabric.

Overall, the developed fabric is highly acceptable in terms of appearance, as indicated by the grand mean of 4.23. This means that if the fabric made from the Kerson plant is mass-produced, it will contribute significantly to the supply of the global natural fiber market, as it was expected to register high growth over the forecast period of 2019 to 2025. The Global Natural Fibers Market mentioned that the natural fibers market is estimated to grow by 6.80%.

Level of acceptability based on the strength of the developed fabric

The result reveals the level of acceptability of the developed fabric based on its durability. The group of tailors/dressmaker workers suggested the highest mean level of acceptability of 4.77, which means highly acceptable. It can also be pointed out that the group of tailoring/dressmaking teachers has the lowest mean level of acceptability of the developed fabric based on its durability.

Overall, the developed fabric is highly acceptable in terms of durability, as supported by the grand mean of 4.61.

According to Karima et al., in 2021, natural fibers have low density and high strength-to-weight ratio and reduction, making them potentially lightweight composite and reinforcement materials. Natural fibers have higher cellulose content and crystallinity, which tend to result in better tensile strength properties.

Level of acceptability based on usefulness of the developed fabric

The data indicates the level of acceptability of the developed fabric based on its usefulness. It can be drawn from the table that both the tailors/dressmaker's workers and student groups have the same level of acceptability, a means of 4.93, with the verbal interpretation of highly acceptable. Tailoring/dressmaking teachers, however, indicated a lower mean level of acceptability of 4.90, although it is still interpreted as highly satisfactory.

Overall, the three groups of respondents suggested that the developed fabric is highly acceptable in terms of its usefulness, as supported by the grand mean of 4.92.

Natural fibers started to be a new trend. It has been seen that it can be as effective as a synthetic fiber. They are eco-friendly and produce the kind of fiber that meets the sustainable development goals of the United Nations.

General acceptability of developed Kerson fabric

The data shows the overall level of acceptability of the developed fabric from the Kerson plant in terms of appearance, strength, and usefulness. It can be inferred from the table that the developed fabric has a high level of acceptability in all the criteria indicated with a grand mean of 4.59 and with a description of "highly acceptable." Furthermore, it reveals that appearance has the lowest level of acceptability while usefulness has the highest level of acceptability.

The result implies that the developed fabric from Kerson plant fiber can be utilized in many ways. This supports the study conducted by Goel and Nishkam, 2013. They have stated that bast plant fibers are used because of their excellent performance. Also, natural fibers are mostly used in different applications, from clothing, home textiles, and industrial textiles to technical textiles (Gayathri and Bala, 2016).

Level of acceptability of the developed fabric according to group of respondents

The data indicates the level of acceptability of the fabric developed from the Kerson plant as evaluated by the three groups of respondents, namely, tailors/dressmakers' workers, tailoring/dressmaking teachers, and students. Although they all indicated a high level of acceptability, it was the group of industry workers who registered the highest mean of 4.70, followed by the group of students, and then lastly, the group of tailoring and dressmaking teachers. This can be attributed to the fact that teachers are more critical in evaluating the developed fabric since they have in-depth knowledge of the different types of fiber.

Comparison of the respondent's evaluation of the acceptability of the developed fabric

The data reveals the one-way Analysis of Variance (ANOVA) of the responses of the three groups of respondents, namely, tailors/dressmakers/industry workers, tailoring/dressmaking teachers, and students. The results show that the p-value 0.02147 corresponding to the F – statistic 4.4434 of the one–way ANOVA is lower than 0.05, suggesting that one or more groups are significantly different. Since ANOVA cannot identify which group is substantially different from the other, the Tukey post – hoc test that follows identified the pair of groups that are significantly different.

Tukey HSD post–hoc test

The data indicates the result of Tukey's post – hoc test, which determined the pair of groups to be significantly different. It reveals that responses between the groups of Dressmaker/Tailoring workers and teachers are significantly different. This implies that the mean level of acceptability of the developed fabric from Kerson plant fiber is higher for the group of Tailors/Dressmaker Workers than for the mean level of acceptability of the Teachers' group. Findings show that teachers are more serious, detailed, and comprehensive in evaluating the fabric developed from the Kerson plant. This supports the article of Ian MacRae (2018) that teachers are more theoretical and abstract and seek to impart knowledge and provide information.

CONCLUSION AND RECOMMENDATION

Due to its high strength, low cost, and renewable resource, consumers are positive about the newly developed fabrics made from Kerson (*Muntingia calabura*) fiber and the improvements they bring to the lives and environment of some people. It has been shown to have awareness. A group of boutique owners/fashion designers/tailors, as well as worker-owners, said the product needs to be improved in texture, stiffness, and crease resistance. Nonetheless, the findings of the survey show that newly developed fabrics made from Kerson (Muntingia Calabura) fibers are widely accepted as new fabrics and have the potential and ability to be included in the list of locally produced fabrics. Showed that you have. From this, we can conclude that the newly developed fabric is an eco-friendly product along with domestic fabrics. You can also use it in your daily life.

The researcher recommends that future studies explore the use of sodium peroxide during the degumming process of Kerson (*Muntingia calabura*) plant fiber to improve its quality. Additionally, as the current study was limited to one standard testing procedure, future research should aim to include more comprehensive evaluation methods related to the development of the product. Expanding the scope of testing, particularly for other indigenous materials, could enhance universal acceptability. Further, researchers are encouraged to experiment with submerging the Kerson fabric in color or dye to evaluate its responsiveness to treatments. The findings of this research open new opportunities for future studies to address environmental challenges in eco-friendly apparel industries. It is also recommended that all experimental or developmental research undergo assessment by concerned agencies, such as DOST-PTRI and the Department of Agriculture, to evaluate the performance and longevity of the developed products through rigorous laboratory tests.

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