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Utilizing Sustainable Pineapple Fibre in Artisanal Batik Craftsmanship: A local handdrawn technique

Mohamad Fareez Azuan Abdullah*, **Hazizul Abd Aziz**
**Corresponding author*

Universiti Kuala Lumpur MIDI, Cheras,Kuala Lumpur

fareez.azuan@unikl.edu.my , hazizul@unikl.edu.my
Tel: +60137199517

Abstract
This research investigates the sustainability of pineapple fibre, a natural textile material utilized in the production of hand-drawn batik products in Malaysia. Since the 1930s, Malaysia has been using pineapple leaf fibres for textiles. The study employs a Utilizing Sustainable Pineapple Fibre in Artisanal Batik Craftsmanship: A Local HandDrawn Technique triangulation method involving interviews, experimentation, and observation. A key objective is to assess the sustainability of pineapple fibre in the Malaysian hand-drawn batik industry. Notably, this research seeks to promote awareness and adoption among Malay batik producers regarding the integration of hand-drawn batik onto pineapple fabric, offering a novel approach to sustainable textile production.

Keywords: Sustainability, Pineapple Fabric,Hand-Drawn Batik

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1.0 Introduction

This study is part of a larger ongoing research project aimed at exploring the integration of natural pineapple fibres into Malaysia's hand-drawn batik-making tradition. The research commenced with a comprehensive examination of the potential of pineapple fibres as a viable and sustainable medium for local batik production. Previous investigations have highlighted the unique properties of pineapple fibres, and this study builds upon that foundation by delving into the practical application of these fibres through hand-drawn batik techniques.The study includes a review of related literature to contextualize the sustainability and cultural significance of pineapple fibres within the local batik industry. This also encompasses visual documentation to illustrate the fibres' adaptability and aesthetic potential. A key focus is on mapping the material's performance attributes, such as wax absorption and dye retention, through various stages of the batik-making process, culminating in a final product evaluation.

The experimentation process, which involves hand-drawn techniques applied to different pineapple-based fabrics—including Pineapple Cotton, Silk, and Fibres forms the core of this research. Insights derived from these explorations contribute to understanding the feasibility and characteristics of pineapple fibres as an innovative material for batik production. Ultimately, the conclusions of this study are drawn from a thorough compilation of findings, including investigations and experimental results sourced from diverse methods and perspectives. These outcomes aim to not only expand the knowledge base surrounding sustainable batik practices but also to establish pineapple fibres as a transformative medium in Malaysia's textile heritage.

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2.0 Literature Review

The term "natural fibre" refers to fibres derived directly from natural sources, including minerals, animals, and plants. At present, reliance on petroleum-based products is constrained and fraught with uncertainties due to environmental and economic concerns. Consequently, many firms and research organizations are seeking sustainable and economical alternatives that utilize readily available resources (Brundtland, 1987). Natural fibres are abundant in the environment, making them a preferred choice for multiple applications. Their unique properties, such as ease of dyeing, moisture absorption, body comfort, resistance to melting, and static-free processing, make them superior to synthetic fibres. Furthermore, they are dermatologically safe, easy to sew, and maintain strong seam integrity. According to Derahman (2021), exploring alternative materials like pineapple fibres holds potential for the Malaysian batik and textile industry, offering an innovative and sustainable medium for production.

Recent studies have emphasized the environmental and economic benefits of natural fibres. Abdullah et al. (2023) explored the potential of pineapple fibres as a sustainable alternative for batik production, emphasizing their compatibility with eco-friendly dyes and reduced environmental footprint. Additionally, Kamaruddin et al. (2022) investigated advancements in decorticating technologies for efficient fibre extraction, reducing production waste and costs. These findings align with the United Nations' Sustainable Development Goals (SDG 12: Responsible Consumption and Production) and Malaysia's commitment to achieving a circular economy by 2030 (Economic Planning Unit, 2021). Pineapple fibre, extracted from pineapple plant leaves using a decorticating machine, is a soft and eco-friendly material. In the textile industry, it is often blended with silk or polyester to achieve a luxurious texture. Pineapple leaves, often regarded as agricultural waste, can be converted into valuable fibres and sold in commercial markets, presenting an opportunity for waste reduction and resource optimization. Asia, particularly the Philippines, leads pineapple production, making this fibre a promising material for sustainable textile applications. Recent research has also focused on enhancing fibre properties through hybridization with other natural materials (Rahman et al., 2021), expanding its use in high-performance textiles. Batik, a significant part of Malaysia's cultural heritage, derives its name from the Javanese words *amba* (to draw) and *titik* (dot). Traditionally, batik involves dye-resist techniques, creating intricate patterns.Today, it is recognized as an art form requiring innovative exploration of materials and techniques (Azlina, 2012). Shahrulnizam (2017) highlights that batik practitioners, inspired by nature, use flora and fauna motifs to merge art with environmental themes, emphasizing the beauty of natural surroundings as a medium for creative expression. Recent studies, such as those by Yusof et al. (2022), have explored natural dyes derived from local plants, offering sustainable alternatives to synthetic dyes, reducing water pollution, and preserving the environment.

Zainon (1990) explains how the modernization of batik concepts, techniques, and philosophies has transformed it into a global art form. The evolution of batik reflects societal changes, cultural influences, and technological advancements—once symbolic of status, batik exhibitions reflect a global interest in eco-conscious design and cultural preservation. Similarly, studies by Mahadzir et al. (2021) highlight the potential for batik as a medium for international collaboration, fostering cross-cultural exchange and innovation.To ensure the relevance of this research, it is essential to incorporate findings from the last five years. Recent studies have explored innovations in natural fibre production, sustainable textile practices, and advancements in batik-making techniques. Aligning this research with SDG 9 (Industry, Innovation, and Infrastructure) and Malaysia's National Textile Policy (2021) will enhance its contribution to sustainable development and the global fashion industry.

3.0 Research Methodology

The primary objective of this study is to evaluate the sustainability and adaptability of pineapple fibre in traditional Malaysian hand-drawn batik techniques, exploring its potential to preserve cultural heritage while supporting environmental and economic sustainability. This research focuses on pineapple fibre extracted from the leaves of commonly cultivated varieties in Malaysia, such as Moris, Josapine, and MD2. The fibres are sourced exclusively from the leaves, which are agricultural by-products, to ensure alignment with sustainable practices. In contrast, fibres from the fruit are excluded to emphasize the repurposing of waste material.

Thus, the study employs a qualitative research approach, integrating primary and secondary data sources to address the research objectives comprehensively. Participants include batik artisans, textile researchers, and agricultural experts, whose combined expertise offers diverse perspectives on the practical and technical aspects of incorporating pineapple fibre into batik production. Batik artisans, with their extensive experience in hand-drawn batik techniques, contribute insights into the feasibility and aesthetic outcomes of the material. Textile researchers provide valuable knowledge on the properties and potential applications of natural fibres. At the same time, agricultural experts offer an understanding of pineapple cultivation and fibre extraction processes, ensuring the relevance of agricultural practices to the study.

Data collection involves structured interviews and focus group discussions with participants to gather in-depth qualitative insights. Field observations further document the processes and challenges associated with integrating pineapple fibre into batik production. Secondary data, including academic literature, industry reports, and relevant documentation, are analysed to provide a broader contextual understanding of the subject.

Moreover, the experimental phase of the study focuses on evaluating the performance and feasibility of pineapple fibre in batik-making. Pineapple leaves are processed into fibres using a decortication machine, and these fibres are crafted into fabric samples. Traditional batik tools such as canting, wax, and dye vats are used, and the processed pineapple fibre fabrics are compared with conventional materials like cotton and silk. The batik-making process, including wax application, dyeing, and wax removal, is applied to the pineapple fibre samples. The outcomes are assessed based on durability, dye absorption, and the clarity of motifs, providing critical insights into the material's suitability for batik production. The data analysis involves thematic coding of qualitative data obtained from interviews, focus groups, and observations. This helps identify patterns and themes related to the usability and sustainability of pineapple

fibres in batik-making. Experimental results are evaluated by analysing the durability of the fabrics during the batik process, the aesthetic quality of motifs in terms of clarity and vibrancy, and sustainability metrics, such as the potential for waste reduction and environmental benefits when compared to conventional textiles. The qualitative methodology is particularly suited to this research as it explores the intersection of cultural practices, material science, and sustainability. The inclusion of artisans, researchers, and agricultural experts ensures that the findings are grounded in both practical and technical expertise. The emphasis on repurposing agricultural by-products aligns with Malaysia's commitment to the United Nations Sustainable Development Goals, particularly SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action). By addressing these aspects, the study establishes a comprehensive framework for evaluating the integration of pineapple fibre into Malaysian hand-drawn batik, contributing significantly to cultural preservation and sustainable textile innovation.

4.0 Finding and Discussion

The results of this study reveal significant contributions to the sustainability and innovation of Malaysian pineapple fibre batik products through the integration of hand-drawn batik techniques with pineapple-based natural fabrics, namely Pine Cotton, Pine Silk, and Pine Fibres. The findings emphasize that these materials provide unique characteristics to the final batik products, including differences in texture, colour absorption, and motif clarity, which stem from the distinct properties of the fibres. The research further highlights advancements in the batik application process, encompassing materials, colours, techniques, motifs, and designs specific to pineapple fibres. Detailed discussions on the processes of hand-drawn batik on Pine Cotton, Pine Silk, and Pine Fibres elucidate the challenges and opportunities in utilizing these fabrics. The experiments also profile the resist and wax processes applied to these materials, providing insights into their compatibility with traditional batik-making tools and methods. Notable differences were observed among the three fabric types of terms of durability during the wax application, the vibrancy of colours after dyeing, and the clarity of motifs, which merit further analysis and discussion. Moreover, the experimentation phase revealed varied lengths and outcomes for the processes depending on the specific fabric type. Pine Cotton demonstrated excellent durability and colour retention, making it suitable for intricate motifs. Pine Silk, with its fine texture, provided vibrant colours and elegant designs but required careful handling during wax application. Pine Fibres, being coarser, yielded a more rustic aesthetic and absorbed dyes differently, resulting in unique and unconventional motifs. However, these variations in results across the three experiments require further clarification to fully understand the impact of material properties on the batik-making process.

Despite the abstract and methodology sections noting the collection of data through interviews, experimentation, and observation, the findings and discussions primarily focused on experimental results, leaving gaps in reporting qualitative data from interviews and field observations. Future revisions should integrate these insights to present a more comprehensive analysis of the artisans' perspectives, challenges, and recommendations regarding the integration of pineapple fibres into batik production.

This study's contributions extend beyond technical findings, emphasizing the importance of making these innovations known to local batik producers. By raising awareness of the potential of pineapple fibres, the research seeks to inspire producers to embrace sustainable practices and enhance the uniqueness of their products in a competitive market. Additionally, this novel pineapple fibre batik fabric offers a fresh and appealing experience for batik enthusiasts, mainly tourists, thus contributing to the growth of Malaysia's textile and tourism industries. Thus, the study underscores the need for batik producers to explore natural fibres like pineapple to innovate and sustain traditional practices. It also calls for the adoption of modern textile technology to refine these processes, ensuring their longevity and cultural significance for future generations. Through these findings, the research promotes a unified effort among batik practitioners and producers to elevate Malaysia's batik industry, blending heritage with modernity while fostering economic growth and sustainability.

Table 1 below shows the Hand Drawn Batik made from three different pineapple fabrics.

Hand-Drawn Batik Technique	Pineapple Fabric
 Fig. 1: Pine Silk (2021) (Source:) Fareez Azuan	Pineapple Silk Fabric

 Fig. 2: Pine Fibre (2021) (Source:) Fareez Azuan	Pineapple (100%) Fabric
 Fig. 2: Pine Cotton (2021) (Source:) Fareez Azuan	Pineapple Cotton Fabric

5.0 Discussion

Based on the research discussion, Table 1 shows the application of local hand-drawn batik into three different pineapple fabrics made from pineapple fibre. There are different motifs and attributions from the experimentation process. For instance, the finding, the hand-drawn batik makers found that pineapple cotton fabric gives a finesse surface than other materials. According to batik makers, the dyeing process of the pineapple cotton is much slower than the other polyester fabric, and the wax application into the pineapple cotton is also much slower than the other polyester fabric; the batik makers must wait 5 minutes for the fabric to absorb the dyed. While, for the 100% pineapple fabric takes longer than pineapple cotton and pineapple silk to absorb the dye and also to absorb the wax.The findings from the experiment were important to profile the suites pineapple fabric for hand-drawn batik application to create a finesse batik product incorporating wax absorption and dyed absorption until the end product. Moreover, society, especially hand-drawn batik producers, will recognize and know more about the outcome when they use the three different pineapple fabrics in their batik product.

6.0 Recommendation

Overall, the research findings indicate that pineapple natural fabric, when used as a medium for local hand-drawn batik, offers promising results in terms of its performance throughout the batik-making process. The experimentation conducted focused on observing the absorption of wax and dye, ultimately culminating in a finished product. The findings demonstrate that pineapple fibre-based fabrics are not only feasible for batik production but also present a unique opportunity to infuse the traditional batik-making process with innovative, sustainable materials. Collectively, the positive reception of this study, particularly at the global level, highlights the increasing demand for natural fibres that align with modern environmental and sustainability concerns. This suggests a significant opportunity for the development of sustainable alternatives in the textile industry, especially within the context of batik-making. The acceptance of pineapple fibres as a viable batik medium signifies a broader movement towards eco-conscious practices within the textile sector. This trend reflects a growing awareness among global communities about the importance of utilizing natural resources in textile production to reduce the environmental footprint. The research reinforces the idea that by exploring new, sustainable materials such as pineapple fibres, the textile industry can contribute to long-term sustainability and economic growth, especially in traditional sectors like batik.Based on the research findings, it is recommended that further studies explore the full potential of pineapple fibres in other textile applications beyond batik making.

Additionally, there is a need to investigate the scalability of pineapple fibre processing to ensure its broader applicability in large-scale textile manufacturing. This includes researching methods to optimize the production process and enhance the durability and quality of pineapple-based fabrics for diverse uses in fashion, interior design, and other textile industries.Furthermore, it is essential to continue fostering collaboration between batik artisans, textile researchers, and agricultural experts to refine further the processes of extracting

and utilizing pineapple fibres. Training and education programs should be developed to equip local artisans with the necessary skills to work with these new materials, ensuring that they can incorporate pineapple fibres into their craft with ease and expertise. By investing in both the technical aspects and the cultural knowledge surrounding batik production, the industry can support innovation while preserving Malaysia's rich textile heritage. Lastly, this study's findings should be disseminated widely through industry workshops, international conferences, and collaborations with textile and fashion brands to raise awareness.

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