Using pineapple leaf fiber as a sustainable future textile

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Abstract. The textiles of the future are environmentally friendly textiles that are non-biodegradable. These textiles can be produced from natural plant fibers. Pineapple, as a bush fruit plant, has spiny and fibrous leaves. These fiber characteristics can be used as raw material for hygroscopic textiles. This research aims to discover the process of processing pineapple leaves as textile raw material using the Practice-Led Research method with 4 stages: discover, define, develop, and deliver. The research started with grouping leaf lengths, fiber extraction, drying, combing, and splicing the fibers. Splicing can be done by tying the fibers at both ends to form a bulge, and twisting 3 to 8 pineapple fibers as weft threads on an 8-campran machine with a 60 cm comb with a density of 40 fibers according to the desired fiber twist size. The twisted fibers are combined with 60/2 warp threads to produce ageometric textile woven structure. The finished weaving results show the surface and fall of pineapple leaf fibers as a distinctive and unique textile that the public likes.

1 INTRODUCTION

Pineapple (Ananas comosus), is an annual plant in the Bromeliaceae family. This plant is a tropical plant that grows widely in Indonesia and is cultivated for its fruit. Pineapples have tapered sword-shaped leaves with a length of between 55 - 75 cm, a width of between 3 and 5.5 cm, and a thickness of between 0.18 and 0.27 cm [1]. Pineapple leaves have an outer layer consisting of an upper and lower layer. Between these layers, bonds or strands of fibre (bundles of fibre) are bound to one another [2]. Fibre bundles are arranged in a multicellular structure held together by several pectin [3].

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Fig. 1. Honey Pineapple (Source: Nahari, 2024).

Even though pineapple has a very large production of leaf fibre, so far it has not been processed adequately, due to the lack of information among farmers regarding the processing of pineapple leaves as an alternative product. As a result, pineapple leaves are underused and are sometimes thrown away without control by burning them, or allowing them to decompose freely [4].

Pineapple leaf fibre as a by-product is one of the largest productive systems in the agroindustry sector [5]. Pineapple leaves can produce competitive and high-quality fibre for textile purposes [6].

The fast fashion industry is a major contributor to environmental pollution and waste. The movement towards sustainable fashion is about minimizing the environmental and social impact of the fashion industry. For this reason, it is necessary to use natural and renewable fibres in the textile industry [7]. Pineapple fibre is a biodegradable natural fibre that can decompose naturally without causing pollution. A natural fibre that can be grown and harvested sustainably.

2 Method

This research is the creation of works of art using the Practical-Ied Research method with four stages: exploration, planning, realization and analysis [8]. The exploration stage focused on the pineapple leaf extraction process using the decorticator process. At the design stage, ideas are visualized in the weaving process by connecting and twisting the fibers. The fiber splicing process is carried out by continuously joining the end of the first fiber with the base of the second fiber to produce feed fiber. Meanwhile, thread making is done by twisting 3-8 pineapple leaf fibers into a weft thread. Fiber and pineapple leaf fiber thread are both used as a weaving structure. The embodiment process is carried out by actualizing the design into a work that is outlined in a 70 cm X 200 cm woven cloth. The weaving process is carried out by crossing weft threads made from pineapple leaf fibers or threads with warp threads made from cotton threads. Cotton thread is used because it also comes from natural fibers twisted into filaments suitable for use as warp threads. After the exploration, design and realization stages, the next stage is to carry out work analysis. Analysis of the work is carried out to explain the relationship between the work and the visual form by the curator as an analytical responsibility and visualization of the work.

3 Results and Discussion

3.1 Results

3.1.1 Processing Pineapple Leaves into Pineapple Fiber

1. Cutting and sorting pineapple leaves is intended to make it easier to group the leaves in length during the extraction process.

Fig. 1. Cutting and Sorting Pineapple Leaves. (Source: Nahari, 2024).

2. Extracting pineapple leaves into fiber is done using a decorticator.

The extraction process is intended to remove the leaf cuticle until the pineapple leaf fiber remains. In this process, 3 – 10 pineapple leaves are put into a decorticator machine by pulling the leaves alternately between the tip and the base of the leaf. The process to get maximum results can be done between 3 - 5 times in the decorticator.

Fig. 2. Pineapple Leaf Extraction Process. (Source: Nahari, 2024).

3. Washing and Scraping Fiber

Before scraping, the fibers are washed to ensure they are clean from the cuticle. The part of the cuticle that is still attached is scraped off with a palette or non-sharp flat media until nothing remains in the fiber, and then the length is flattened by cutting the end of the fiber.

Fig. 3. Washing and Scraping Pineapple Leaf Fiber. (Source: Nahari, 2024).

4. Drying

Drying takes between 3 – 7 days depending on sunlight. In the dry season, the average drying time is 3 days, while in the rainy season it can take 1 week or even more depending on the heat of the sun. On the first day of drying, the fiber is still greenish, on the second day the green color begins to fade, starting on the third day the fiber will be white.

Fig. 4. Drying Pineapple Leaf Fiber. (Source: Nahari, 2023).

5. Sweeping

Combing is carried out to untangle the twisted fibers in each fiber, making it easier to store and retrieve the fibers from spinning for later storage.

Fig. 5. Combing Pineapple Leaf Fiber. (Source: Nahari, 2024).

3.1.2 Weaving Pineapple Leaf Fibers into Cloth

There are 2 thread joining techniques. First, spin the thread or connect the thread strands using the fiber joining technique to get a small and strong knot. Spinning is done by combining two fibers with a horizontal twist to be flat and strong. The second the two ends of the fiber or thread.

Fig. 6. Pineapple Leaf Fiber Weaving Process. (Source: Nahari, 2024).

3.2 Discussions

Weaving results can be divided into 2 types. Firstly, weaving is produced from splicing fibers. Both weaves are produced due to the twisting of threads. The weaving results carried out by connecting pineapple leaf fibers with a mixture of cotton yarn and pineapple leaf fibers show a material that is not stiff, langsai, and thick. Meanwhile, the finished result of weaving from twisted pineapple leaf threads is stiff, not saggy, and thick.

Fig. 7**.** Finished Pineapple Leaf Fiber Cloth Using Pineapple Leaf Fiber and Yarn (Source: Nahari, 2024).

3.3 Evaluation of Results

a. Splicing the fibers with binding results in knots in the weaving.
b. An unequal number of pineapple fiber twists can result in an uneven weaving surface.

c. The fiber twists from the tip and base of the fiber alternately randomly on each fiber strand, making the lines and squares unequal in size.
d. The difference still has an impact on the distance between the results so the weave is not the same.
e. Unequal weft spacing affects unequal weaving spacing.

4 Conclusion

Pineapple leaves can be used as woven fiber. The manufacturing process starts with grouping the length of the leaves, extracting the fibers, drying, combing, and splicing the fibers. Splicing can be done by tying the fibers at both ends to form a bulge, and twisting 3 to 8 pineapple fibers as thread. The twisted fibers are combined with 60/2 warp threads to produce a woven structure design that is suitable for clothing and crafts. Pineapple leaf processing can be used as a substitute for polyester fiber as a future sustainable textile that is environmentally and socially friendly.

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