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Mangrove Exploration In Eco-Friendly, Sustainable Competitive Batik

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ABSTRACT
The development of the batik industry plays a significant role in environmental pollution due to its waste products, as many batik artisans use synthetic substances as dyes for their batik fabrics. Judging from its components, the use of dyes containing chemicals and the use of wax that is not soluble in water causes problems for the surrounding environment. In batik, one of the plants used for natural dyeing is mangrove. The use of natural dyes does not cause environmental problems, both in the production and use processes, and maintains ecological stability. The raw materials for making natural dyes are also obtained from renewable and relatively inexpensive sources. The colors produced from these natural materials are unique and softer on fabrics. The method used is the experimental method. The experimental method is a study that seeks to find the effect of primary data applied with secondary data obtained under controlled conditions. The object of this research uses the mangrove tree Rhizopora Sp. (Rhizopora Stylosa). In this study, natural dyes (bark and roots) of mangroves were used. The results of this study are that the color content produced from mangrove pigments is mostly brown and tends to be soft. Tree trunks and roots produce different colors. The characteristic color of mangroves is what distinguishes mangrove batik from other types of batik. While other types of batik can be determined or manipulated according to the artist's wishes, mangrove batik allows for gradations. The use of natural materials from mangroves is an innovation in batik development. Producing batik dyes from natural materials and utilizing mangroves as a dyeing agent is an exploratory effort undertaken to develop batik products.
Keywords: *Innovation, Batik, Natural Dyes, Mangrove, Environmentally Friendly*

INTRODUCTION

Background

The use of dyes is essential in the textile industry because the presence of dyes in a product makes it look beautiful and attractive. A dye is a substance used to color a product. In general, dyes are divided into two types: synthetic dyes and natural dyes (Hadita&Navanti, 2025; Sari, 2013). In the 17th century, the use of natural dyes was already known in Indonesia, which were used as dyes for batik cloth (Fazruza et al., 2018). Natural dyes are obtained by extracting certain parts of plants. The process of extracting natural dyes takes a longer time and produces less color variation, so in the 19th century, to improve color quality and time efficiency, synthetic dyes began to be created. These synthetic dyes are more practical, have high color quality, and produce a variety of colors (Fazruza et al., 2018).

The development of the batik industry is currently contributing significantly to environmental pollution due to its waste, as many batik artisans use synthetic dyes to dye their fabrics. Considering the components, the use of chemical dyes and non-water-soluble waxes has created environmental problems (Rahmadani, M., Dewi, R & Fitriana, 2022). The use of chemicals in the batik industry can cause health problems such as irritation and other skin disorders in the form of itching, dry and cracked skin, redness (blisters), erythema (spotted skin), and so on. Furthermore, it can have environmental impacts such as water and soil pollution, which also indirectly impact human health due to the presence of hazardous heavy metals such as lead (Pb), copper (Cu), and zinc (Zn) (Manurung, 2012). Consequently, several countries have banned the use of chemical-based dyes. Therefore, the development of naturally derived dyes, utilizing biodiversity, has begun.

In batik, one of the plants used for natural dyes is mangroves. Mangroves are a species of Rhizopora sp. Mangroves are coastal plants that can protect the coast from the impact of sea waves that cause abrasion. In Muara Gembong, Bekasi, from 2009 to 2019, the mangrove ecosystem was 1,017,746 hectares, with a reduction of 275.37 hectares. Furthermore, 255,057 hectares of mangrove land remained between 2009 and 2019. Therefore, land changes, including mangroves, in the Muara Gembong sub-district tended to

increase mangrove area, with a 66% increase in mangrove area (Maulani, 2021). The use of natural dyes does not pose environmental problems during production or use, and it maintains ecological stability. The raw materials for natural dyes are also obtained from renewable and relatively inexpensive sources. The colors produced from these natural materials are unique and gentler on fabrics. They can vary from one source to another, and some materials contain antibacterial and anti-allergenic substances (Riwayati et al., 2016). The use of natural dyes also has several drawbacks: the resulting colors are less intense and require a longer process to produce dyes ready for use. Based on the above description, the researchers are interested in conducting a study entitled "Color Innovation from Mangroves for Sustainable, Environmentally Friendly Batik Competitiveness." The urgency of this research is that conventional production processes using synthetic raw materials can damage environmental sustainability. Therefore, innovation in natural dyes is needed to replace synthetic dyes so that batik production can develop without harming the environment. The specific objective of this study is to identify the quality of the color content of mangrove plants as a natural batik dye.

LITERATURE REVIEW

Batik

Batik is an Indonesian cultural heritage recognized internationally. In 2009, UNESCO designated batik as a Masterpiece of Oral and Intangible Heritage of Humanity (Rizal et al., 2022; Prabowo, 2024). Batik is not simply patterned fabric, but a medium of cultural expression rich in symbolism and profound meaning (Maarif, 2020; Rangkuti et al., 2021). Each batik motif has a unique story and meaning, reflecting the outlook, values, and philosophy of the society that created it (Ma'arif et al., 2020; Hadita&Navanti, 2025).

Batik Dyes

Based on their source, textile dyes are classified into two categories: Natural Dyes (ZPA) and Synthetic Dyes (ZPS). Initially, the textile dyeing process used natural dyes. However, with technological advances and the discovery of synthetic dyes for textiles, the use of natural dyes has diminished (Hasibuan, 2024).

Natural Dyes

Natural dyes are sourced from plants, animals, and microorganisms (Pujilestari, 2015). Natural dyes are found mostly in plants. To obtain these dyes, they must be extracted or fermented from the parts of the plant that contain the most dye (leaves, wood, bark, roots, flowers, fruit skins, seeds, or seed coats) (Bayu, 2017).

Mangroves (Rhizophora Stylosa) as Natural Dyes

Figure 1. Mangrove Tree Rhizopora Stylosa

a. Classification

Division: Spermatophyta; Subdivision: Angiospermae; Class: Dicotyledonae; Subclass: Dialypetalae; Order: Myrtales; Family: Rhizophoraceae; Genus: Rhizophora; Species: Rhizophora sp.

b. Parts Used

Parts used for the dyeing process are the bark, leaves, fruit, and roots.

c. Chemical Content

Almost all parts of the Rhizopora sp. (Rhizopora stylosa) plant contain alkaloids, saponins, flavonoids, and tannins. Alkaloids are toxic to microbes, making them effective in killing bacteria and viruses. Tannins are complex phenolic compounds that can inhibit bacterial activity. Therefore, plants containing tannins are often used in the pharmaceutical industry because tannins contain tannic acid, which has been used as an antiseptic. Furthermore, tannins are also commonly used as dyes, adhesives, and mordants. Therefore, the dyeing process using mangroves as the base material can be carried out without the mordanting process, which is intended to facilitate the penetration and binding of dyes to the fabric fibers.

RESEARCH METHODOLOGY

Data Sources

The method used was an experimental method. Experimental research attempts to determine the effect of primary data applied to secondary data obtained under controlled conditions. The object of this research was the mangrove tree Rhizopora sp. (Rhizopora stylosa). This study used natural dyes (bark and roots) from mangrove trees (Hasibuan&Wiratma, 2024).

Research Stages:

This research was conducted in several stages, namely:

1. Experimental preparation stage: Preparation of fabric materials, production of mangrove extract from bark and roots.
2. Experimental stage: Batik making, dyeing, and dyeing.

Conceptual Framework

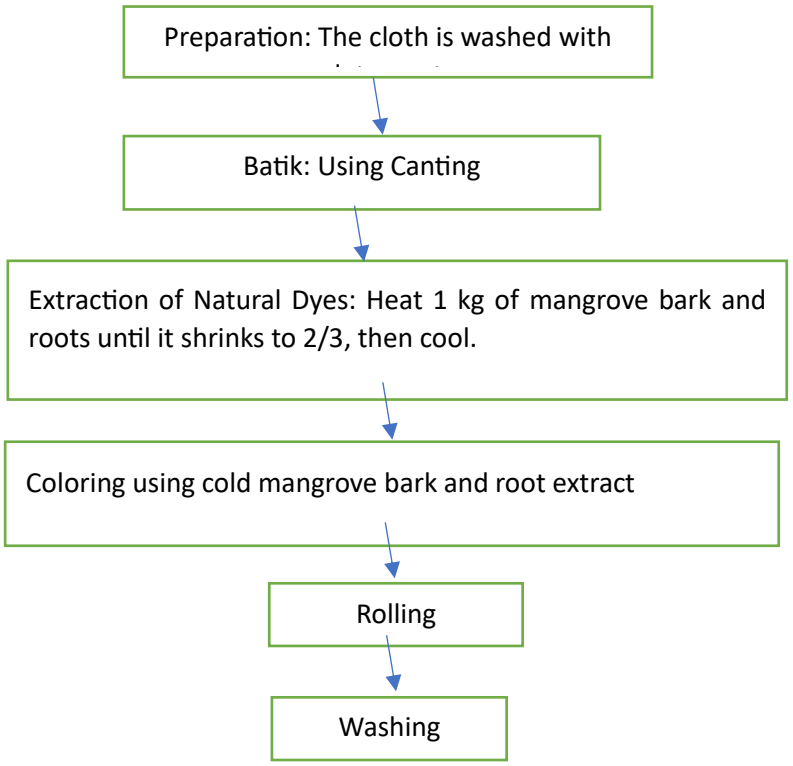


Figure 3.1 Conceptual Framework of the Research

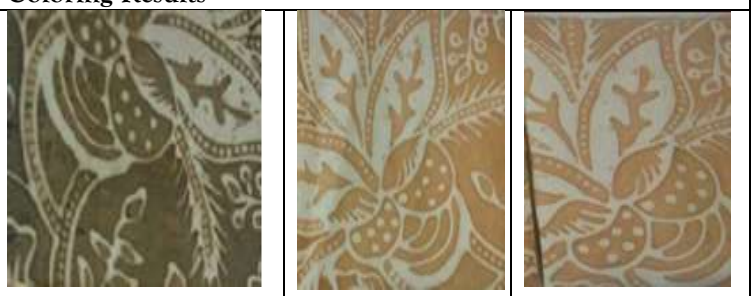
DISCUSSION RESULTS

Research Results

Results of Batik Fabric Dyeing with Mangrove Extract from Bark and Roots:

1. The results of dyeing batik fabric with mangrove bark extract tended to produce dark gray, milk chocolate, and light brown colors.
2. The results of dyeing batik fabric with mangrove root extract tended to produce greenish gray, reddish brown, and light brown colors.

Table 4.1 Comparison of Bark and Root Dyeing Results

No.	Mangrove Dye Material	Coloring Results
1.	bark	
2.	Root	

Research Discussion

Exploring batik dyes utilizing the uniqueness of mangroves as a dyeing medium, the process of making mangrove batik is indeed different from other batiks (Lubis et al., 2020). Mangrove batik is made from mangroves, and its raw materials are derived from mangroves, and its designs are also shaped like mangroves. The dyeing process for mangrove batik is natural, with the dye boiling process taking 10 days (Wibowo DS Drajad et al., 2023). The dyes used in mangrove batik are predominantly derived from mangrove waste, including calyptropis, taro, pah, bringtonia, and helgua gimnoriva. The colors produced from mangrove pigments are mostly brown and tend to be soft (Maarif et al., 2020). Fruit, leaves, and stems produce different hues. These characteristics of mangrove color distinguish mangrove batik from other types of batik. While other types of batik can be determined or manipulated according to the batik maker's wishes, mangrove batik's colors can gradate (Mujahiddin et al., 2021).

This color gradation is what determines the uniqueness and uniqueness of mangrove batik, as the color gradation process occurs naturally due to the nature of the dye itself. Meanwhile, the equipment for making mangrove batik is also quite simple: a small stove, a canting (hand-held tool), a brush, and other unique tools (Prabowo et al., 2024). Furthermore, a special soap is also used to wash mangrove batik. Because of the delicate nature of batik, washing it requires careful handling (Ritonga&Ernanda 2024).

Figure 4.1 Mangrove Natural Batik Dye

The use of natural materials from mangroves is an innovation in batik development. Producing batik dyes from natural sources and utilizing mangroves as a dye is an exploratory effort undertaken to develop batik

products (Ginting et al., 2024; Irawati et al., 2020). In terms of quality, mangrove dyes are essentially the same as other natural dyes. However, they are still relatively new. They can even produce somewhat brighter colors, but often with softer finishes (Hadita&Navanti, 2025). Technically, the difficulty level of mangroves is similar to other materials. The suitability of the material, as well as its quality and durability, is the same as other natural materials that have also been tested (Ihsan&Utami, 2022).

CLOSING

CONCLUSION

Mangrove batik is a batik development based on explorations based on the natural coastal environment, namely coastal areas abundant with mangrove plants and forests. This presents potential for coastal batik development, particularly in the dyeing medium. This experimental study yielded findings with the following conclusions: (1) Mangrove waste, particularly leaves and stems, produces different colors and can be used as an environmentally friendly batik dye characterized by soft, monochromatic brownish colors and a classic feel. (2) The use of mangrove waste as an environmentally friendly batik dye is a form of nature conservation that impacts the cultivation and maintenance of mangrove plants.

Recommendations

From the results of this study, the following recommendations can be made:

1. Batik artisans should continue to develop batik through exploration, including exploring natural mangrove dye media and batik motifs based on the natural, physical, and socio-cultural environment.
2. The community should develop a love and pride in batik production and also develop an interest in becoming batik artisans, either as artisans or as batik entrepreneurs. They should protect and cultivate mangrove plants in coastal areas and utilize their waste as a dye medium for batik.
3. The local government should provide support for the development of batik by providing facilities to batik artisans in the form of capital, training, promotion, and product marketing.

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