Batik Grajen: Eco-friendly batik utilizing wood waste for batik dye

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Abstract. Grajen Batik is batik which coloring process uses natural dyes from grajen (sawdust) waste. Batik Grajen was developed by batik artisans in the Bulakan area, Sukoharjo, Central Java. The development of Batik Grajen is ecologically alluring since the Bulakan community processes sawdust from the sawmill industry into eco-friendly batik dyes. Sawdust (grajen) waste is used as batik dye because of the pigment contained. The dyes produced are safer and more eco-friendly than synthetic dyes. The effort made by the Bulakan community through Batik Grajen products is a creative solution to respond to environmental problems, especially waste problems that can be recycled into creative products with economic value.

1. Introduction

In the past, Indonesian people have known various ways to color the fabric using natural dyes. The flora richness in Indonesia provides a variety of plants containing dyes that can be applied as a fabric dye. Plants such as the bark skin of the Tingi (Ceriops tagal) tree produce brown color, the leaves of the Tarum (Indigofera sp) tree generate blue color (indigo), the bark skin of Tegeran (Cudrania javanensis) tree, and turmeric give yellow dye, and the roots of the Noni (Morinda citrifolia) tree create red color.

A variety of natural dyes is also used to color batik cloth. The natural dyes are often considered exclusive traditional batiks, such as brown soga, blue tarum, and red noni. The use of natural dyes in various forms can display the place of origin of the user and the tradition of the fabric produced. Brown soga in combination with blue (indigo) is commonly found in the Kraton Solo and Jogja style batik, while red, yellow, and green noni colors are widely used in coastal batik fabrics.

Until the end of the 19th century, batik cloth dyes use natural materials such as teak, noni, soga, indigo, tingi, tegeran, mahogany, and others [1]. Later in its development around the end of the 19th century following the discovery of synthetic dyes (indigosol, naphthol, and rapid), batik cloth dyes began to utilize synthetic colors. The use of synthetic dyes resulted in a faster and more effective batik production process, as well as provides many color choices from dark to bright colors.

Given the widespread distribution of synthetic dyes, the use of natural dyes for batik has begun to be abandoned. The renunciation of natural dyes is because the process of making them consumes more time, natural colors will not last in the storage phase before the coloring process, and the durability of natural colors is easy to fade. Likewise, in the coloring process (through dyeing) it takes more time and must be repeated in order to produce better color.

On the other hand, the widespread use of synthetic dyes for batik leads to environmental problems in the form of pollution from batik waste [2]. Batik waste comes from the washing process which
requires large amounts of water as a medium. This process generates large amounts of wastewater and contains toxic synthetic dye residues [3]. Synthetic color waste can endanger public health and poison the environment.

The number of pollution cases due to synthetic dye waste and the awareness of batik artisans as well as batik consumers of the effects of batik waste prompt natural dyes to be reused. Natural dyes are considered more eco-friendly and safe for consumers (non-allergic). The return to nature movement, the fear of pollution effects by synthetic dyes that may cause cancer, and the desire of batik artisans to produce unique products have encouraged the rise of natural dyes use [4].

The area that develops batik products using natural dyes is Batik Grajen in Bulakan Sukoharjo, Central Java. Grajen batik is batik which coloring process uses natural dyes derived from wood cutting waste in the form of sawdust (Javanese: grajen). This article will discuss how Batik Grajen is produced applying natural dyes obtained from wood waste and how these natural dyes are safe for the environment and human beings. This article examined the batik Grajen artisans in making batik cloth, the coloring process, and the results of eco-friendly batik cloth.

2. Methods
This article is based on qualitative research with a design approach. A design approach is to find something that does not only come from sensory data but also other complex and multidimensional data. In this study, the design approach is to examine concrete-physical-tangible objects and abstract-non-physical-intangible objects. Concrete objects are in the form of descriptions or analysis of physical, material, or tangible forms, and can be in the form of interpretations of the abstract contents behind them such as values, ideas, and meanings [5]. In particular, the interpretation of batik products used a visual research method based on the thoughts of Hannula et al. in which this method is used to investigate, interpret, and record the socio-cultural context of visual products based on fieldwork [6].

3. Results and discussion
Batik Grajen is located in Bulakan Village, Sukoharjo, Central Java. Historically, Batik artisans in Bulakan Village have been existing for 70 years ago. Initially, the batik artisans in Bulakan deposited their batik products with batik merchants in Surakarta. The process of batik deposit took decades until the batik artisans in Bulakan village mastered parang, kawung, broken coffee, and tirtotejo motifs. These motifs developed in Bulakan village as a result of traditional motif influence developed by batik merchants in Surakarta.

Figure 1. The immersion of grajen and wood chip waste to extract color. Photo F Fitriani, 2019.
Over time, batik produced in Bulakan village not only produced batik cloth in the form of raw materials which were deposited to Surakarta, but Bulakan batik began to enter the process of dyeing batik using synthetic dyes. The use of synthetic dyes gave an environmental impact around the batik production site in Bulakan village because there was no place to manage batik dye waste. The batik artisans disposed of the dye waste into the water disposal stream (river) without any proper waste treatment process. Batik waste from synthetic dyes containing hazardous chemical levels eventually polluted the surrounding environment.

Some batik artisans in Bulakan finally realized the environmental impact of using synthetic dyes. They began to switch to using coloring materials from nature that would not pollute the environment. One of the artisans who use natural dyes is Mrs. Darsono, the owner of 'Sari Rejeki' batik. The owner of the batik came up with the idea of using natural dyes by utilizing wood waste. The idea of using wood waste emerges since Bulakan Village is one of the fastest-growing furniture centers in Central Java. Furniture companies produce fairly large wood waste daily which is used as fuel for the wood drying process, and also sawdust waste (grajen) that has not been used optimally.

Table 1. Colors produced from mahogany waste using 3 types of fixators

| No | Figure | Batik Name | Fixator |
|----|--------|------------|---------|
| 1  | ![Image](image1.jpg) | Parang Pecut | Tunjung |
| 2  | ![Image](image2.jpg) | Parang Pecut | Lime |
| 3  | ![Image](image3.jpg) | Lereng Slobog | Alum |

The grajen waste produced from the wood sawmill (in Bulakan there are twelve sawmill production units) approximately reaches forty eight cubic meters of grajen waste per week. Grajen waste is the result of sawdust from cutting mahogany, teak, and mindi wood. The abundant grajen waste is used by batik artisans as natural dyes for batik coloring. The use of grajen waste for batik...
dyes has benefitted in terms of the uniqueness of the color generated. The *grajen* waste produces a unique and different brown color compared to other natural dyes sold in the market.

For *grajen* waste to be used as batik dyes must undergo a color extraction process (Figure 1). The process of color extraction is following the procedure by mixing *grajen* waste with pieces of wood that can no longer be used and are soaked for about one day. The immersion will produce the color that appears from *grajen* and wood chips. After the extraction process, the resulting color is boiled for one day, then filtered to separate the dye from impurities and *grajen* waste powder. The process of making color from *grajen* waste utilizes an iron drum. This affects the resulting dye, which produces a darker color. The iron content in the drum contains acids such as fixators that result from the *tunjung* which makes the final color to be darker.

To make the final color on the fabric (materialized) last, a fixator agent is required. Batik artisans in Bulakan village apply three types of fixators as locks to produce different colors. The fixators are: (1) *tunjung* which is a strong acid to darken the color. (2) Lime which can bring out the true color from *grajen* waste dye, as well as alum which produces a lighter color than the original color produced by natural dyes (Table 1 and 2).

Table 2. Colors produced from teak wood using 3 types of fixators

| No | Figure | Batik Name | Fixator |
|----|--------|------------|---------|
| 1  | ![Figure 1](image1.png) | *Parang* | *Tunjung* |
| 2  | ![Figure 2](image2.png) | *Tumpal Bunga* | *Lime* |
| 3  | ![Figure 3](image3.png) | *Tirtotejo* | *Alum* |

*Grajen* batik waste produces different brown soga colors. It depends on the type of wood waste used in the coloring process. The *grajen* waste in Bulakan village consists of three types of wood,
comprising mahogany, teak, and mindi wood. Each wood entails different tannins (wood color); mahogany produces a reddish-brown (soga; Figure 2), teak creates a blackish color (Figure 3), and mindi wood powder does not produce color but can affect the color of batik. Grajen waste itself is a mixture of those three kinds of wood.

The content of grajen waste from a mixture of three different kinds of wood will affect the color results of the extraction process. Batik artisans must understand wood type that dominates grajen waste, for instance, grajen waste is dominated by mindi wood, resulting in poor color or failing to appear. On the other hand, if the grajen waste is dominated by mahogany and teak wood, it will produce different colors depending on the amount of wood in the grajen waste.

![Figure 2. Grajen waste which contains a lot of mahogany wood produces a reddish-brown color. Photo F Fitriani, 2019](image)

![Figure 3. Grajen waste which contains a lot of teak wood produces dark brown and black colors. Photo F Fitriani, 2019](image)

The dyeing technique of batik cloth carried out by batik artisans of grajen waste is the tie dye technique, in which the coloring starts from the lightest color to the darkest color. The color barrier uses wax which is inscribed onto the fabric using a canting. This color barrier not only prevents colors from leaving the color area but also uses canting to form batik motifs (pictures and ornaments). After the coloring process is complete, the next process is penglorodan, which is the process of removing wax from the fabric by boiling it in hot water.

The wax used to block the color of the grajen waste is the number one quality wax. The use of high-quality wax takes into account that the dyeing process of natural color from grajen waste is not done once, but up to 60 dyes or more depending on the intended color. If using ordinary wax, the wax will crack and break during dyeing, leading to the penetration of unwanted color.

4. Conclusion
The use of grajen waste for batik coloring in Bulakan shows how batik artisans become aware of and concerned about environmental issues. Batik artisans have consciously switched from synthetic dyes to natural dyes, which are from grajen waste. The use of natural dyes is prudent for the environment
(does not cause water pollution in the batik center area). Even the remaining dye from *grajen* waste can be reused as fuel to make batik color extraction. The utilization of *grajen* waste in making batik is optimal so that it does not pollute the environment. In conclusion, *Grajen* batik is deemed close to zero waste.

**References**

[1] Kerlogue F 2004 *The Book of Batik* (Singapore: Archipelago Press)

[2] Anshori A and Kusrianto A 2011 *Keeksotisan Batik Jawa Timur* (Jakarta: Elex Media Komputindo).

[3] Fendi and Kurniati D 2016 *J. Ilmu Pertanian Indonesia* **21** 167-171

[4] Haerudin A and Farida 2017 *Limbah serutan kayu matoa (Pometia pinnata) sebagai zat warna alam pada kain batik katun* (Yogyakarta: Balai Besar Kerajinan dan Batik)

[5] Piliang Y A 2010 *Pendekatan dalam Penelitian Desain: Pelbagai Perkembangan Paradigma* dalam Walker JA. *Desain, Sejarah, Budaya: Sebuah Pengantar Komprehensif* (Yogyakarta: Jalasutra)

[6] Hannula M 2005 *Artistic Research: Theories, Methods and Practices* (Helsinki: Academy of Fine Art, Helsinki Finland)