Fabric Coloring using Cuscuta as A Form of Environmental Sustainability

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Abstract. Synthetic dye liquid waste causes various problems, one of them is environmental pollution. There are 5 rivers in Pekalongan in which all are black due to the contamination of synthetic dye liquid waste from the batik industry. The five rivers contain Chemical Oxygen Demand (COD) 230 mg / L at the upstream and 157 mg / L at the downstream, while the maximum COD content should only be 50 mg / L. The use of natural dye in batik production alters the use of synthetic dyes and reduce its hazards. Natural dyes, in general, can be extracted from plant parts such as roots, stems, leaves, bark and flowers to be used as an alternative to batik dyeing. The sustainability problem arises when these plants are continuously used. Weeds can be used as an alternative for natural dyes. Weeds are plants that are parasite for other plants, therefore the use of weeds as natural dye can help eradicate them from the main crop. This research was conducted by experimenting the weed extraction on cotton cloth. Furthermore, the dyeing was tested for its color direction using a color catalog. The purpose of this study was to examine the direction of color produced by cuscuta with vinegar mordant

1. Introduction
Batik is an interesting topic to discuss, including the techniques and types of coloring. Currently, natural dyes for batik has been a main choice as it is environmentally friendly. It is chosen to alter the many damages caused by synthetic dyes. The data shows that rivers in Pekalongan, a city with one of the largest batik industries, contain 230 mg / L of Chemical Oxygen Demand (COD) in the upstream and 157 mg / L in the downstream, while the maximum COD content should only be 50 mg / L (Maghfiroh, et al. 2018). Synthetic dye waste endangers human health and indirectly poison the environment (Handayani & Maulana, 2014). Liquid waste that indirectly contacts with human skin will cause itching, heat, dry and hard skin due to its chemicals agents. The chemical is 7.0 mg/ L chromium or heavy metal which can cause cancer (Andriani, 2017).

Natural dyes can be used as an alternative by the batik makers and alter the use of synthetic dyes to reduce the hazards it causes. Natural dyes are thought to be helpful in reducing the usage of chemical agents, which helps to solve pollution issues (Kusumastuti, et al. 2019). In general, natural dyes can be produced by extracting the plant parts such as roots, stems, leaves, bark and flowers. Many batik
makers have found various types of natural dyes, such as indigo, tegeran bark, secang, rosella flowers and others. Other than the use of natural dyes, there is still a problem about it, which is the sustainability of these plants. If they are used continuously, the environmental balance will be disturbed. Weeds are presumed to be an alternative for natural dyes.

Weeds are unwanted plants that grow on the main crop. Many researches on weeds are limited to substances or methods of eliminating weeds as parasites. Experiments of dye produced from weeds were carried out and resulted in several different colors using different types of color generator or mordant. Previous experiments still did not define the color direction clearly. One of the weeds experimented was Cuscuta. The purpose of this study was to determine the direction of color produced by Cuscuta using vinegar mordant. Natural dyes made of cuscuta can be an alternative used by batik makers to produce a good quality batik that is environmentally friendly without producing harmful liquid waste resulted by synthetic dyes.

2. Literature Review
Batik is an Indonesian textile in which the motif is made by using the rintang dyeing technique using wax as a color barrier which is attached using canting and stamp canting (SKKNI, 2018). The batik coloring process consists of synthetic dyes and natural dyes. Natural dyes have grown in popularity as an alternate choice for textile dyeing. Natural colors are less allergic and poisonous than synthetic dyes, and they produce wastewater that may be cleaned by biodegradation. (Dos, et al. 2020). Natural dyes are pigment dyes derived from plants, animals, and minerals. (Sulistyani, 2015). Natural colors for textiles are often obtained by extracting various plant components such as roots, wood, leaves, seeds, or flowers.

Natural Dyes Extraction Process
Cuscuta is extracted by the boiling, which is to boil the ingredients used as natural dyes to produce the desired color. The boiling process is carried out until half of water remains (50% of the initial water volume (Pujilestari, 2014). The amount of natural color solution needed depends on the amount of fabric dyed. The usual ratio used is 1:10. For example, 1 kilogram of fabric should be dyed using 10 liters of it. The Ph Solution has a significant impact on dye extraction. The optimal pH for pH solution was discovered to be 12 after extensive research. (Kusumastuti et. al, 2019).

Batik Coloring Process using Weeds
Weeds are plants that are not wanted by humans. Weeds competes for life with the main crop. The weeds used in this study was Cuscuta.
As a form of innovation, weeds need to be tested as an alternative to natural dyes for batik. Weeds as batik dyes were processed by boiling it. The fabric used in the dyeing experiment using cuscuta was cotton fabric. The dyeing process to produce color from cuscuta was carried out using the post mordanting technique. The steps are as follows: (1) preparing a cuscuta extract-based natural dye solution (2) soaking the fabric in the solution for ± 7 minutes, turning it over until the solution is evenly absorbed on the cloth; (3) draining and aerating the fabric; (5) the dyeing and drying process is carried out for approximately 10 times; (6) the dyed cloth is then added to the mordant solution, which is vinegar.

Mordanting
Natural dyes, for the most part, require a mordant to be bonded onto the fiber. (Jothi, 2008). Mordanting is the process of treating textile fabric with metallic salts or other complex forming agents that bind natural mordantable colors to the textile strands (Samanta & Agrawal, 2009). Mordan is a color generator that helps in absorption and fixation of natural dyes (Prabhu & Bhute, 2012). The research result showed that the mordant used had a color effect and was resistant to dyeing (Gong, et al. 2020). The mordanting technique is carried out in 3 ways, which are: (1) pre mordanting, the dyeing of the material which is done by dipping the material first in a metal compound and then dyeing it with a dye; (2) simultaneous mordant (metachrom, monochrom), the fabric was dyed using dipping solution that must consist of dye and mordant substance; (3) post mordanting, immersing the material in a dye solution then followed by working the mordant using metal compounds. Mordan has been shown to have strong color retention and fastness properties (Sheikh, et al. 2016).

3. Method
The research method used is the experimental research method. The experimental method was applied in the dyeing process using cuscuta parasites and vinegar mordan, then the result was then tested for color direction. The color direction test was carried out using a color catalog. The color that resembles the dyeing result is the color direction of the fabric. The following is the catalog of colors used.

![Figure 2. Color Catalog](image-url)
4. Result and Discussion

The test results on the color direction test are shown in table 4.1.

| Immersing result | Color Catalog |
|------------------|---------------|
|                  | **parmesean** |

| Table 1 | Results of the Cotton Fabric Coloring on the Color Direction |
|---------|-------------------------------------------------------------|

The test for color direction or color difference of the fabric was carried out by using a color catalog to determine which one was close to the color of the dyeing result. The resulting color direction tends to yellow. According to table 4.1, the results of cotton cloth dyeing in the cuscuta extract dye with mordant vinegar produce a parmesean color. It can be seen that the color is quite bright.

Vinegar mordant proves to be able to bind colors and produce bright colors. This fact is supported by the research results on eco print coloring of cotton fabric using teak leaves (Tectona grandis) and vinegar mordant in which 77, 22% of panelists stated bright color. The use of vinegar mordant can make the colors to be brighter (Masyitoh & Ernawati, 2019).

5. Conclusion

Weeds are proven to be able to produce colors in fabrics. The use of different mordants will result in different levels of lightness (hue). Vinegar mordant produces a light color. The color direction produced based on the color catalog is parmesean.

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