The impact of the use of different mordant types on the ecoprint dyeing using tegeran (*Cudraina javanensis*) dye on primisima fabric

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Abstract. The purposes of this study are (1) to determine the effect of mordant tawas, tunjung, and tannins on the ecoprint dyeing result using tegeran (*Cudraina javanensis*) dye on primisima fabrics (2) to find the best results in ecoprint dyeing using different types of mordant including the pattern clarity, colour sharpness, colour fairness, and colour absorption. The method of this research is experimental. The independent variables are mordant tawas, tunjung and tannins. The dependent variables are the ecoprint dyeing results including the pattern clarity, colour sharpness, colour fairness, and colour absorption. The control variables are tegeran (*Cudraina javanensis*) dye, mordanting technique, and primisima fabric. The data of the study were collected by using observation. Based on the test of pattern clarity, colour sharpness, colour fairness, and colour absorption, the best ecoprint treatment is shown in sample C, which is the ecoprint treatment using mordant tunjung on the main fabric, tegeran (*Cudraina javanensis*) dye on the blanket, and mordant tawas in the fixation.

1. Introduction

Sustainability design is a design that is made in the long term, environmentally friendly, and continues to improve in quality following social and environmental development [1]. Sustainability design in the field of fine arts and design can develop from the interior, product, and textile fields. In the textile sector, one of the issues that are currently developing and also of great interest is the environmental issue, namely in the process of making clothing and its decomposition, it is still environmentally friendly, which is known as Eco-fashion.

Eco-fashion is a form of environmentally friendly fashion industry using organic raw materials, low in the use of chemicals both in the production process and in the colouring process, in the production process using environmentally friendly and durable materials [2]. Natural dye is one of the many potential ways to develop eco-fashion [3]. The natural dye technique is a colouring technique that uses natural dyes the absorbed colour will blend with the fibres in the fabric, so it can withstand friction and washing. Over time, natural dye techniques are increasingly developing with various new findings, one of which is the ecoprint technique. Ecoprint technique defined as a process to transfer colours and shapes to fabrics through direct contact [4]. Flint applies this technique by attaching plants that have colour pigments to cloth which are then boiled in a large cauldron. The plants used are also plants that have high sensitivity to heat, because it is an important factor in extracting colour pigments.
Dyeing is a process of transferring the dye to the substrate to get the permanent colour [5]. The method used for dyeing depends on chemical structure as well as physical characteristics of the dyestuff as well as the fibres. This means staining is the process of transferring dye to the substrate to get permanent colour. The method used for dyeing depends on the chemical structure as well as the physical characteristics of the dye and the fibre. In the dyeing process, both natural and synthetic, additional substances are needed, namely mordant.

Mordant serves to form a chemical bridge between the dye and the fibre so that the affinity (attraction) of the dye increases to the fibre and is useful for producing good colour [6]. Several types of mordant can be used in the colouring process including tawas, tunjung, baking soda, quicklime, salt, etc. The process of applying mordant to staining can be done by several techniques, namely preliminary mordanting (pre-mordanting), simultaneous mordanting (meta-Chrom, monochrome), and final mordanting (after chrome).

Natural dyes began to be widely reused by batik craftsmen. Natural dyes are considered cheaper because many raw materials are obtained in Indonesia, with an easy extraction process and provide a unique and elegant colour direction [7]. Natural dyes can come from plants or animals and are present in the form of pigments that already exist or are formed in certain processes [8]. Most natural dyes are brown without any variation in the direction of the primary colour [9]. Previous studies on the application of natural resources as colourant have been done [10-12]. One source of natural yellow dye is Tegeran (Cudrania javanensis) wood [13].

Tegeran has the Latin name Cudrania javanensis Trécul (Synonym: Maclura javanica Blume/ C. cochinchenensis (Lour.)/M. cochinchenensis) and yellow wood, is a plant widely distributed in South Asia (Himalaya Mountains, Nepal, and India), East (Japan) and Southeast (Malay Peninsula, Papua Island, Bismark Island, New Caledonia to Eastern Australia). The tegeran (Cudrania javanensis) tree grows branches to a height of 10 m in the lowlands to an altitude of 1800 m above sea level, with branches with a diameter of 10-15 cm, the surface of the trunk is rough, sharp thorns and contains sap. The bark is light gray to brown, the leaves are elliptical, clustered, and have fairly large [14]. In Indonesia, tegeran (Cudrania javanensis) wood is also used as a fever medicine, a decoction of its roots can relieve coughing, the leaves and fruit can be eaten raw. As a dye for batik cloth, Tegeran (Cudrania javanensis) wood is used with the bark of Ceriops tagal (Perr.) C.B. Robinson (Soga tingi) and Peltophorum pterocarpum (DC.) Backer ex K. Heyne (Soga jambal) to make soga colour. Compounds found in the bark and wood of tegeran (Cudrania javanensis) include flavonoids, alkaloids, steroids, saponins, and tannins [15]. The main flavonoid in tegeran (Cudrania javanensis) wood is morin which gives silk its yellow colour [16].

2. Method
This study uses the type of experimental research. Experimental research is research that is intended to determine whether or not there is a result of "something" imposed on the subject under investigation [14]. This type of experimental research is a way to find a cause-and-effect relationship (casual relationship) between two factors that are intentionally, caused by the researcher by eliminating or reducing or setting aside other disturbing factors. The purpose of experimental research is to try to examine whether or not there is a cause-and-effect relationship, by comparing one or more experimental groups that are treated with one or more comparison groups that do not receive treatment.

The independent variables were mordant tawas, tunjung and tannins. Dependent variable: ecoprint colouring results include motif clarity, colour sharpness, colour evenness, and colour absorption. Control variables: natural dye tegeran (Cudrania javanensis), mordantting technique, primisima fabric. Variable Operational Definition
a. Independent Variable
In this study, the independent variables used were mordant tawas, tunjung and tannins.

b. Dependent Variable
This study using the dependent variable, namely the results of ecoprint colouring including motif clarity, colour sharpness, colour evenness, and colour absorption
c. Control Variable

The control variable is the variable or object of research that is used as a benchmark in the treatment of the object. In this study there are control variables, namely:

1) natural dye tegeran (*cudraina javanensis*)
2) mordanting technique
3) primisima cloth
4) Same fabric size
5) same way of making
6) People who do the same

Research design is a design made to avoid deviations in collecting data. The design of this research (table 1) is an experimental study that uses 6 samples of ecoprint treatment.

| Mordant Type on Main Cloth (X) | Blanket cloth using tegeran (*cudraina javanensis*) natural dyes (Y) | Fixation using Tawas Mordant (Z1) | Fixation using Tunjung Mordantt (Z2) |
|--------------------------------|-------------------------------------------------|----------------------------------|-------------------------------------|
| Tawas (X1)                    | X1YZ1 = Sample A                                 | X1YZ2 = Sample B                 |                                     |
| Tunjung (X2)                  | X2YZ1 = Sample C                                 | X2YZ2 = Sample D                 |                                     |
| Tanin (X3)                    | X3YZ1 = Sample E                                 | X2YZ3 = Sample F                 |                                     |

Information:

Sample A = The main fabric using tawas mordant, blanket fabric using tegeran (*cudraina javanensis*) dye, and fixation using tawas mordant

Sample B = The main fabric using tawas mordant, blanket fabric using tegeran (*cudraina javanensis*) dye, and fixation using tunjung mordant

Sample C = The main fabric using tunjung mordant, blanket fabric using tegeran (*cudraina javanensis*) dye, and fixation using tawas mordant

Sample D = The main fabric uses a tunjung mordant on the main fabric, the blanket fabric uses a tegeran (*cudraina javanensis*) dye on the blanket fabric, and fixation uses a tunjung mordant

Sample E = The main fabric uses tannin mordant on the main fabric, blanket fabric uses tegeran (*cudraina javanensis*) dye, and fixation uses tawas mordant

Sample F = The main fabric using tannin mordant, blanket fabric using tegeran (*cudraina javanensis*) dye, and fixation using tunjung mordant

The data collection method is a method that can be used to collect data in a study. Data collection aims to obtain the data needed to form the reality and description of a specified object. To obtain objective conclusions. The data collection method used in this research is the observation method. Observation method is an activity of focusing attention on an object by using all the senses [14]. In the checklist, there are research guidelines for each aspect observed, in the form of the criteria for Ecoprint staining results on primisima fabrics with different types of mordant used. Data collection was carried out by 40 people, consisting of 8 lecturers of Fashion Design, PKK Department, Faculty of Engineering, and 32 students of the Fashion Design study program who had taken the Textile Design course.

3. Results and Discussion

Ecoprint making tools and materials: leaves, TRO, tawas, tunjung, tannins, soda ash, symplocos, tegeran (*cudraina javanensis*) and primisima cloth. Steps of making Ecoprint: (1) sourcing process: soak the primisima cloth in the TRO for 15 minutes. TRO size is 3 tablespoons: 10 liters of water. Then rinsed and dried not under the sun; (2) pre mordantt: soak the cloth into a solution of Tawas (14 grams) + US Soda (6 grams/liter) for 8 hours. Then rinsed and dried; (4) post mordant: the main fabric treatment process is soaked in tawas / tunjung / tannin solution, the leaves are soaked in a tunjung solution. The blanket cloth is soaked in a tegeran (*cudraina javanensis*) dye. Then the ecoprint treatment is according to the research design according to table 1.
Fixation

Fixation results according to the research design are as illustrated in Figure 1 to Figure 6.

a. Sample A = The main fabric using tawas mordant, blanket fabric using tegeran (*cudraina javanensis*) dye, and fixation using tawas mordant

![Figure 1. Sample A](image)

b. Sample B = The main fabric using tawas mordant, blanket fabric using tegeran (*cudraina javanensis*) dye, and fixation using tunjung mordant

![Figure 2. Sample B](image)

c. Sample C = The main fabric using tunjung mordant, blanket fabric using tegeran (*cudraina javanensis*) dye, and fixation using tawas mordant

![Figure 3. Sample C](image)

d. Sample D = The main fabric uses a tunjung mordant on the main fabric, the blanket fabric uses a tegeran (*cudraina javanensis*) dye on the blanket fabric, and fixation uses a tunjung mordant
Sample E = The main fabric uses tannin mordant on the main fabric, blanket fabric uses tegeran (*cudraina javanensis*) dye, and fixation uses tawas mordant.

Sample F = The main fabric using tannin mordant, blanket fabric using tegeran (*cudraina javanensis*) dye, and fixation using tunjung mordant.

The results achieved in the research entitled "The impact of the use of different mordant type on the ecoprint dyeing using tegeran (*cudraina javanensis*) dye on primisima fabric" include tests for motif clarity, colour sharpness, colour evenness, and colour absorption as follows:

3.1. Motive Clarity Test

The number of respondents in this test is as many as 40 people. Each respondent was asked to rate each sample by looking at the clarity of the 6 motifs from the ecoprint sample results. The results of the questionnaire assessment (questionnaire) with a Linkert scale of 5-1. Figure 7 illustrated Test the Clarity of Ecoprint Motifs with Tegeran.
Figure 7. Test the Clarity of Ecoprint Motifs with Tegeran (cudraina javanensis) Natural Dye

From the diagram above, it can be seen that the motif clarity test in sample C has the clearest motif clarity, which is 4.7. Sample A also has a very clear motive clarity of 4.55. Sample D has a clear motive clarity, which is 3.775. Meanwhile, samples B and E have quite clear motives, namely 3.05 and 2.825 and the sample F has a less clear motive clarity, namely 2.05.

The motif clarity test in sample C using mordant tunjung on the main fabric, tegeran (cudraina javanensis) dye on the blanket, and mordant tawas in the fixation have the clearest motif clarity.

3.2. Colour Sharpness Test
The number of respondents in this test is as many as 40 people. Each respondent was asked to rate each sample by looking at the colour sharpness of the 6 ecoprint samples. The results of the questionnaire assessment (questionnaire) with a Linkert scale of 5-1. Figure 8 illustrated Ecoprint Colour Acuity Test with Tegeran.

Figure 8. Ecoprint Colour Acuity Test with Tegeran (cudraina javanensis) Natural Dye
From the diagram above, it can be seen that the colour sharpness test in sample C has the sharpest motif sharpness, which is 4.7. Sample A also has a very sharp motif sharpness of 3.825. Sample D has a sharp colour sharpness of 3.4. Meanwhile, sample B has a fairly sharp colour sharpness of 2.625 and the samples E and F have less sharp colour sharpness, namely 2.475 and 2.05.

The colour sharpness test on sample C using mordant tunjung on the main fabric, tegeran (*cudraina javanensis*) dye on the blanket, and mordant tawas in the fixation have the sharpest motif sharpness.

### 3.3. Colour Uniformity Test

The number of respondents in this test is 40 people. Each respondent was asked to give a value to each sample by looking at the colour flatness of the ecoprint sample results. The results of the assessment questionnaire (questionnaire) with a Linkert scale of 5 – 1. Figure 9 show that Ecoprint Colour Uniformity Test.

From the diagram above, it can be seen that sample C has the most even colour average of 4.55. Samples A and D have an even colour average of 3.4. Meanwhile, samples B and E have fairly even colour, namely 2.625 and 2.475. Sample F has an uneven colour average of 2.475. The colour evenness test on sample C using mordant tunjung on the main fabric, tegeran (*cudraina javanensis*) dye on the blanket, and mordant tawas in the fixation have the most average colour evenness.

![Ecoprint Color Uniformity Test with Tegeran Natural Dye](image)

**Figure 9.** Ecoprint Colour Uniformity Test with Tegeran (*cudraina javanensis*) Natural Dye

### 3.4. Colour Absorption Test

The number of respondents in this test is as many as 40 people. Each respondent was asked to rate each sample by looking at the absorption of the 6 motifs of the ecoprint sample. The results of the questionnaire assessment (questionnaire) with a Linkert scale of 5-1. Figure 10 illustrated Ecoprint Colour Absorption Test.
From the diagram above, it can be seen that the colour absorption test in sample C has the best colour absorption, which is 4.55. Sample A has a good colour absorption of 3.775. While samples B, D, and E had good colour absorption, namely 2.775, 3.4, and 2.625. Sample F has a poor colour absorption, namely 2.

The colour absorption test on sample C using mordant tunjung on the main fabric, tegeran (Cudraina javanensis) dye on the blanket, and mordant tawas in the fixation have the best colour absorption.

4. Conclusion
The motif clarity test in sample C using mordant tunjung on the main fabric, tegeran (Cudraina javanensis) dye on the blanket, and mordant tawas in the fixation have the clearest motif clarity, which is 4.7. The colour sharpness test on sample C using mordant tunjung on the main fabric, tegeran (Cudraina javanensis) dye on the blanket, and mordant tawas in the fixation have the sharpest motif sharpness, which is 4.7. The colour evenness test on sample C using mordant tunjung on the main fabric, tegeran (Cudraina javanensis) dye on the blanket, and mordant tawas in the fixation have the most average colour evenness, which is 4.55. The colour absorption test on sample C using mordant tunjung on the main fabric, tegeran (Cudraina javanensis) dye on the blanket, and mordant tawas in the fixation have the best colour absorption, which is 4.55. The best ecoprint treatment is seen from the motif clarity test, colour sharpness, colour evenness and colour absorption, namely sample C with ecoprint treatment using mordant tunjung on the main fabric, tegeran (Cudraina javanensis) dye on the blanket, and mordant tawas in the fixation.

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