The impact of different types of mordant on the eco-print dyeing using tingi (*Ceriops tagal*)

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Abstract. The purposes of this study are (1) to determine the effect of mordan tawas, tunjung, and tannins on the ecoprint dyeing result using Tingi *(Ceriops tagal)* dye on primisima fabrics (2) to find the best results in ecoprint dyeing using different types of mordan including the pattern clarity, colour sharpness, colour fairness, and colour absorption. The method of this research is experimental. The independent variables are mordan 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 Tingi *(Ceriops tagal)* dye, mordaning technique, and primisima fabric. The data of the study were collected by using observation. There were 5 ecoprint treatment samples used in the design of this study, i.e. sample A - using mordan tawas on the main fabric, Tingi *(Ceriops tagal)* dye on blanket and mordan tawas in the fixation; sample B - using mordan tawas on the main fabric, Tingi *(Ceriops tagal)* dye on the blanket, and mordan tunjung in the fixation; sample C - using mordan tunjung on the main fabric, Tingi *(Ceriops tagal)* dye on the blanket, and mordan tawas in the fixation; sample D - using mordan tunjung on the main fabric, Tingi *(Ceriops tagal)* dye on the blanket, and mordan tunjung in the fixation; sample E - using mordan tannin on the main fabric, Tingi *(Ceriops tagal)* dye on the blanket, and mordan tawas in the fixation; and sample F - using mordan tannin on the main fabric, Tingi *(Ceriops tagal)* dye on the blanket, and mordan tunjung in the fixation. Based on the test of pattern clarity, colour sharpness, colour fairness, and colour absorption, the best ecoprint treatment is shown in sample A, which is the ecoprint treatment using mordan tawas on the main fabric, Tingi *(Ceriops tagal)* dye on the blanket, and mordan tawas in the fixation.

1. Introduction

Natural dyes or natural colouring is one of the many potential ways for the development of eco-fashion. This technique is a colouring technique using raw materials from nature, the absorbed colour will blend with the fibers in the fabric. Every plant has the potential to be used as a fabric dye. Of course, the resulting colour will be different for each plant. The results depend on the season, the intensity of the rain, the air (which is already polluted), and the quality of the soil. The character of the plant chosen to be used as colouring material will also affect the final result. Leaves that are still fresh, dry, even leaves that have just fallen will give different results [1].

Eco printing is the process of printing colours and shapes onto textile materials through direct contact. Eco print is transferring the pattern (shape) of leaves and flowers onto the surface of various fabrics that have been processed to remove the waxy layer and fine dirt on the fabric so that the plant colours can

easily absorb (mordant technique) [2]. The eco print process using the roll technique (Bundles) is done by attaching natural materials directly to textile materials and then steaming to bring out the shapes and colours of natural materials.

Textile materials used for eco print colouring should be of natural origin. Cellulose fiber is divided into seed fiber, stem fiber, leaf fiber, and fruit fiber [3]. Furthermore, cotton fabric is one type of fabric derived from cellulosic fibers or plants [4]. On this occasion, the author chose Primisima fabric as the object of research because cotton is one of the materials that are good at absorbing dyes.

Sources of natural dyes are plants, animals, and microorganisms [5,6,7]. Natural dyes can be obtained from plants, animals, or minerals [8]. From these various sources, only a few are available in sufficient quantities to be used commercially as a food colouring [5,6,7]. From which small amounts are mostly of plant origin [5,6]. Previous studies on the application of natural resources as colourant have been done [9-11].

General description of *Ceriops tagal* is a small tree or shrub up to 25 m in height. The bark is gray, sometimes brown, smooth and the base is bulging [9]. Having the scientific name *Ceriops tagal*, this plant is also known by several other names such as tengar, tingi, palun, parun, bido-bido, and others [12]. Tannins from the bark of Tingi (*Ceriops tagal*) can vary, from 13% to more than 40% which is a common and important feature of mangrove bark. This tannin belongs to the group of condensed tannins of the procyanidin type so that staining with the bark of a high soga tree gives a reddish-brown colour. The bark of *Ceriops tagal* is used for dyeing and tanning in eastern Africa and Asia. In fishing communities, nets and sails are treated with extracts of the bark of *Ceriops tagal* to protect the nets and sails from damage. In Southeast Asia, the bark of *Ceriops tagal* is the main ingredient for the famous 'soga-batik' of Javanese batik [13].

One of the decisive processes in dyeing fabrics is the mordanting process. Mordanting is a pre-treatment on the fabric to be dyed so that the fat, oil, starch, and dirt left in the weaving process can be removed and the dye can be directly absorbed by the fabric. Besides aiming to increase the attractiveness of natural dyes to textile materials, mordanting is also useful for producing good evenness and sharpness of colour [14]. Mordant materials commonly used in the colouring process include soda ash, tawas, tunjung, and Turkish Red Oil [15]. The success of dyeing the fabric is determined by the accuracy of the type of mordant used and the selected mordanting process. The mordanting process can be carried out before, after, or simultaneously with immersion, otherwise known as pre-mordant, post-mordant, and simultaneous mordant [16]. This mordanting process is also a fixation that serves to strengthen the colour and change the natural dye according to the type of metal that binds it and locks the dye that has entered the fiber. The principle is to condition the dye that has been absorbed for a certain time so that a reaction occurs between the dyed fabric and the material used for fixation [17].

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. [18]. This type of experimental research is a way to find a cause-and-effect 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 Tingi (*Ceriops tagal*), mordanting technique, primisima fabric.

The design of this research is an experimental study that uses 6 samples of ecoprint treatment as shown in Table 1.

Table 1. Research Design

Mordant Type on Main Cloth (X)	**Blanket cloth using Tingi *(Ceriops tagal)* natural dyes (Y)**	
	Fixation using Tawas Mordant (Z1)	**Fixation using Tunjung Mordant (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 Tingi *(Ceriops tagal)* dye, and fixation using tawas mordant

Sample B = the main fabric using tawas mordant, blanket fabric using Tingi *(Ceriops tagal)* dye, and fixation using tunjung mordant

Sample C = the main fabric using tunjung mordant, blanket fabric using Tingi *(Ceriops tagal)* dye, and fixation using tawas mordant

Sample D = the main fabric uses a tunjung mordant on the main fabric, the blanket fabric uses a Tingi *(Ceriops tagal)* 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 Tingi *(Ceriops tagal)* dye, and fixation uses tawas mordant

Sample F = the main fabric using tannin mordant, blanket fabric using Tingi *(Ceriops tagal)* dye, and fixation using tunjung mordant

The data collection method used in this research is the observation method. The observation method is an activity of focusing attention on an object by using all the senses [15]. 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, Home Economics Department, Faculty of Engineering, and 32 students of the Fashion Design study program who had taken the Textile Design course.

3. Result

The results achieved in the research include tests for motif clarity, colour sharpness, colour evenness, and colour absorption.

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 can be seen in the Figure 1.

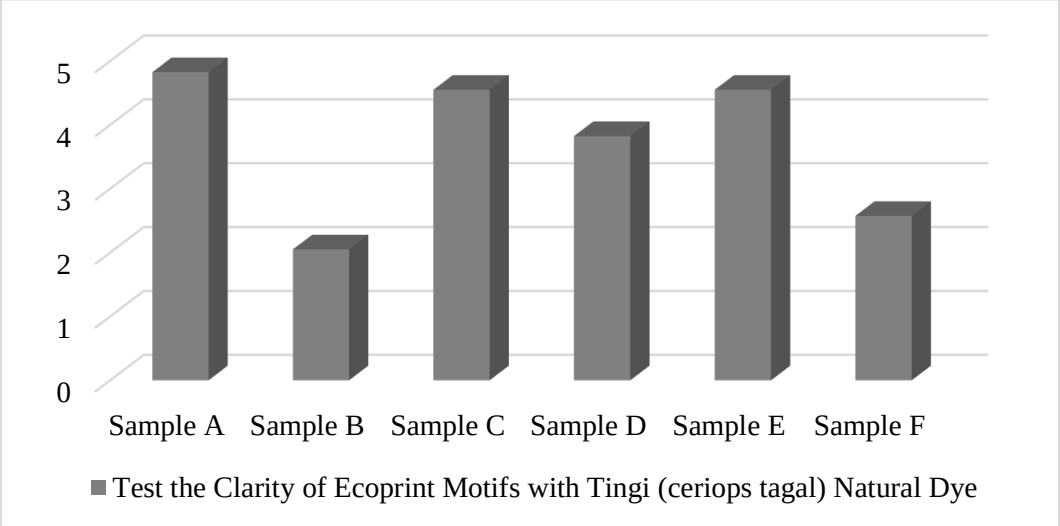

Figure 1. Test the clarity of ecoprint motifs with *Tingi (Ceriops tagal)* natural dye

From the Figure 1, it can be seen that the motif clarity test in sample A has the clearest pattern, which is 4.825. Sample C and E have a "clear" pattern, which is 4.55. Sample D has a "clear" pattern, which is 3.825. Sample F have an "average" clear pattern, which is 2.575 respectively. Meanwhile, sample B has "less clear" pattern, which is 2.05.

The motif clarity test in sample A using mordan tawas on the main fabric, tingi (ceriops tagal) dye on blanket and mordan tawas in the fixation have the clearest pattern, which is 4.825.

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 can be seen in the Figure 2.

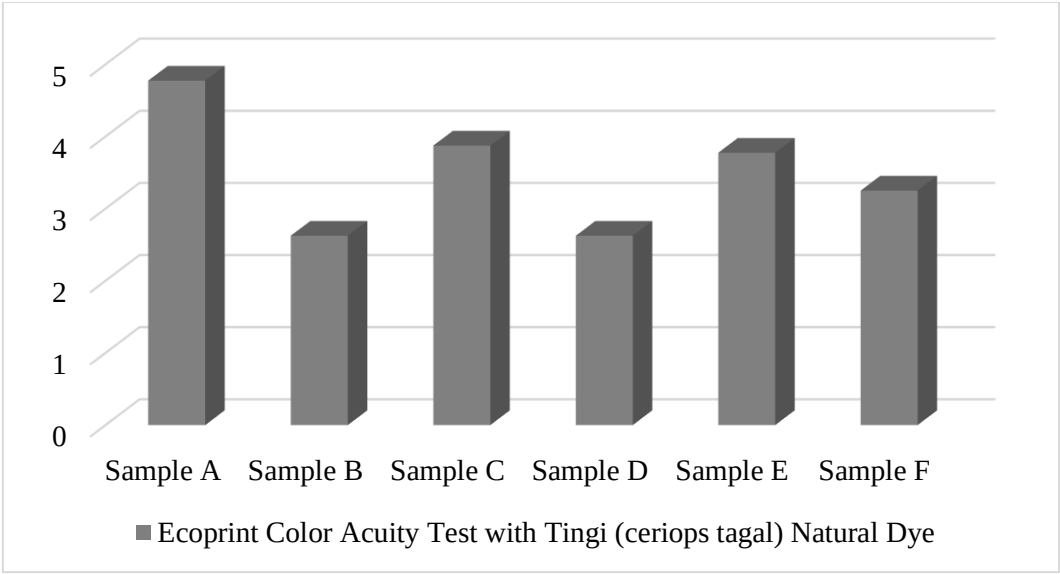

Figure 2. Ecoprint colour acuity test with Tingi *(Ceriops tagal)* natural dye

From Figure 2, it can be seen that the colour sharpness test in sample A has the sharpest pattern, which is 4.775. Sample C and E have a "sharp" pattern, which are 3.875 and 3.775 respectively. Sample

F has an “average” colour sharpness, which is 3.25. Meanwhile, samples B and D have “less sharp” colours, which is 2.625.

The colour sharpness test on sample A using mordan tawas on the main fabric, Tingi (*Ceriops tagal*) dye on blanket and mordan tawas in the fixation have the sharpest pattern, which is 4.775.

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 6 ecoprint sample results. The results of the assessment questionnaire (questionnaire) with a Linkert scale of 5 - 1 can be seen in the Figure 3.

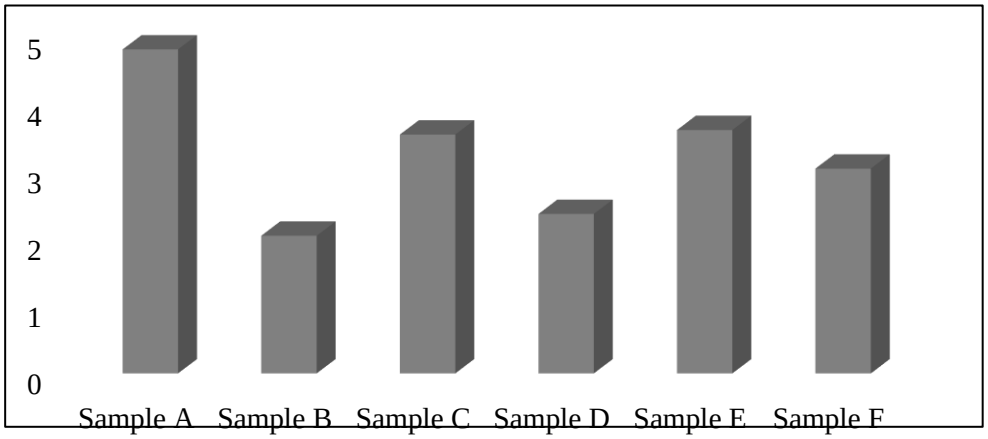

Figure 3. Ecoprint colour uniformity test with Tingi (*Ceriops tagal*) natural dye

From the Figure 3, it can be seen that sample A has the fairest colour, which is 4.825. Sample C and E have fair colours, which are 3.557 and 3.625 respectively. Sample F has an “average” fairest colour, which is 3.05. Meanwhile, samples B and D have “less” colour fairness, which are 2.05 and 2.375 respectively.

The colour uniformity test on sample A using mordan tawas on the main fabric, Tingi (*Ceriops tagal*) dye on blanket and mordan tawas in the fixation has the fairest colour, which is 4.825.

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 can be seen in the Figure 4.

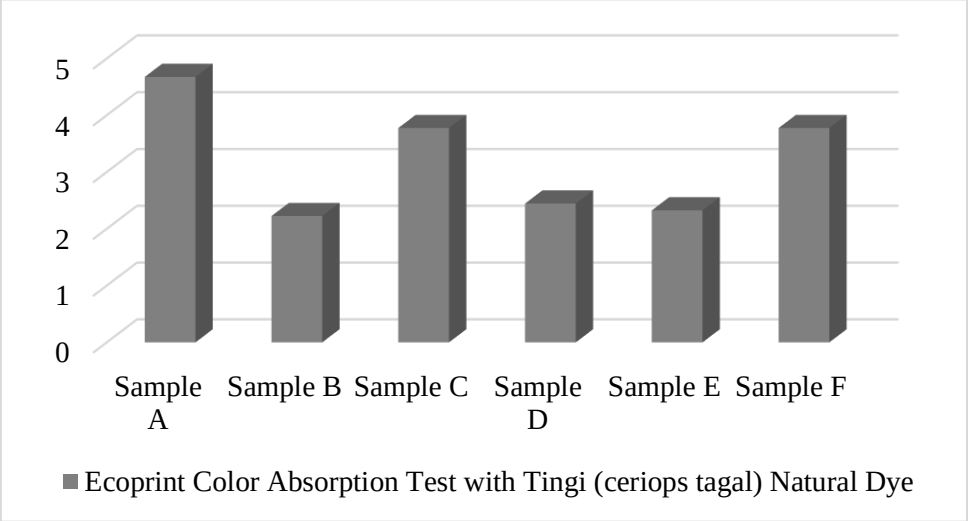

Figure 4. Ecoprint colour absorption test with *Tingi (Ceriops tagal)* natural dye

From the diagram above, it can be seen that the colour absorption test in sample A has the best colour absorption, which is 4.675. Sample C's and F's colour absorption is "good", which is 3.775. Meanwhile, sample B's, D's, and E's colour absorption is "less good", which are 2.225, 2.445 dan 2.325 respectively.

The colour absorption test on sample A using mordan tawas on the main fabric, Tingi (*Ceriops tagal*) dye on blanket and mordan tawas in the fixation have the best colour absorption, which is 4.675.

4. Conclusion

1) The motif clarity test in sample A using mordant tawas on the main fabric, Tingi (*Ceriops tagal*) dye on blanket and mordant tawas in the fixation have the clearest pattern, which is 4,825.
2) The colour sharpness test on sample A using mordant tawas on the main fabric, Tingi (*Ceriops tagal*) dye on blanket and mordant tawas in the fixation have the sharpest pattern, which is 4,775.
3) The colour uniformity test on sample A using mordant tawas on the main fabric, Tingi (*Ceriops tagal*) dye on blanket, and mordant tawas in the fixation have the fairest colour, which is 4,825.
4) The colour absorption test on sample A using mordant tawas on the main fabric, Tingi (*Ceriops tagal*) dye on blanket, and mordant tawas in the fixation have the best colour absorption, which is 4,675.
5) Based on the test of pattern clarity, colour sharpness, colour fairness, and colour absorption, the best ecoprint treatment is shown in sample A, which is the ecoprint treatment using mordant tawas on the main fabric, Tingi (*Ceriops tagal*) dye on the blanket, and mordant tawas in the fixation.

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