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The Influence of Fixer Types and Mixed Teak Leaves-Soil on Batik Coloring

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***Abstract*—This research aims to examine the effects on colors in *Batik* when using both fresh and dried teak leaves (*tectona grandis*) mixed with soil and alum, lime, and *tunjung* as fixers. Data were collected from 50 batik consumers as participants using a checklist to measure the perceived quality of the newly produced colors. Results show the best coloring using a combination a combination of fresh teak leaves mixed soil with lime fixer. Further, it is suggested that the results of this research can be used to be an alternative to color *batik*.**

Keywords—fixer type, leaf type, soil, batik, natural coloring

I. INTRODUCTION

Batik is a highly valued art that becomes one of Indonesian and world heritages, of which historical values and meanings permeated on it. A movement to use local product, entitled 'we love Indonesian product', makes batik more popular and interested [1]. Based on the data retrieved from Indonesia Department of Commerce, batik contributes to the country income for about 45.32% from all export activities in 2006 by the amount US$ 2,087 billion and the growth number of 8.63% verified by diverse products. This shows that batik is a potential commodity either in domestic or international scope, as well as being one of tourism attraction supports. Since it has been acknowledged by UNESCO, batik is worldwide accepted and developed on every layer of society.

Coloring on batik can use natural or synthetic dyes. Natural dyes have many advantages, such as low toxicity and allergic reactions, in addition to biodegradability, because they are taken from animal or plant matter without chemical processing [2]. Nowadays, due to the environmental pollution problems raised by synthetic dyes, natural dyes are gaining significance. Ever since the saga started to search for new and newer sources for natural dyes, a lot of natural substance was discovered and reported [3].

Based on the preliminary interview done to a producer of mangrove batik, it was stated that there must be an innovation in exploring natural coloring medium by mixing soil and other natural coloring mediums to get varied colors, i.e. by using teak leaves. Teak leaves contain antosionin pigments which can be utilized as natural dyes with the result of the various staining formula antosionin structure as follows:

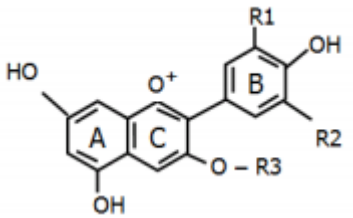

Fig. 1. Antosionin Structure Formula [4]

Teak leave is one of natural coloring medium that is adequate in giving color on textile [5]. It is popular to know teak leaves used as food color in several Indonesia culinary. Teak leave can also be used as textile color, however, there is none can apply teak leave mixed with soil as coloring medium for batik.

As in [6], coloring in batik using fresh teak leaves is better than using the dried ones. On the contrary, this research chooses the dried teak leaves mixed with soil to produce solid color. The soil used in this research is the one which is called *tanah Madura* or Maduresse soil gotten from Tanjung Bumi. The textile used is cotton because its type has a high absorbing power in which it is expected that such textile type can absorb color maximally.

As in [7], it is gotten that a development of coloring technique using the combination between soil and synthetic. Such technique has got its copyright and batik producers in Tulangan Village, Sidoarjo city, Indonesia had an opportunities being trained to produce batik with the combination color of soil and synthetic.

To lock the fixed color in batik, a good fixer namely *tohor* lime ($CaCO_3$), *tunjung* ($FeSO_4$), and alum($Al_2(SO_4)_3$) by the comparison of 1: 0.02, of which 0.02 kilograms the fixer and 1 kilogram color extract. The technique used is simultaneous fixation for experiment using fresh and dried teak leaves combined with soil. The use of soil is based on 1:1 comparison; 1 kilogram soil and 1 kilogram the extract. In this study staining applied to cotton fabrics.

Cotton fabrics belong to the textile group whose polymer is cellulose. Cellulose is a linear polymer composed of condensation of glucose molecules. At each glycate hitting

there are 3 hydroxyl reactive groups having the ability to bind water molecules/chemicals [8].

Based on above explanations, the researchers aim to use teak leaves mixed with soil as a coloring method for batik. Thus, it is necessary to investigate 1) the results of coloring medium for batik using fresh and dried teak leaves mixed with soil, and using alum, lime, and *tunjung* as fixers under simultaneous technique, and 2) the influence of alum, lime, and *tunjung* as fixers used in batik coloring mixed with soil on the result of batik's colors.Young teak leaves can be used to dye cotton fabrics with varied color directions ie purple, purple and gray. The resulting color depends on the type of fixator used while the aging and color direction is determined by the pH of the solution used in the dyeing [4]. As an [9] PH and temperature treatment affects the stability of teak leaf extract, the higher the PH and the color quality temperature decreases.

II. METHODS

This quantitative research used experimental approach because the researchers wanted to know the influence of fresh and dried teak leaves and fixer types (alum, lime and *tunjung*) on the result of batik colors. The design used is doubled factorials design. The independent variables are fresh and dried teak leaves; 500 grams and fixers (lime, *tunjung* and alum), while the dependent variable is the result of batik colors –the intensity of solidness. The last is the control variables that include 1) a set of batik tools, 2) cotton textile typed *primisima* sized 40 x 40 centimeters, 3) making batik technique using cold coloring, 4) batik design, 5) ones who make batik and coloring, 6) coloring medium using 1:1; 1 kilogram soil and 1 kilogram teak leave extracts, 7) 2 kilograms water to make the extracts; 2 kilograms water with 500 grams boiled teak leaves, which later become 1 kilogram extraction, and 8) amounts of fixers with 1:0.02 comparison.

Data were collected using observation about the fixed result of batik using teak leaves mixed with soil. There were 30 observers as the research participants, while the objects were the results of 6 samples of batik coloring in which each composition had three times reprocessing the batik. The instruments used in this research were observation sheet with Likert scales; '4' for *good*, '3' *enough*, '2' for *less good*, and '1' for *bad*. The instruments consisted of the following elements; a) color solidness; score 4 for a brownish orange color result, 3 for orange color result, 2 for a yellowish color result, and 1 for cream color result, and b) color flatness; score 4 for no stripped color, 3 for rarely dotted color, 2 for <50%-75% stripped color appeared, and 1 for >75% stripped color appeared.

The research design used is drawn in Fig 1. The data obtained were analyzed using doubled Anova in SPSS 14. Table. I shows that X=fixer type; X1=lime, 1:0.02; X2=alum, 1:0.02; X3=*tunjung*, 1:0.02; Y=teak leave types; Y1=dried teak leave; Y2=fresh teak leave; Y1,X1=results of batik coloring using dried teak leaves with lime; Y1,X2=results of batik coloring using dried teak leaves with alum; Y1,X3=results of batik coloring using dried teak leaves with *tunjung*; Y2,X1=results of batik coloring using fresh teak leaves with lime; Y2,X2=results of batik coloring using fresh teak leaves with alum; Y2,X3=results of batik coloring using fresh teak leaves with *tunjung*.

TABLE I. DOUBLE FACTORIALS DESIGN USED IN THIS REASEARCH

Y / X	Y1	Y2
X1	Y1.X1	Y2.X1
X2	Y1.X2	Y2.X2
X3	Y1.X3	Y2.X3

III. RESULTS AND DISCUSSION

Based on the observation results done to batik consumers as participants, the mean found as follows;

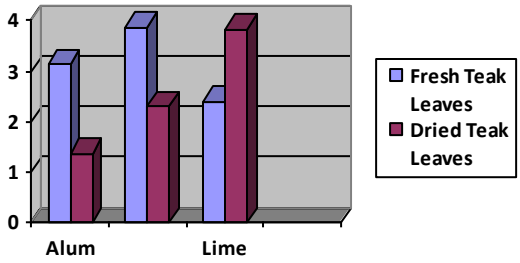

Fig. 2. Mean in the aspect of color flatness.

First, in the aspect of color flatness using natural coloring fresh teak leaves mixed with soil and alum, *tunjung* and lime, the high mean with 3.87, categorized as very good, is by using *tunjung*. Meanwhile, the low mean with 2.40, categorized as good, is by using lime. Second, in the aspect of color flatness using natural coloring dried teak leaves, the fact shows that the high mean 3.83, categorized as very good, is by using lime. Meanwhile, the low mean with 1.37, categorized as enough. Thus, it means that the highest mean among other means is 3.87, of which the coloring method is by using fresh teak leaves mixed with soil and *tunjung* as the fixer.

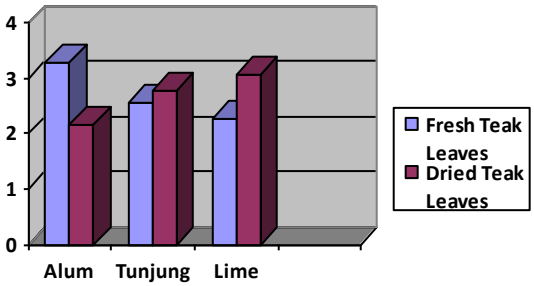

Fig. 3. Mean in the aspect of color solidness.

Moreover, Fig. 3 shows the mean in the aspect of color solidness. In this aspect, the high mean is by using alum as the fixer, while the low mean is by using lime. In coloring method using dried teak leaves mixed with soil, the high mean is a

method using lime as the fixer with 3.07, categorized as very good, while the low mean one is by using alum as the fixer. The highest mean in this aspect is by using alum with 3.3, of which categorized as very good.

Henceforth, by knowing both figures (Fig 2 and Fig 3), it can be retracted that the highest mean is the fixer using lime with 3.45, categorized as very good. The second high mean is alum and the third high one is *tunjung (see Fig 3)*.

A. Results of Doubled Anova in Color Flatness and Solidness

TABLE II. ANOVA RESULT IN THE ASPECT OF COLOR FLATNESS

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	143.383	5	28.677	89.797	0.000
Intercept	1428.050	1	1428.050	4471.758	0.000
Teak Leave Type	18.050	1	18.050	56.521	0.000
Fixer Type	28.933	2	14.467	45.301	0.000
Teak Leave Type * Fixer Type	96.400	2	48.200	150.932	0.000
Error	55.567	174	0.319		
Total	1627.000	180			
Corrected Total	198.950	179			

Table II shows the results of doubled anova for the aspect of color flatness. For a coloring type using different teak leaves mixed with soil, it conveys a significance 0.000 which means really significant (P=0.00 < 0.05, significant). It means that there is an influence in using teak leaves mixed with soil on the aspect of color flatness. In addition, still in the same aspect, the use of different fixers shows a significant difference of effects, showing 0.000 which also means indeed significant. So, based on the data above, there is a significant influence in the relation between the use of teak leaves and fixer types on the color flatness in batik coloring.

TABLE III. ANOVA RESULT IN THE ASPECT OF COLOR SOLIDNESS

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	29.644	5	5.929	12.439	0.000
Intercept	1301.422	1	1301.422	2730.476	0.000
Teak Leave Type	0.089	1	0.089	0.186	0.666
Fixer Type	0.178	2	0.089	0.186	0.830
Teak Leave Type * Fixer Type	29.378	2	14.689	30.818	0.000
Error	82.933	174	0.477		
Total	1414.000	180			
Corrected Total	112.578	179			

Table 3 shows that there is no significant influence between the use of different, either fresh or dried, teak leaves and the color solidness, proven by the significance point 0.666 (P > 0.05, meaning that not significant). Moreover, in this aspect, there is also no significant influence of the use of different fixers on the color solidness, proven by 0.83 significant point (P > 0.05, meaning that not significant). However, there is a significant influence the use of different fixers on the use of different teak leave types, proven by 0.000 significant point (P < 0.05, meaning that is significant). In short, it can be said that the use of different fixers on and the use of different teak leave types create different color solidness for batik coloring.

TABLE IV. ANOVA RESULT IN THE COMBINATION ASPECT

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	62.428	5	12.486	44.855	0.000
Intercept	1650.139	1	1650.139	5928.235	0.000
Teak Leave Type	4.050	1	4.050	14.550	0.000
Fixer Type	6.944	2	3.472	12.474	0.000
Teak Leave Type * Fixer Type	51.433	2	25.717	92.389	0.000
Error	48.433	174	0.278		
Total	1761.000	180			
Corrected Total	110.861	179			

For the combination aspect between color flatness and solidness, there is a significant influence the use of teak leave types on the result of batik coloring, proven by significant point 0.00 (P < 0.05, meaning that is significant) (see Table 4). Interestingly, there is also a significant influence the use of different fixers on the results of batik, proven by significant point 0.00 (P < 0.05, meaning that is significant).

Lastly, the data shows a significant influence the use of different teak leave types and the fixer types to the final product of batik, proven by 0.00 significant point (P < 0.05, meaning that is significant) (see Table 4).

B. Discussion

Based on above results, the highest mean score is 3.45, categorized as good, for the use of natural coloring medium namely fresh teak leaves combined with soil with lime as the fixer type. This is due to that lime fixation can strengthen the reaction between color and the textile fiber. The possibility of adding the active core of the fiber may also increase the absorbing power and the sharpness of color, even without using fixers. This is relevant with [10] that adding lime concentrates causes the color substance able to give color on wood. On the contrary, the results may not be successful without adding more lime concentrates. Since wood and

cotton fibers are similar each other, of which covering cellulose, the use of lime can enhance the tightening reaction between both elements of fibers.

Based on Anova results, it can be known that each aspect of color flatness and sharpness shows different results. Types of teak leaves and fixers shows significant relation, which further means that the use of teak leaves and fixers determine the result of batik coloring. This is due to each fixer type may react to chlorophyll and anthocyanin substance owned by teak leaves, of which creating diverse results of colors such as green, yellow, orange, reddish, and brownish. The use of fixer either can or cannot strengthen the reaction between color substances and the textile fibers, so it also creates different color solidness and sharpness [11]. Reference [12] has emphasized a statement to response above phenomenon that plants have several coloring pigments depend on the chemical structure, i.e. chlorophyll, carotene, tannin, and anthocyanin. Mostly, those substances are unstable depending on the certain heat, light, pH level. The presence of metal ions, oxygen and sulfur dioxide can affect the stability of anthocyanins. Metals can form complexes with anthocyanins that cause anthocyanins as natural dyes to become more stable [4].

IV. Conclusion

It can be concluded that, in order to get the best color results in batik, fresh teak leaves combined with soil with lime fixer are the best set of composition. Moreover, the use of different teak leave types combined with soil with different fixers can cause the results of batik coloring viewed by the aspects of color flatness, sharpness and solidness.

It is suggested for scholars or batik producers, it is necessary to add different substances to be combined with plant's natural colors to get the best color wanted. This result can be implemented in various textiles which contain high cellulose because it has high absorption, however, it needs further researches.

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