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The Effect of Mordan on the Result of Dyeing Rayon Twill Fabric with Longan Leaf Extract (Dimocarpus Longan L.)

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ABSTRACT
This research is motivated by the use of longan leaves as a natural dye because of the tannin and flavonoid content that can produce color. This study aims to describe the color name (hue), color evenness, and color fastness to washing produced from dyeing rayon twill fabric with longan leaf extract (Dimocarpus Longan L.) with the influence of alum mordant, tunjung, and betel lime. This type of research uses an experimental research type with primary data from 18 panelists through a questionnaire. Data were analyzed using the Friedman K-Related Sample test with SPSS version 26. This study produced a color name without mordant: Off-White Lemon #F4E5AA, average color evenness, color fastness to washing 1x and 2x slightly changed/reduced, 3x washing changed/reduced. The effect of alum mordant produces Pale Golden #EBDC98, average color evenness, color fastness to washing 1x, 2x, and 3x slightly changed/reduced. The effect of tunjung mordant produces Dark Gray (13% white) #222222, the color evenness is quite even, the color fastness to washing 1x, 2x, and 3x changes/decreases slightly. The effect of betel lime mordant produces Golden Sundace #C2A66C, the color evenness is even, the color fastness to washing 1x does not change at all, 2x and 3x washings change/decrease slightly. The result of the Friedman K-Related Sample test for color evenness is 0.000 <0.05 = Ho is rejected, meaning there is a significant difference in color evenness. The results of the Friedman K-Related Sample test for color fastness to washing without mordant, alum, and lime were 0.000 <0.05 = Ho was rejected, tunjung was 0.001 <0.05 = Ho was rejected, meaning that there was a significant difference in color evenness and color fastness to washing due to the influence of tunjung, lime, and alum mordants on the results of dyeing twill rayon fabric with longan leaf extract (Dimocarpus Longan L.).

KEYWORDS

Logan Leaf, Rayon, Twill, Mordan.

INTRODUCTION

Initially, the textile dyeing process used natural dyes. However, as time goes by, many people or industries use synthetic dyes, because synthetic dyes are easy to obtain. However, the use of synthetic dyes is not environmentally friendly and can cause environmental pollution. According to Novita et al. (2022:145) said that, "The use of synthetic dyes has a negative impact, namely it can cause environmental pollution and health problems". For this reason, it is necessary to explore safer alternative dyes such as coloring using natural materials that are easily absorbed and environmentaly friendly.

One of the plants that has the potential as a natural dye is longan leaves (*Dimocarpus Longan L.*). According to Anggraeny & Pramitaningastuti (2016) longan leaves contain *saponins, flavonoids, triterpenoids, steroids, tannins, and glycosides* , which make it a potential source of natural dyes. In

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longan leaves (*Dimocarpus Longan L.*), the leaves that are selected are old leaves and used as compost, therefore old longan leaves can not only be used as compost and end up as waste but also as natural dyes.

Because natural dyes cannot be completely bound to the material, an auxiliary substance called a mordant is needed. According to Masyitoh & Ernawati (2019:388) , "Mordan is a special substance that can increase the adhesion of color and shape to the fabric". According to Nabila & Adriani (2024:19) , "The type of mordant used has a different effect on the results of dyeing". Therefore, a mordant is needed to increase the color absorption of the material, increase the color bond to the fiber of the material so that it does not fade easily. The use of different mordants will produce different colors. In this study, mordants were used as alum, tunjung and betel lime because they are fixators that are commonly used and recommended by experts for coloring and are easy to obtain. *Mordanting* technique also affects the results of natural dyeing. According to Ahmad & Hidayati (2018:2) , " This *mordanting* is a fixation that functions to strengthen the color and change the natural dye according to the type of metal that binds it and locks the dye that has entered the fiber". In this study, the author used the *post-mordanting technique* (*mordanting* at the end after dyeing).

Dyeing using natural dyes is also influenced by the textile materials used. The material used in this study is rayon twill. According to Primadani (2016:9) states that, "Rayon or rayon fabric is a fabric made from regenerated cellulose fibers. The fibers used for rayon yarn come from organic polymers, so they are called semi-synthetic fibers because they cannot be classified as synthetic fibers or true natural fibers". Therefore, rayon is included in semi-synthetic fibers made from a mixture of cellulose and chemicals. In line with the opinion of Pratiwi (2017:37) who said that, "The basic material for semi-synthetic fibers is cellulose fiber. Thus, semi-synthetic fibers have properties like cellulose fibers, namely absorbing water and even their properties can exceed the properties of cellulose fibers". Therefore, rayon twill is suitable for dyeing in the natural dye process because of its good absorption.

Based on the description above, the purpose of this study is to describe the color name (*hue*), color evenness and color fastness to washing and the effect of tunjung, lime and alum mordants on the results of dyeing rayon twill fabric using longan leaf extract (*Dimocarpus Longan L.*) on the color name (*hue*), color evenness and color fastness to washing produced in dyeing.

METHOD

This study uses a quantitative approach with an experimental research design. According to Hidayati et al. (2021:245) , "The quantitative method is a quantitative research method based on the philosophy of positivism, used to research certain populations or samples, data collection using research measuring instruments (instruments), quantitative/statistical data analysis". While the experimental research design according to Sukmadinata (2017:95) , "Experimental research design can be understood as the most complete quantitative research methodology, in the sense that it meets the requirements for evaluating causal relationships". The object of research that is the focus of this study is longan leaf extract (*Dimocarpus Longan L.*) with the influence of alum, tunjung and betel lime mordants that have been dipped in rayon twill fabric. Using the same tools, materials, *mordanting techniques* , dyeing recipes and time with the same treatment. The difference lies in the use of the mordants used, namely alum, tunjung and betel lime mordants.

The data used are primary data obtained through data collection techniques, namely research instruments in the form of questionnaires. The questionnaires were distributed to 18 panelists, namely 3 lecturers who had taught textile courses, proven by a teaching SK in the field of textiles. 15 students of the Family Welfare Education Study Program (S1 Fashion Design) Padang State University with the criteria of having passed the Textile course got A and A-, and were able to distinguish colors and understand the questionnaires distributed by the panelists.

The collected data were then processed and anallyzed using frequency percentages to determine the color name (*hue*), color evenness and color fastness to washing. Then the data were analyzed using the *Friedmand K-Related Sample test using the SPSS (Statisticali Product And Service Solution) Version 26* program .

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RESULT AND DISCUSSION

1. Color Name (Hue)

Colors can show different characteristics and times, and even have many variations, namely light colors, dark colors, bright colors, dark colors, dull colors and bright colors (Ernawati & Nemira, 2008:205). The color name (*hue*) is obtained using the *Colorblind Assistant application* . The *Colorblind Assistant application* can show the color name (*hue*), RGB content and color code.

Table 1Hue)

No.	Rayon Twill Fabric Infused with Longan Leaf Extract	Color	Color Name (*Hue*)	RGB	Color Code	F	%F	Total
1.	Without Mordant		*Off White*	R240 G230 B198	#F0E6C6	1	5.6%	100%
			Off White	R247 G231 B198	#F7E7C6	1	5.6%	
			Off White Lemon	R255 G243 B199	#FFF3C7	16	88.9%	
2.	Mordant Alum		*Pale Golden*	R235 G220 B152	#EBDC98	18	100%	100%
			Pale Golden	R254 G240 B161	#FEF0A1	0	0%	
			Pale Golden	R246 G226 B157	#F6E29D	0	0%	
3.	Mordan Tunjung		*Dark Gray (27% white)*	R068 G068 B068	#444444	0	0%	100%
			Dark Gray (13% white)	R034 G034 B034	#222222	16	88.9%	
			Dark Gray (18% white)	R045 G045 B045	#2D2D2D	2	11.1%	
4.	Betel Lime Mordant		*Golden Sundance*	R195 G168 B111	#C3A86F	2	11.1%	100%
			Golden Sundance	R190 G168 B111	#BEA86F	0	0%	
			Golden Sundance	R194 G166 B108	#C2A66C	16	88.9%	

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Table 1 shows the results of the color name (*hue*) in dyeing rayon twil fabric with longan leaf extract (*Dimocarpus Longan L.*). In dyeing without mordant, 16 panelists (88.9%) chose *Off-White Lemon.* #FFF3C7 . In dyeing with the influence of alum mordant, 18 panelists chose *Pale Golden* #EBDC98. In dyeing with the influence of tunjung mordant, 16 panelists chose *Dark Gray (13% white)* #222222. In dyeing with the influence of lime mordant, 16 panelists chose *Golden Sundace* #C2A66C

Based on the results of the studys conducted testing using the *colorblind assistant application* and assessed by the panelists, it can be seen that the results of the color name (*hue*) in dyeing without mordant produce the color *Off-White Lem* on with R255 G243 B199 color code #FFF3C7). Based on the results off the studys by Nabila & Adriani (2024:303) The direction of the color name of purple cabbage dyeing without using a mordand produces the color *Off-White Lavender* with RGB R 168 G 183 B 206 code #A8B7CE.

In alum mordant produces *Pale Golden color* with R235 G220 B152 color code (#EBDC98). Based on research by Bara & Adriani (2022:272) Dyeing avocado leaf extract using alum mordant produces the color name *Golden Sundance* and R225 G188 B081 color code #E1BC51.

The tunjung mordant produces a *Dark Gray color (13% white)* with R034 G034 B034 color code (#222222). Based on research by Muharrani et al. (2023:415) dyeing cotton with henna leaf extract (*Lawsonia Inermis L*) using tunjung mordant produces a *dark olive green color* #32441E which has a value off R (Red) 050 = 88%, G (Green) 068 = 56%, an B (Blue) 030 = 27%. In line with the opinion of Arsa & Adriani (2024:28) , "The dark or dark color produced is influenced by tunjung which is basic so that it is able to absorb color pigments".

In the betel lime mordant produces the *Golden Sundace color* with R194 G166 B108 color code (# C2A66C). Based on the reseiarch results of Muharrani et al. (2023:415) Separate henna leaf coloring using tight betel lime produces *Golden Sundance* #BDB76B with R (Red) 189 = 56%, G (Green) 183 = 43% and B (Blue) 107 = 74%. According to Zulikah & Adriani (2019:211) , " That betel lime will produce a medium or brownish color in natural coloring".

Dyeing with different mordants can affect the final color of a dye, because the use of different mordants will produce different colors. The color name (*Hue*) is also influenced by the acid content (pH) of the mordant used (Sevira & Ernawati, 2024 :125) . In line with the opinion of Adriani & Sari (2024:296) , " The difference or addition of the amount of electrolyte affects the name of the color produced. The addition of electrolytes produces different color names."

2. Color Flatness

Table 2 Description of Color **Evenness**

No.	Dyeing	Color Flatness	F	%
1.	Without Mordant	Very Flat	3	16.7%
		Flat	13	72.2%
		Fairly Average	2	11.1%
		Less than Average	0	0%
		Uneven	0	0%
2.	Mordant Alum	Very Flat	4	22.2%
		Flat	13	72.2%
		Fairly Average	0	0%
		Less than Average	1	5.6%
		Uneven	0	0%
3.	Mordan Tunjung	Very Flat	0	0%
		Flat	4	22.2%
		Fairly Average	11	61.1%
		Less than Average	3	16.7%
		Uneven	0	0%
4.	Betel Lime Mordant	Very Flat	7	38.9%
		Flat	9	50%

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	Fairly Average	2	11.1%
	Less than Average	0	0%
	Uneven	0	0%

Table 2 shows the color evenness of rayon twill fabric dyeing with longan leaf extract (*Dimocarpus Longan L.*). In dyeing without mordant, 13 panelists or 72.2% stated that it was even. In dyeing with the influence of alum mordant, 13 panelists or 72.2% stated that it was even. In dyeing with the influence of tunjung mordant, 11 panelists or 61.1% stated that it was quite even. In dyeing with the influence of betel lime mordant, 9 panelists or 50% stated that it was even.

Based on the results of the research conducted, the color evenness value produced in dyeing rayon twill fabric with longan leaf extract (*Dimocarpus Longan L*) without using mordant, the color evenness obtained was even with a percentage of 72.2%. In the influence of alum mordant, the color evenness obtained was even with a percentage of 72.2%. In the influence of tunjung mordant, the color evenness obtained was quite even with a percentage of 61.1%. And in the influence of lime mordant, the color evenness obtained was even with a percentage of 50%.

Based on the research resultst of Muharrani et al. (2023:416) Cotton dyeing using henna leaf extract (*Lawsonia inermis L*) without using mordant, there were 66.6% of panelists who thought that the dyeing results were even. In cotton dyeing using henna leaf extract (*Lawsonia Inermis L*). Cotton dyeing using henna leaf extract (*Lawsonia Inermis L*) with lime mordant, there were 61.1% of panelists who stated that the dyeing results were even. Natural dyeing of coton using henna leaf extrak (Lawsonia Inermis L) with tunjung mordand, 77.7% of panelists stated that the dyeing results were even.

According to Zulmi et al. (2016:8) , "The coloring process is considered complete and perfect when a state of equilibrium is achieved, namely when the dye enters the dyed material reaching its maximum point". In line with the opinion of Putri et al. (2024:8117) , "Equilibrium occurs in the coloring process when the dye is absorbed into the material so that perfect color evenness is obtained which can be observed visually from the results of more or les color on the surfacea of the fabric, requiring auxiliary substances so that the results are better and more even ". This means that the coloring process is considered complete and perfect when equilibrium is achieved, namely when the dye is maximally absorbed into the material so that it produces perfect evenness which can be observed visually whether it is absorbed well or not on the surface of the material. This requires the help of auxiliary substances so that the coloring results are better and more even.

3. Color Fastness to Washing

Table 3of Color Fastness to Washing

No.	Dyeing	Washing Repetition	Washing Resistance Test		Information
			Frequency	presentation	
1.	Without Mordant	1x	10	55.6%	Slightly changed/ reduced
		2x	9	50%	Slightly changed/ reduced
		3x	13	72.2%	Changed/decreased
2.	Mordant Alum	1x	13	72.2%	Slightly changed/ reduced
		2x	13	72.2%	Slightly changed/ reduced
		3x	11	61.1%	Slightly changed/ reduced

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3.	Mordan Tunjung	1x	16	88.9%	Slightly reduced	changed/
		2x	13	72.2%	Slightly reduced	changed/
		3x	10	55.6%	Slightly reduced	changed/
4.	Betel Lime Mordant	1x	10	55.6%	No Change	At All
		2x	16	88.9%	Slightly reduced	changed/
		3x	13	72.2%	Slightly reduced	changed/

Table 3 shows the color fastness to washing produced by dyeing rayon twill fabric with longan leaf extract (*Dimocarpus Longan L.*). Dyeing without mordant at 1x washing 10 panelists (55.6%) chose slightly changed/reduced, 2x washing 9 panelists (50%) chose slightly changed/reduced and 3x washing 13 panelists (72.2%) chose changed/reduced. So the results of dyeing longan leaves on rayon twill material, the color fastness to washiing the resultsc of dyeing longan leaves without using mordant at the first and second washing the color looks slightly changed/reduced and at the third washing with the color category looks changed/reduced.

On the effect of alum mordant on the resultsc of dyeing rayon twill fabric with longan leaf extract at 1x washing 13 panelists (72.2%) chose slightly changed/reduced, 2x washing 13 panelists (72.2%) chose slightly changed/reduced and 3x washing 11 panelists (61.1%) chose slightly changed/reduced. So the results of dyeing longan leaves on rayon twill material, color fastness to washing the results of dyeing longan leaves using alum mordant at the first, second and third washings are categorized as the color looks slightly changed/reduced.

The effect of tunjung mordant on the resultsc of dyeing rayon twill fabric with longan leaf extract at 1x washing 16 panelists (88.9%) chose slightly changed/reduced, 2x washing 13 panelists (72.2%) chose slightly changed/reduced and 3x washing 10 panelists (55.6%) chose slightly changed/reduced. So the results of dyeing longan leaves on rayon twill material, color fastness to washing the results of dyeing longan leaves using tunjung mordant at the first, second and third washings are categorized as the color looks slightly changed/reduced.

On the effect of lime mordant on the resultsc of dyeing rayon twill fabric with longan leaf extract at 1x washing 10 panelists (55.6%) chose no change at all, 2x washing 16 panelists (88.9%) chose slightly changed/reduced and 3x washing 13 panelists (72.2%) chose slightly changed/reduced. So the results of dyeing longan leaves on rayon twill material, the color fasness to washing the resultsc of dyeing longan leaves using lime mordant at the first, second and third washings are categorized as the color looks slightly changed/reduced.

Based on the research results of Gustiani et al. (2024:472) The results of the color fastness/fastness test against 3x washing using soap nuts soap on dyeing primissima cotton mori cloth with gambir leaf extract (*Uncaria Gambir roxb*) without using mordant were 88.9% of panelists stated that it changed/decreased, 100% of panelists stated that the color changed/decreased with alum mordant, 100% of panelists stated that the color did not change at all with tunjung mordant and 100% of panelists stated that it changed/decreased slightly.

4. The Effect of Mordant Alum, Tunjung and Betel Lime on Color Evenness and Color Fastness/Fastness to Washing

Table 4*Friedman K-Related Sample* **Color** Evenness Test Results

Test Statistics [a]	
N	18
Chi-Square	31,699

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Df	3
Asymp. Sig.	,000

a. Friedman Test

Based on table 20 above, it can be explained that the *Friedman K-related sample test* of color evenness on the influence of alum, tunjung and lime betel mordants on the results of dyeing rayon twill fabric with longan leaf extract (*Dimocarpus Longan L.*) obtained a significant value of 0.000 which is smaller than the significance level of 0.05 or 0.000 <0.05. This means that there is a significant difference due to the influence of alum, tunjung and lime betel mordants on color evenness on the results of dyeing rayon twill fabric with longan leaf extract (*Dimocarpus Longan L*).

This is in accordancee with research from Ramelawati et al. (2017:13) the analysis obtained from the *Friedman K-relative sample test* for the evenness of the color of the data obtained was 0.005 which is smaller than the significa nce level of 0.05 due to the use of alum and lime mordand on the evenness of color in dyeing sillkmaterials using shallot extrak (*Allium Ascalonium L*) meaning Ho is rejected.

Table 5*Friedman K-Related Sample* **Test** Results for Color Fastness to Washing

Test Statistics [a]

Without Using Mordant	N	18
	Chi-Square	19,632
	df	2
	Asymp. Sig.	,000

a. Friedman Test

Test Statistics [a]

Mordant Alum	N	18
	Chi-Square	16,800
	df	2
	Asymp. Sig.	,000

a. Friedman Test

Test Statistics [a]

Mordan Tunjung	N	18
	Chi-Square	13,556
	df	2
	Asymp. Sig.	,001

a. Friedman Test

Test Statistics [a]

Betel Lime Mordant	N	18
	Chi-Square	24,776
	df	2
	Asymp. Sig.	,000

a. Friedman Test

The Friedman K-related sample test analysis for color fastnness to washing on the influence of alum, tunjung and betel lime mordants on dyeing rayon twill fabric with longan leaf extract

(*Dimocarpus Longan L.*) without using mordant, using alum mordant and using betel lime mordant the data obtained are significance value <significance level = 0.000 <0.05 = Ha ist accepted and Ho is rejected. Where Ha states that there is a significant difference in color fastness to washing due to the influence of alum, tunjung and betel lime on the results of dyeing rayon twill fabric with longan leaf extract (*Dimocarpus Longan L*).

the Friedman K-related sample test analysis for color fastness to washing on the influence of alum, tunjung and lime betel mordants on dyeing rayon twill fabric with longan leaf extract (*Dimocarpus Longan L.*) using tunjung mordant the data obtained is a significance value <significance level = 0.001 <0.05 = Ha is accepted and Ho is rejected. Where Ha states that there is a significant difference in color fastness to washing due to the influence of alum, tunjung and lime betel on the results of dyeing rayon twill fabric with longan leaf extract (*Dimocarpus Longan L.*).

This is in line with the journal of Fajri & Ernawati (2024:35631) washing resistance obtained a significance value of 0.015 which is smaller than the significance level of 0.05 or 0.015 <0.05, meaning that there is a significant difference due to the use of no mordant, alum mordant and alum mordant with the addition of (NaCl) on washing resistance in *ecoprint* using pagoda leaves with the pounding technique on satin material.

Based on the explanation above, its can be concluded that there is a significant difference in color eveness and color fastnness to washing due to the influence of alum, tunjung and betel lime mordants on the results of dyeing twill rayon fabric with longan leaf extract (*Dimocarpus Longan L*).

CONCLUSIONS

Dyeing rayon twill fabric with longan leaf extract (Dimocarpus longan L.) without mordant produced an Off-White Lemon color (#F4E5AA) with 72.2% evenness, while alum yielded Pale Golden (#EBDC98) with the same evenness. Tunjung produced Dark Gray (#222222) with 61.1% evenness, and lime gave Golden Sundace (#C2A66C) with 50% evenness. Color fastness to washing showed varying levels of reduction across mordants, with tunjung showing the highest initial stability and lime showing no change after the first wash. Statistical analysis using the Friedman K-Related Sample test indicated a significant difference ($p < 0.05$) in both color evenness and washing fastness due to the effects of alum, tunjung, and lime mordants.

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