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**COTTON DYEING USING *ARECA CATECHU L* SEED EXTRACT WITH  
COCONUT WATER MORDAN**

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**ABSTRACT**

Natural dyes are a recent discovery that is used as an alternative to coloring materials in the world of textiles. Most textile businesses use synthetic dyes and natural dyes side by side, according to the requests of customers who will use their services. The aim of the research was to describe the color name (hue), light darkness (value), color evenness, and washing resistance using young coconut mordant water. This research uses an experimental method with primary data sources. The data collection technique uses an instrument in the form of an assessment sheet. The data analysis technique is using the Friedman K-Related sample test with the help of SPSS. The results of the research show 1) The names of the colors that appear are sepia brown and cocoa brown, 2) The dark light obtained is quite light and light, 3) The evenness of the color obtained is quite even and even, 4) The durability of washing without mordant always changes from each washing stage, and the young coconut water mordant changed at 3 and 5 washings.

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**INTRODUCTION**

Natural dyes that come from plants are dyes that come from plant extracts such as leaves, seeds, stems, flowers, skin, and roots. One extract from plants that can be used is extract from areca nut seeds [1]. Areca nut contains many secondary metabolite compounds including tannins and flavonoids [2].

Natural dyes can be obtained from plants, animals or minerals [3]. Natural dyes can be obtained from animals, minerals and plants either directly or indirectly [4]. This natural dye is obtained by traditional extraction or boiling.

The use of raw materials from plants to make natural dyes has been widely used but still has weaknesses, one of which is washing resistance. Washing resistance is assessed by comparing the color change that occurs with the color change standards



issued by the International Standards Organization (ISO) and created by the Society of Dyers and Colorists (S.D.C) in England and the American Association of Textile Chemists and Colourists. (AATCC) in the United States. The color change standard issued is a gray scale standard to assess color changes in laundry [5].

Low washing resistance requires dyeing with natural dyes to be accompanied using mordant on the material to be dyed. Mordant functions as a strengthening agent and color generator [5]. Mordant is a process to increase the attractiveness of natural dyes to textile materials and is useful for producing better color evenness and sharpness [6]. It can be concluded that the use of mordant is a process in dyeing which aims to bind the color, increase the attractiveness of the color, and increase the evenness and sharpness of the color.

The electrolyte content in old coconut water can increase the amount of dye absorbed in the dyeing process[7]. The chemical content of young coconut water is higher than that of old coconut water. In pre-experiments conducted by researchers, it was proven that the use of young coconut water mordant produced different colors, namely that dyeing with young coconut mordant produced a lighter color compared to old coconut water mordant, but there was no significant difference [8].

The textile material used in dyeing is cotton. The properties of cotton is (a) a stiff material, (b) a material with a dull texture, (c) a material that feels strong [9].

Based on the background that the researcher stated above, the problem formulation in this research is as follows. 1) What is the name of the color produced by dyeing cotton material with areca nut extract (*Areca catechu L*) without mordant, and young coconut water mordant?, 2) What is the dark light (value) produced by dyeing cotton material with areca nut seed extract (*Areca catechu L*) without mordant, and young coconut water mordant?, 3) What is the evenness of the color produced by dyeing cotton material with areca nut extract (*Areca catechu L*) without mordant, and young coconut water mordant?, 4) What is the color fastness of the produced by dyeing cotton material with areca nut (*Areca catechu L*) extract without mordant, and young coconut water mordant?

Based on the description above, researchers are interested in conducting experimental research on the effect of young coconut mordant on cotton dyeing results using areca nut extract (*Areca catechu L*).

## METHOD

This type of research is experimental research. Experimental research is the most scientifically reliable (most valid) research, because it is carried out with strict control over confounding variables outside those being experimented with [10]. Experimental research is research that aims to explain the causal relationship (quality) between one variable and another variable (variable X and variable Y) [11].

In this research, the natural dye used was areca nut extract (*Areca catechu L*). The areca seeds used are old areca nut seeds that are immediately pounded and then boiled to remove the coloring matter, so that the skin color is more brownish red. By using the same tools, materials, and treatments. The difference lies in the mordant.





Figure 1. Areca nut extract after boiled



Figure 2. Dyeing cotton material into areca nut extract



Figure 3. Rinsing cotton fabric

This research uses an instrument in the form of an assessment sheet regarding the differences in color dyeing results (hue), dark, light (value), and color evenness. The instrument is in the form of a questionnaire as a data collection tool which is arranged according to a rating scale, namely several answer choices for the resulting value.

The collected data is processed and given a value and arranged in table form. To explain the average respondents' answers regarding the differences in dyeing results using areca nut extract and young coconut mordant with a vlot of 1:10. The color name assessment of this research sample was obtained from the Colorblind Assistant application, with this application the panelists can find out the color name and the resulting color code.

Data were processed using the Friedman K-Related sample test. To see the difference in the effect of dyeing results on the color name (hue) and dark and light color (value) obtained on cotton material with areca nut extract and young coconut mordant.



## RESULTS AND DISCUSSION

### Results

Based on the research results, it can be concluded that the name of the color (hue) produced by dyeing cotton material with natural dyes from areca nut extract (*Areca catechu L*) without dyeing mordant. 17 panelists (94.4%) stated the color sepia brown and 1 panelist (5.6%) states the color soft brown.

When dyeing with young coconut water mordant, 15 panelists (83.3%) stated the color cocoa brown and 3 panelists (16.7%) stated the color sophia brown.

After repetition, the resulting color becomes darker than before. The more often you dye it, the darker the color you will get [12].

Table 1. Distribution of Light Dark Frequency (Value) in Dyeing Cotton Material Using Areca Seed Extract (*Areca catechu L*) Without Mordant

No	Value	Frequency	% Frequency
1	Very Dark	0	0%
2	Dark	7	38.9%
3	Quite Light	10	55.6%
4	Light	1	5.6%
Total		18	100%

In the table above, the frequency of dark and light dyeing in cotton using *Areca catechu L* seed extract without mordant is 0% of panelists said it was very dark, 38.9% of panelists said it was dark, 55.6% said it was quite light, 5.6% said it was light. This means that the light dark (value) when dyeing cotton without using mordant is quite light.

Table 2. Distribution of Light Dark Frequency (Value) in Dyeing Cotton Material Using Areca Seed Extract (*Areca catechu L*) Young Coconut Water Mordant

No	Value	Frequency	% Frequency
1	Very Dark	0	0
2	Dark	2	11.1%
3	Quite Light	13	72.2%
4	Light	3	16.7%
Total		18	100%

In the table above, the frequency of dark and light dyeing in cotton using Areca Seed Extract (*Areca catechu L*) with young coconut mordant is 0% of panelists said it was very dark, 11.1% of panelists said it was dark, 72.2% said it was quite light, 16.7% said it was light. This means that the light dark when dyeing cotton using young coconut water mordant is quite light.

To change the value to light by adding white in stages and to change the value to dark is to add black [13]. On the value scale there are nine levels from dark to light. Levels 1, 2, and 3 are dark values called shade. Levels 4, 5, and 6 are medium values called tones. Levels 7, 8, and 9 are bright values called tint [14].



Table 3. Results of the Friedman K-Related Sample Light Darkness Test (Value) on Dyeing Cotton Material Using Areca Seed Extract (*Areca catechu L*) Without Mordant and Young Coconut Water

Test Statistics <sup>a</sup>	
N	18
Chi-Square	22.877
df	2
Asymp. Sig.	.000

a. Friedman Test

In the table above it can be explained that the Friedman K-Related Sample light dark test on dyeing primisima cotton using areca seed extract (*Areca catechu L*) without mordant, and young coconut water mordant obtained a significance 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 use of mordant in dyeing primisima cotton using areca seed extract (*Areca catechu L*).

Table 4. Frequency Distribution of Color Flatness in Dyeing Cotton Material Using Areca Seed Extract (*Areca catechu L*) Without Mordant

No	Color Flatness	Frequency	% Frequency
1	Less Flat	1	5,6%
2	Quite Flat	13	72,2%
3	Flat	3	16,7%
4	Very Flat	1	5,6%
Total		18	100%

In the table above, the frequency of color evenness of dyeing in cotton using areca seed extract (*Areca catechu L*) without mordant is 5.6% of panelists said it was not even, 72.2% of panelists said it was quite even, 16.7% said it was average, 5.6 % states very even. This means that the flatness of color when dyeing cotton without using mordant is quite flat.

Table 5. Frequency Distribution of Color Evenness in Dyeing Cotton Material Using Areca Seed Extract (*Areca catechu L*) Young Coconut Water Mordant

No	Color Flatness	Frequency	% Frequency
1	Less Flat	0	0%
2	Quite Flat	2	11.1%
3	Flat	14	77.8%
4	Very Flat	2	11.1%
Total		18	100%

In the table above, the frequency of color evenness of dyeing in cotton using areca seed extract (*Areca catechu L*) with young coconut water mordant is 0% of panelists said it was not even, 11.1% of panelists said it was quite even, 77.8% said it was average, 11, 1% said it was very average. This means that the evenness of the color when dyeing cotton using young coconut mordant is even.

In research, Areca nut seed extract using the post mordanting technique produced an even color. Textile materials that are to be colored must be mordanted first. This mordanting process is intended to increase the attractiveness of natural dyes to textile materials and is useful for producing good evenness and sharpness of color[6].



Table 6. Results of the Friedman K-Related Color Evenness on Dyeing Cotton Material Using Areca Seed Extract (*Areca catechu L*) Without Mordant and Young Coconut Water

Test Statistics <sup>a</sup>	
N	18
Chi-Square	25.018
Df	2
Asymp. Sig.	.000

a. Friedman Test

In the table above it can be explained that the Friedman K-Related Sample test for color evenness in dyeing primisima cotton using *Areca catechu L* seed extract without mordant, and young coconut water mordant obtained a significance 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 in color evenness due to the use of mordant in dyeing primisima cotton using areca seed extract (*Areca catechu L*).

Table 7. Frequency Distribution of Washing Resistance in Dyeing Cotton Material Using Areca Seed Extract (*Areca catechu L*) Without Mordant 1 x Washing

No	Washing Resistance	Frequency	% Frequency
1	No changes	7	38.9%
2	Little changes	11	61.1%
3	Quite changes	0	0%
4	Very changes	0	0%
Total		18	100%

In the table above, the frequency of washing resistance for dyeing in cotton using *Areca catechu L* seed extract without mordant is 38.9% of panelists stated there was no change, 61.1% of panelists stated there was a slight change. This means that the washing resistance of dyeing cotton without mordant is a slight change in 1 wash.

Table 8. Frequency Distribution of Washing Resistance in Dyeing Cotton Material Using Areca Seed Extract (*Areca catechu L*) Young Coconut Water Mordant 1 x Washing

No	Washing Resistance	Frequency	% Frequency
1	No changes	18	100%
2	Little changes	0	0%
3	Quite changes	0	0%
4	Very changes	0	0%
Total		18	100%

In the table above, the frequency of washing resistance for dyeing cotton using *Areca catechu L* extract with young coconut water mordant is 100%. The panelists stated that there was no change. This means that the washing resistance of dyeing cotton with young coconut water mordant is no change.

Table 8. Frequency Distribution of Washing Resistance in Dyeing Cotton Material Using Areca Seed Extract (*Areca catechu L*) Without Mordant 3 x Washing

No	Washing Resistance	Frequency	% Frequency
1	No changes	0	0%
2	Little changes	5	27.8%
3	Quite changes	13	72.2%
4	Very changes	0	0%
Total		18	100%



In the table above, the frequency of washing resistance of dyeing in cotton using *Areca catechu L* seed extract without mordant is 72.2% of panelists stated that it had changed quite a bit, 27.8% of panelists stated that there had been a slight change. This means that the washing resistance of dyeing cotton without mordant is sufficient changes after 3 washings.

Table 9. Frequency Distribution of Washing Resistance in Dyeing Cotton Material Using *Areca* Seed Extract (*Areca catechu L*) Young Coconut Water Mordant 3 x Washing

No	Washing Resistance	Frequency	% Frequency
1	No changes	5	27.8%
2	Little changes	13	72.2%
3	Quite changes	0	0%
4	Very changes	0	0%
Total		18	100%

In the table above, the frequency of washing resistance in dyeing cotton using *areca* seed extract (*Areca catechu L*) with young coconut water mordant is 72.2% of panelists stated there was a slight change, 27.8% of panelists stated there was no change. This means that the washing resistance of dyeing cotton with water mordant young coconut is that there is a slight change after 3 washings.

Table 10. Frequency Distribution of Washing Resistance in Dyeing Cotton Material Using *Areca* Seed Extract (*Areca catechu L*) Without Mordant 5 x Washing

No	Washing Resistance	Frequency	% Frequency
1	No changes	0	0%
2	Little changes	0	0%
3	Quite changes	8	44.4%
4	Very changes	10	55.6%
Total		18	100%

In the table above, the frequency of washing resistance of dyeing in cotton using *Areca catechu L* extract without mordant is 55.6% of panelists said it has changed greatly, 44.4% of panelists said it has changed quite a bit. This means that the washing resistance of dyeing cotton without mordant is greatly changed after 5 washings.

Table 11. Frequency Distribution of Washing Resistance in Dyeing Cotton Material Using *Areca* Seed Extract (*Areca catechu L*) Young Coconut Water Mordant 5 x Washing

No	Washing Resistance	Frequency	% Frequency
1	No changes	1	5.6%
2	Little changes	13	72.2%
3	Quite changes	4	22.2%
4	Very changes	0	0%
Total		18	100%

In the table above, it can be seen that the frequency of washing resistance of dyeing in cotton using *Areca catechu L* seed extract with young coconut water mordant is 72.2% of the panelists stated that there was a slight change, 22.2% of the panelists stated that it had changed quite a bit, and 5.6% of the panelists stated that there was no change. This means that the resistance washing when dyeing cotton with young coconut water mordant, there is a slight change after 5 washings.



Table 12. Results of the Friedman K-Related Sample Test for Washing Resistance in Dyeing Cotton Material Using Areca Seed Extract (*Areca catechu L*) Without Mordant, d and Young Coconut Water

Test Statistics <sup>a</sup>	
N	18
Chi-Square	28.933
Df	2
Asymp. Sig.	.000

a. Friedman Test

In the table above it can be explained that the Friedman K-Related Sample test for washing resistance, obtained a significance 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 use of mordant on washing resistance in dyeing cotton materials using areca seed extract (*Areca catechu L*).

### Discussion

Based on the results of the research the author conducted, in this discussion the author presents research results related to theories. This discussion relates to the effect of repeated dyeing on the color results of cotton materials with areca nut extract (*Areca catechu L*) without mordant, and with young coconut water mordant, which can be seen from the color name (hue), dark light color (value), evenness of color (value), and washing resistance.

1. Name of the color produced by dyeing cotton using areca nut (*Areca catechu L*) extract without mordant, and young coconut water.

After conducting research, Areca nut seed extract can be used as a natural dye. The resulting color is a graduated brown color. Researchers determined the name of the color (hue) according to the color direction according to the Color-Blind Assistant computer program which uses the RGB color mode (Red, Green, Blue.)

In dyeing the color produced without a mordant is sepia brown with RGB R166 G088 B013, while the color produced using a young coconut water mordant is cocoa brown with RGB R198 G120 B048.

Based on the explanation above, it can be concluded that areca nut seeds (*Areca catechu L*) contain tannin which is a color-producing pigment that can be used as a natural dye in textile dyeing and the color produced is also influenced by repeated dyeing.



Figure 4. Result of Dyeing Cotton





2. Light Darkness produced by Dyeing Cotton Material Using Areca Seed Extract (*Areca catechu L*) without mordant, and Young Coconut Water.

The results of the research carried out revealed that the value of dark light color (value) is influenced by the mordant used for dyeing cotton material with areca nut extract (*Areca catechu L*), where for dyeing without mordant the color indicator is quite bright, for dyeing using mature coconut water as a mordant. produces a bright color indicator, and for dyeing using young coconut water mordant produces a bright color indicator.

The research results show that the dark and light values (Value) are influenced by differences in mordant and the resulting RGB values. The results of dyeing silk materials using natural dyes from extracts of Blood Sambang leaves (*Excoecaria cochinchinensis*) using alum mordant with the post mordanting technique are less bright with a percentage of 66.67%.

It can be concluded that the color values require white and black. Colors that contain a lot of white will produce a lighter color, called tint, with a higher RGB value, and colors that contain more black will produce a darker color with a lower RGB value, called shade, and between the two there are neutral colors. which is called tone.

3. Evenness of Color produced on Dyeing Cotton Materials Using Areca Seed Extract (*Areca catechu L*) without mordant, and Young Coconut Water.

The color evenness value from the results of repeated dyeing of cotton material with areca nut (*Areca catechu L*) seed extract without dyeing mordant produces even color evenness, as does dyeing using young coconut water mordant which also produces even color evenness.

Based on the description above, it can be concluded that mordanting technique and temperature greatly influence the dyeing process. This is in line with research conducted by Zulikah and Adriani with the results obtained from the Friedman K-relative sample test. The color evenness of the data obtained was  $0.001 < 0.05 = H_0$  was rejected. This means that there is a significant influence due to the use of mordanting techniques.

With the post mordanting technique, the attraction of the material to the dye produces good evenness and room temperature slows down the absorption process resulting in good evenness too. This means that if repeated dyeing is carried out, the attraction of the material will be more frequent, and the absorption will be longer so that the color evenness results in repeated dyeing will be evener.

4. Washing resistance resulting from Dyeing Cotton Material Using Areca Seed Extract (*Areca catechu L*) without mordant, and Young Coconut Water.

The durability of washing dyeing cotton with areca nut extract (*Areca catechu L*) without mordant for 1 wash there was a slight change in color, as well as 3 washes which also experienced quite a change, whereas for 5 washes the resulting color changed greatly.



Durability of washing, dyeing cotton with areca nut (*Areca catechu L*) extract with young coconut water mordant for 1 wash, there was no change in color, likewise with 3 washes there was a slight change, whereas for 5 washes the resulting color had a slight change.

## CONCLUSION

Based on the results of research and discussion, the following conclusions can be drawn:

1. The name of the color produced by dyeing cotton using natural dyes from areca nut extract (*Areca catechu L*) without using a mordant is sepia brown, and using a mordant from young coconut water is cocoa brown. Based on the dyeing results, the more often the dyeing is done, the darker the resulting brown color will be.
2. The dark and light color produced by dyeing cotton using natural dyes from areca nut extract (*Areca catechu L*) without mordant is quite bright, and for dyeing using young coconut water as a mordant, it is quite bright. This states that the more often dyeing is done, the darker the light value of the color (value) will move towards dark.
3. The evenness of the color produced by dyeing cotton using natural dyes from areca nut extract (*Areca catechu L*) without mordant is quite even, and dyeing using young coconut water mordant results in even color evenness. This states that the more often dyeing is done, the more perfect the color evenness will be.
4. The washing resistance produced by dyeing cotton using natural dyes from areca nut extract (*Areca catechu L*) without mordant always changes at each washing stage, and dyeing using young coconut water mordant shows that the washing resistance does not change once washing, and after 3 washes there was a slight change, then there was a slight change after 5 washes.

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