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The Application of Natural Dyes Soga Tingi on Tanned Leather for Dyeing with Jumputan Tie Technique

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Abstract:
The purpose of this research is the application of natural dyes from the extraction of Soga Tingi wood (Cereopcandolleana L) on tanned leather for the process of dyeing colors with jumputan tie technique on color absorption and fastness. The material used is wood from Soga Tingi, the leather of sheep crust.is wood from Soga Tingi, the leather of sheep crust. Using the experiment method, with 4 (four) stages, namely: (1) Extraction of Soga Tingi wood counter current variation method(Dry Soga Tingi and Fermented Soga Tingi),(2) Application of natural dyes of Soga Tingi Through Dyeing method with Jumputan Tie technique, variation: (a) Soga Tingi dye concentration, (b) Dyeing time, (c) pH, dan (d) Rpm Turning and, (3) Absorption test and color fastness test for rubbing (wet and dry), Standard assessment using the gray scale and staining scale and the level of difficulty of the jumputan tie technique on sheep crust leather. Data analysis uses Analysis of variance. The results of the application of Soga Tingi dyes containing tannin for tanning the leather of sheep crust using the Throuds dyeing method. At a high concentration of 12.0% dyestuff, optimal% absorption was obtained in the leather of sheep crust 80.0% (Fermented Soga Tingi) and 76.0% (Dry Soga Tingi), pH 4.8 to 5.3, dyeing time 120 minutes and rpm play drum 12. The results of the color fastness test obtained dryness test dry rubbing 5.0 (good)or not fade and wet rub test 3.5 (good enough) on the dry Soga Tingi, and obtained dry rub test dryness value of 4.5 (good good), or not fade and wet rub test 4.0 (good) on SogaTingi Fermentation. The results of the level of difficulty in the application of the tie belt technique on sheep crust, for a single tie technique 20% (low),double tie technique 40% (medium) andcross-tie technique65% (high).

Keywords: *Soga Tingi, leather sheep crust, dyeing, jumputan tie technique, color absorption and fastness*

1. Introduction

The leather tanning industry, there are 4 (four) main stages of the process, are as follows: (1) the wet work process (Beam house); (2) tanning process; (3) post-tanning process and (4) finishing process (Finishing). Each stage consists of several types of processes, each process requires additional chemicals and generally requires water, depending on the type of raw skin used and the type of finished skin desired (Guthrie, Jeffry, 2008). Products that contain chemical dyes often used in the process of dyeing the tanned skin by immersing and rotating it in a drum of a dye solution, with the aim of giving the base color to the skin so that its use of a finishing dye (finishing) will not be too thick, so it is not easily broken (Billah, et al ., 2011).

The use of synthetic dyes, containing pigments (dangerous and toxic metals). Carcinogenic compounds benzidine and bifenilamin which have a similar molecular structure that is an aromatic compound amen with a planar molecule, the compound can interconnect into DNA, interact with DNA bases and cause irreversible DNA damage that can trigger cancer (carcinogens) and wastewater can pollute the environment. (Xiaolei, 2009). Although synthetic dyes have advantages including more practical use which means time efficiency, as well as the appearance of colors that provide satisfactory results on the finished leather goods, but has a relatively high price weakness, and has great potential to cause pollution to the environment (Handayani, PA, 2013).

Indonesia as a tropical country and has a high soil fertility has the potential to produce dyes producing plants that have not been largely utilized to be applied to the leather tanning industry. One of them is natural dyes that can be utilized, namely the SogaTingi plant (*Cereopscandelliana* L), visually, the color produced from the Tingi bark is brown-yellow (Purwanto, 2018).From the background arises the problem, how to get environmentally friendly coloring agents that can

be used as coloring agents in the process of coloring on tanned skin with jumputan bonding technique so that the waste is safe for workers and has no toxic effect on the environment.

2. Material and Methods

2.1. Material of the Research

Materials and tools for extraction, used Soga Tingi wood (*Cereopcanddelliana* L), aquades solvents and extraction tools, analytical scales, heaters, UV-Vis Spectrometer stirrers, pH meters, Baumeter devices. Materials and tools for coloring process, tanned leather (sheep crust), Soga Tingi coloring (dry/fermentation), aquadest and process water are used local well water and Rotary drum tools 50 cm in diameter, equipped with temperature and rpm settings, analytical scales, pH meters. The test uses a Crochmeter, a gray scale standard, and a staining scale to assess color stain, color absorption and fastness test

2.2. Research Methods

The experimental research was carried out in a laboratory with 4 (four) stages: (1) Extracting natural dyes of SogaTingi wood with counter current method with dry wood material and fermentation (2) Technique to tie the motive of jumping on the skin of sheep crust, (3) Application of Soga Tingi extraction for skin crust tanned by sheep crust Throuds Dyeing method,(4) Test of color absorption and color fastness. Data analysis of the results of testing the properties and characteristics of the dye material density, yield, and testing the quality of the coloring of Soga Tingi on the skin of a sheep crust against fade resistance using ANOVA.

3. Results and Discussion

3.1. The Result of Extraction of Dye

Extracts from vegetable tannins from the Soga Tingi (*Cereopcandolleana* L) plant as a natural color are ingredients of plants, taste bitter and chelate, containing tannin dyes derived from wood or pepagan for use in tanning leather, to be used as a tanning material or coloring can be used directly or in concentrated form by re-extracting the tannin material. Containing tannin dyes derived from wood or pepagan for use in tanning and dyeing leather, to be used as a dyeing material or coloring can be used directly or in concentrated form by re-extracting the tannin material.

Figure 1: Soga Tingi Wood (Cereopcandolleana L)

Figure 1 The experimented with fermented Soga Tingi (FST) treatment, namely Soga Tingi wood for 5 days fermentation process was carried out to obtain brown-yellow dye containing tannin which was more concentrated, and the treatment of dried Soga Tingi (DST) without fermentation, extraction is then performed using the counter current method, the principle of counter current extraction is a multiple extraction method of liquid-liquid extraction, the separation of substances is one of the various ways for 2 or more substances if the comparative distribution, of the substances is small. Weighing Soga Tingi 200.0 grams, performed 3 repetitions, for SogaTingi fermentation (FST1, FST2, and FST3), and for Dry SogaTingi(DST1, DST2, and DST3), with variations of immersion time (12 hours, 18 hours, 24 hours hour, 30 hours and 36 hours), at the ratio of material and solvent (4:10) w / v, at temperature (70-100^{o}C) to the color density and yield produced.

Time of extraction (hour)	Color Density (^{o}Be)					
	1		2		3	
	FST1	DST1	FST2	DST2	FST3	DST3
12	2.30	0,65	3,78	1,08	5,72	2,20
18	2.65	1,50	3,98	2,31	5,89	2,89
24	2,82	1,72	3,06	2,64	5,60	3,30
30	3,10	1,98	4,45	2,86	5,80	3,81
36	3,54	2,12	4,69	3,99	5,61	4,25

Table 1: The Results of Soga Tingi Dyestuff Extraction Time Variation to Color Density
Source: Laboratory Analysis Results, 2019

Table 1. Show that the results of the counter current extraction method on the color density were measured with a meter rise and fall obtained an optimum of 5.80°Be for hours immersion time, temperature (70°C-100°C), ratio (4:10) in Soga Tingi from fermentation material (FST3), and the lowest color density of 0.65°Be for 12 hours soaking time, temperature (70°C-100°C), ratio (4:10), Soga Tingi from dry matter (DSTI). This difference is due to the fermentation treatment is more concentrated than the dry height because 5 days fermentation time can improve the coloring ability, and each repetition is done 3 time (Suheryanto D, 2012)

Time of Extraction (Hour)	Yield (%)					
	1		2		3	
	FST1	DST1	FST2	DST2	FST3	DST3
12	5,20	1,29	5,88	1,83	6,72	2,15
18	5,48	2,12	6,03	2,35	6,99	3,75
24	5,77	2,72	6,21	3,89	7,32	4,09
30	6,60	3,12	6,45	4,40	7,84	5,60
36	6,45	3,20	6,33	3,75	7,38	6,23

Table 2: The Result of Sogatingi Dyestuff Extraction Time Variation Extraction of Yield
Source: Laboratory Analysis Results, 2019

Table 2, the results of the extraction of dyes containing tannin from the Soga Tingi counter current method to the yield increase and decrease, the optimum yield obtained 7.84% at a time of 30 hours immersion with temperature (70-100°C), ratio (4:10) on the fermentation level (FST3), and the yield is 1.29%, soaking time is 12 hours, temperature (70-100°C), ratio (4:10), dry height (DST1). This difference is due to the longer immersion time means the heavier the dyestuff is used so that more dyes can dissolve, because the solid material extracted results get greater, because contact is more frequent with more solvents and it appears that the liquid has already started to saturate the dyes so the yield is starting to be constant. (Pujilestari, Titik, 2017)

The results of the data analysis showed that the effect of SogaTingi wood (dry and fermented) and the immersion time variation on the color density was significant (F_{count} = 65.012), the effect of Soga Tingi wood (dry and fermented) and the immersion time variation on significant yield (F_{count} = 34.430)

3.2. Tie Technique with Jumputan Motif on Sheep's Crust Tanned Leather

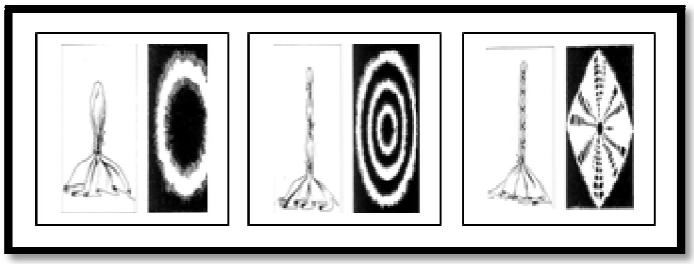

Figure 2: Tie Technique for Jumputan Motifs (A) Single Tie, (B) Double Tie and (C) Cross Ties
(Source :) Jack. L. Larsen (2004)

Figure 2. shows that, there are 3 (three) ways to tie the jumputan motif technique, namely: (1) The single binding technique is carried out by bonding the tanned skin with only one bond, so that one bond motif is obtained, (2) the binding technique Double bonding is done by bonding the tanned skin with more than one bond so that more than one or more bonding motives are obtained, and (3) Cross-binding technique by means of cross-binding so that the bond motif is obtained in the form of crossing one another. The three binding techniques by adding a shirt button filler on the crust of the sheep will reveal the surface of the nerf skin and the lower surface of the fleshing skin (Larsen, 2004).

3.3. The Application of Soga Tingi Dyes for Tanning through Dyeing Method

3.3.1. Through Dyeing Method

Through Dyeing is a method that aims to penetrate the color throughout the skin cross section. This method uses a little water (Short float), high concentrations adjusting the pH of the solution with skin pH, low temperature, (Guthrie, Jeffry, 2008)

3.3.2. Effect of Dye Concentration

The result of using Soga Tingi dye concentration for each liter of water in the coloring process is based on the percentage of crust skin weight, the greater the percentage the stronger the color of the skin, because the amount of water used still ranges between 100% -150% of the skin weight, but for Soga Tingi coloring use 200%. The use of large amounts of coloring agent does not always mean good because it can cause uneven color.

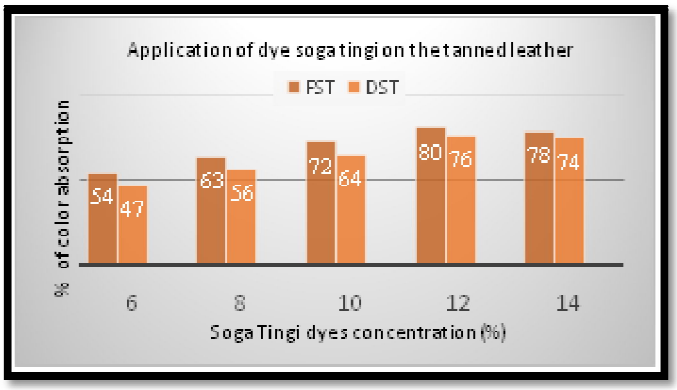

Figure 3: Dyeing Results of Soga Tingi Dyes Concentration to the % of Color Absorption

Figure 3. The coloring process with Soga Tingi dyes on sheep crust skin is obtained at a concentration of 12.0%, optimal color absorption of 80.0% (FST)and 76.0% (DST). The result of coloring shows that the greater the concentration of Soga Tingi dyes added, the more Soga Tingi dyes absorbed into the skin, within a certain time limit there is a decrease in the color absorption of tanned skin, this is due to the absorption of SogaTingi dyes by the skin has reached balance limits, (Daniels, R and W Landmann,2008)

3.3.3. Effect of Time

The results of applying the 12% concentration of Soga Tingi dyes to the skin of sheep crust, with variations in the time of dyeing to the% absorbance results are as follows:

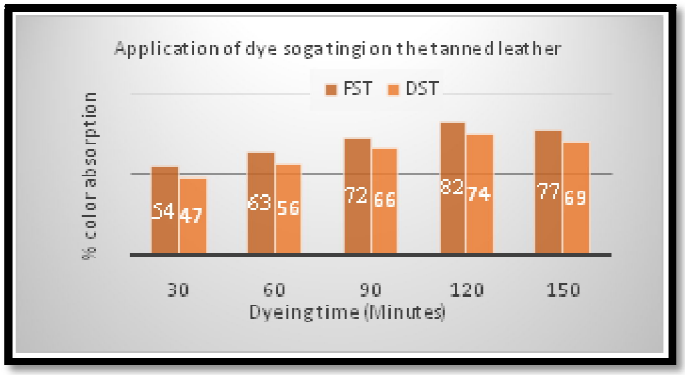

Figure 4: The Results of Soga Tingi Dyes Time Variable to the % Color Absorption

Figure 4. The process of coloring Soga Tingi influence the time obtained optimum absorption% 82.0% fermented Soga Tingi (FST) dyeing time 120 minutes and lowest absorption% 47.0% in Dry SogaTingi (DST) on the leather of sheep crust, 30 minutes. This difference is due to the longer coloring time (dyeing) the more SogaTingi dyes are absorbed into the leather, but after 120-150 minutes of staining time the Soga Tingi dyes are absorbed into the leather. This is due to the absorption of Soga Tingi dyes by the leather has reached the maximum limit is the leather has been saturated with dyes.

3.3.4. Effect of pH

The results of the application of a 12% concentration of Soga Tingi dye,120 minutes of dyeing time on the leather of sheep crust, on the effect on the% absorption of the results are as follows:

Code	**The Relationship between the Initial pH and the% Absorption of the Soga Tingi Dye**				
	(2,0-2.5)	(2,6-3.1)	(3.2-3.7)	(4.2-4.7)	(4.8-5.3)
FST	40,5	56.3	65.8	73.1	84.5
DST	37,2	50.2	59.2	69.3	72.3

Table 3: The Results of the Variable Soga Tingi Dyeing Process Ph to% Color Absorption

Table 3 shows that in the Soga Tingi Fermentation (FST) staining process, optimum absorption of 84.5% was obtained at the initial pH (4.8-5.3), the dyeing time was 120 minutes on sheep's tanned skin and the optimum absorption of dried Soga Tingi was obtained. % (DST), at the lowest initial pH (2.0-2.5) dyeing time 120 minutes on sheep's tanned leather.

3.3.5. The Effect of Rpm

The results of applying SogaTingi dye with a concentration of 12% on sheep's crust tanned leather, with variations in drum rotation speed (Rpm) and dyeing time against% absorption, are as follows:

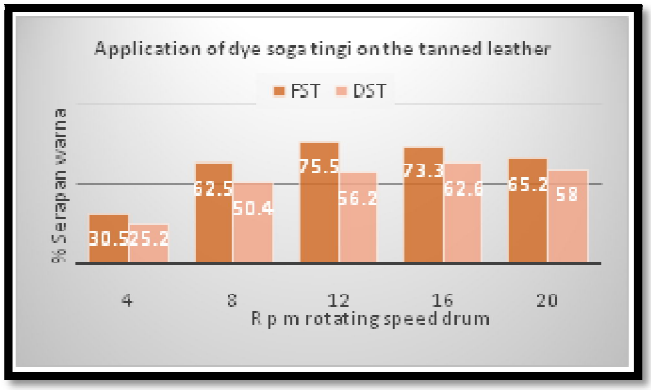

Figure 5: The Results of the Variable Soga Tingi Dye Dyeing Process Rpm against% Absorption of Color

Figure 5 Shows that the drum rotational speed (Rpm) against % absorption shows that the highest is 75.5% (FST) at Rpm = 12 and the lowest is 25.2% (DST) at Rpm = 4, this difference is strongly influenced by the histological structure of the animal sheep, namely the thickness of the skin, the part of the tanned skin (back, stomach, neck and tail), and the drum rotating speed.

3.3.6. Fastness Resistance Test Results

Rpm	Color Fastness Value (Rub dry)						Color Fastness Value (Wet rub)					
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
8	2,5	3,0	3,5	2,0	2,0	2,5	2,5	2,5	3,0	2,5	2,5	2,0
10	3,0	4,5	3,5	3,0	3,0	2,5	2,0	2,5	3,0	2,0	2,5	3,5
12	4,5	5,0	5,0	3,0	3,0	3,5	2,5	3,0	3,5	3,0	3,5	3,0
16	4,0	4,0	4,0	3,5	3,5	3,5	3,0	3,0	3,0	3,0	3,5	3,0

Table 4: Dry Sogatingi Fading Value on the Tanned Sheep Crust
Information: Value 1.0= Not Good; 2.0= Moderate; 3.0=Sufficient; 4.0 =Good and 5.0= Very Good

Table 4, it shows that the fading value at dry Soga Tingi (DST) has the lowest value=2.0 (moderate), meaning that it fades a little at Rpm 8 on the wet rub test, and the highest fading value is 5.0 (very good) or does not fade, Rpm 12 on dry rub test.

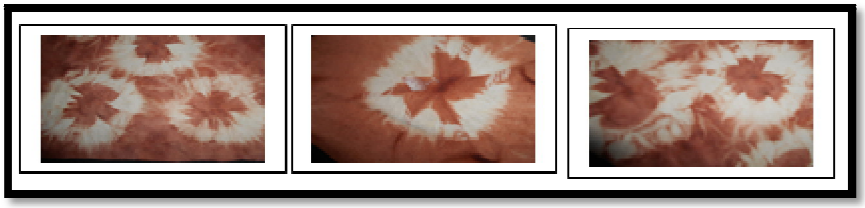

Figure 6: The Results of the Jumputan Motif Leather Tie Technique Dry Soga Tingi Dye (DST)

Figure 6. The results of the application of the jumputan motif tie technique on sheep's crust tanned leather are influenced by the difficulty level of the order of difficulty, namely: The jumputan motif binding technique on sheep's crust tanned skin, is very much influenced by the thickness of the leather, the limpness of the finished leather and the type of tanned leather article to be used. The difficulty level for the single tie technique is 20% (low), the double tie technique is 40% (moderate) and the cross-tie technique is 65% (high). This difference is due to the influence of the histological tissue structure on the ability to absorb Tingi dye on the back (oropon), better than the stomach, tail and neck on the absorption of the color and color shown (yellow-brown), on sheep's tanned skin (Rungruangkirtkrai, 2012).

Rpm	Color Fastness Value (rub dry)						Color Fastness Value (rub wet)					
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
8	2,0	3,0	3,0	2,5	2,5	2,5	2,0	2,0	2,5	2,0	3,5	2,0
10	3,0	3,5	3,0	3,0	3,0	3,0	2,0	2,0	3,0	2,5	2,5	3,0
12	4,0	4,5	4,5	4,0	4,5	4,5	3,0	3,5	4,0	4,0	3,5	3,5
16	4,0	3,5	3,0	3,0	2,5	3,0	3,5	3,0	2,5	2,0	2,5	3,5

Table 5: Fertility Value of Fermentation on the Leather Sheep Crust
Information: Value 1.0= Not Good; 2.0= Moderate; 3.0 = Sufficient; 4.0 = Good And 5.0 = Very Good

Table 5, it shows that the lowest fading value is 2.0 (moderate), meaning that it fades a little at Rpm 8 and 10 on the wet scrubbing test. High fermentation and the highest fading value are 4.5 (good) or does not fade, at Rpm 12.

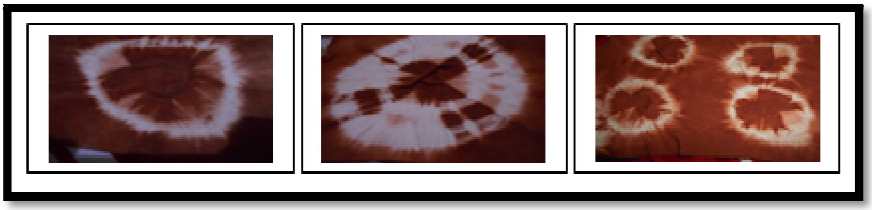

Figure 7: The Results of the Jumputan Motif Leather Tie Technique Fermented Soga Tingi Dye (FST)

Figure 7. The results of the leather product of the jumputan motif tie technique with high fermentation (FST) dye, the ability to absorb dyes is better than dry high dyes, this is because in the fermentation process the resulting coloration is 5.6^{o}Be, so the penetration of dyes is high. on the back (oropon), better than the belly, tail and neck against the absorption of the color and color shown (brown-yellow), on sheep's tanned skin, (Campbell, 2006). The results of data analysis showed that the effect of dry Soga Tingi wood (DST) and immersion time variation on significant fastness (F_{count} = 31.012), the effect of fermented SogaTingi wood (FST) and immersion time variation on significant fastness (F_{count}=34.430).

4. Conclusion and Recommendation

4.1. Conclusion

Extraction of Soga Tingi wood (*Cereopcandolleana* L) natural dye using the counter current method from dry Soga Tingi. The optimum dye concentration (5.80^{o}Be) and yield (7.84%) in Fermentation Soga Tingi, immersion time 30 hours and optimum dye concentration (4.25^{o}Be) and optimum yield (6.23%) in Soga Tingi dry immersion time 36 hour.

The technique of fastening the jumputan motif on sheep's crust tanned leather is very much influenced by the thickness of the leather, the luster of the finished leather and the type of leather article to be used. The difficulty level for the single tie technique is 20% (low), the double tie technique is 40% (moderate) and the cross-tie technique is 65% (high).

The results of the application of sogatingi dye containing tannins for the Throudsdyeng method of sheep crust tanning. At a high dye concentration of 12.0%, the optimal % absorption in sheep crust leather was 80.0% (Fermented Soga Tingi) and 76.0% (Dry Soga Tingi), pH 4.8-5.3, dyeing time 120 minutes and Rpm turn the drum 12.

The results of the color fastness test showed that the dry rubbing test fading value was 5.0 (good) or did not fade and the wet rub test was 3.5 (good enough) on dry Soga Tingi, and the dry rubbing test was 4.5 (good) or did not fade and test rub wet 4.0 (good) on Fermented Soga Tingi.

4.2. Recommendation

As a basis for consideration in the selection to use of environmentally friendly dyes in the basic dyeing process of tanned leather, as an alternative to synthetic dye substitutes to reduce environmental pollution and toxicity for humans.

5. References

i. Billah, S, M, R, etal, (2011). Photochromic Dyeing, *Leather International*, Vol.213, No.4806, pp34- 36
ii. Campbell, 2006, Colour fastness of Leather to perspiration, En ISO 11641/IUF 426, *World Leather*, Vol.19, No.6, p 48.
iii. Daniels, R and W. Landmann, 2008, Pre-Finishing and Finishing, *World Leather*, Vol.21, No.21 pp 42-43.
iv. Guthrie, Jeffry, 2008: Elements in the Leather Industri, *World Leather*, Vol. 21, No. 4, pp 46-47
v. Handayani P.A, (2013). PewarnaAlami Batik Dari Kulit Soga Tingi (Ceriops tagal) Dengan Metode Ekstraksi. JurnalBahan
vi. AlamTerbarukan. Fakultas Teknik, Universitas Negeri Semarang.
vii. Jack. L. Larsen (2004). *The Dyer's Art Ikat, Batik, Plangi*. Second editions, A&C Black: London, pp 123-150.
viii. Purwanto,(2018). Pemanfaatan Bahanpewarnaalamsebagai alternative dalampembuatan batik yang ramahlingkungan.
ix. Prosiding seminar Nasional aplikasisains&Teknologi (SNAST) , ISSN: 1979-911X

x. Rungruangkirtkrai, (2012).'Eco-Friendly of Textiles Dyeng and Printing with Natural Dyes'. RMUTP International
xi. Conferences Textiles &Fashion, 3-4.
xii. Suheryanto D. (2012). Optimalisasi Waktu Fermentasi Pembuatan Zat Warna Alam Indigo (Indigoferatinctoria). In
xiii. Seminar nasional Teknik Kimia, Program Studi Teknik Kimia UPN 'Veteran' Jawa Timur, Surabaya.
xiv. Titiek Pujilestari (2017), 'Batik Fabric Dyeing Process Optimization Using Natural Dyes' Tingi (Ceriops tagal) and
xv. Indigofera Sp.' Jurnal: Dinamika Krajinan dan Batik, Vol. 34, No. 1, Juni 2017, 53-62
xvi. Xiaolei Z, 2009, Ecological Technology of Leather Manufacture, China ,China Leather & Footwear Industry Research
xvii. Institute.