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Disperse dyes composition for ICOLLET product

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Abstract. The objectives of this study were 1) to determine the effect of the disperse dye composition on the ICOLLET finished product, and 2) to determine the best disperse dye for ICOLLET products on hycon polyester chiffon fabric. This experimental research has independent variables of disperse dyes composition. The disperse dyes concentrations were 20 grams, 40 grams and 60 grams, respectively, while the dependent variable was the obtained color of ICOLLET on the hycon polyester chiffon fabric in terms of the fabric absorbency to the disperse dyes, the obtained color of ICOLLET and the level of preference of ICOLLET dyed hijab. The control variable were tying method, dabbing method, equipment and the operator. The data collection method used in this research was observation. Single ANOVA was used to analysis the data. Based on the data analysis, it can be concluded that disperse dyes composition affected the ICOLLET obtained product on hycon polyester chiffon fabric and system with 60 gram disperse dyes has the most absorbency generated the best motive compared to others.

1. Introduction

A kind of decorating cloth art having characteristic in its manufacturing technique is the art of tie dye. The art of tie-dye in Indonesia is known as jumputan. As the name implies, in the process of making a motive, the cloth is pinched in several parts and then tied with rubber or rope and then dyed [1]. Many regions in Indonesia have applied the jumputan technique to their regional clothing. Each region has a different name, technique and style. The term jumputan is better known in Java, pelangi and cinde in Palembang, while Sasirangan in Banjarmasin area. The department of Fashion Education, Universitas Negeri Semarang has an innovative product called ICOLLET. ICOLLET is a dabbing technique aimed to reduce waste of dyeing solution. The fabric that is commonly used for dyeing ICOLLET is hycon polyester chiffon. This fabric, with its absorbent ability, facilitates the binding and pinching process for making hijab products. Meanwhile, some other types of fabrics, such as rayon or other synthetic fabrics are difficult to be treated due to the slippery, hard or low absorbency [2].

Disperse dyes are organic dyes made synthetically, which are insoluble in water but are easily soluble in water. Dyeing with disperse dyes must be carried out at high temperatures with a thermosol process [3]. Disperse dye is applied in the dyeing of synthetic textile fibers which are hydrophobic. In small-scale industries, dyeing with disperse dyes can be done using a carrier without the thermosol process. Carrier is hydrophilic and has an affinity to fibers, thereby increasing the fibers swelling thus open the pores allowing the absorption of dye molecules into the fabric fibers [3].

Hycon polyester chiffon is a polyester fabric that is very thin, dry, light, and transparent. It was produced through plain weaving [4]. Invention of many synthetic fibers inseparable with today's



organdy which is woven man-made fibers of polyester. The thin and transparent nature of the hycon polyester chiffon can affect the dye absorption during printing process. According to Jerde [4] disperse dyes are used on hydrophobic fibers, such as nylon, acetates, polyester, and other synthetics fibers.

Dabbing method using disperse dyes is implemented into three stages [5], i.e. dabbing technique with the aid of carrier; high-temperature scaling technique; and pickling technique with thermosol process. Sunarto [2] stated that the properties of disperse dyes are insoluble in water due to the unavailability of solvent group in the molecular structure; high melting point of 150°C; and having good color fastness to washing and light.

Tie-dyed products are a result of local wisdom of unique patterns and colors in textile fiber [13]. ICOLLET or tie-dyed, fold-dyed, all-dyed sewing is an ancient method for decorating fabrics with colorful and attractive patterns [6]. Meanwhile, according to Nyo [7] tie-dye is a cloth that is tied in certain parts with a binder that does not absorb the dye followed by immersing the fabric in the dyeing solution. The unique motive of ICOLLET is produced by tying the cloth. The motive lines are formed from the color difference between the tied and untied parts. It is therefore the dabbing technique resulted in a color combination thus produces motive. Various binding materials could be applied such as: cotton, polyester, plastic rope, rubber or elastic yarns, which function to prevent dyes from absorbing into the fabric fibers to form motives. The process results in geometric shapes such as circles and lines, flora and fauna shapes. The process gives beneficial effect of minimizing waste of dyeing solution [8].

Tie dye or ICOLLET technique consists of binding, stitching (sewing), and folding [6]. Organdy fabric used in ICOLLET is a crisp, sheer, transparent, lightweight cotton fabric. It was woven with tightly twisted fine yarns thus having characteristics of dry, thin, and light cotton fabric [9]. In the current development, organdy is not only woven from cotton fibers but also from man-made fibers such as polyester [10, 14, 15]. Hycon polyester chiffon has characteristics of a dry surface, light, thin and stiff, translucent, and wrinkle resistance [11].

2. Method

This experimental research was intended to determine whether there is a result of "something" imposed on the subject investigating [12]. This type of research is a way of finding any causal relationship between two factors that are deliberately caused by the researcher by eliminating or reducing or setting aside other disturbing factors. The purpose of conducting experimental research is to examine the presence or absence of a cause-and-effect relationship, by comparing one or more experimental groups treated with one or more control groups who do not receive treatment. The data collection method in this study was observation, with 25 observers. The research instrument was an observation sheet, namely the ICOLLET finished result assessment sheet on Hycon polyester chiffon fabric. The data analysis used was single classification ANOVA with the help of the SPSS 12 program.

3. Results and Discussion

3.1 Result

3.1.1 The absorption aspect of hycon polyester chiffon fabric against disperse dyes

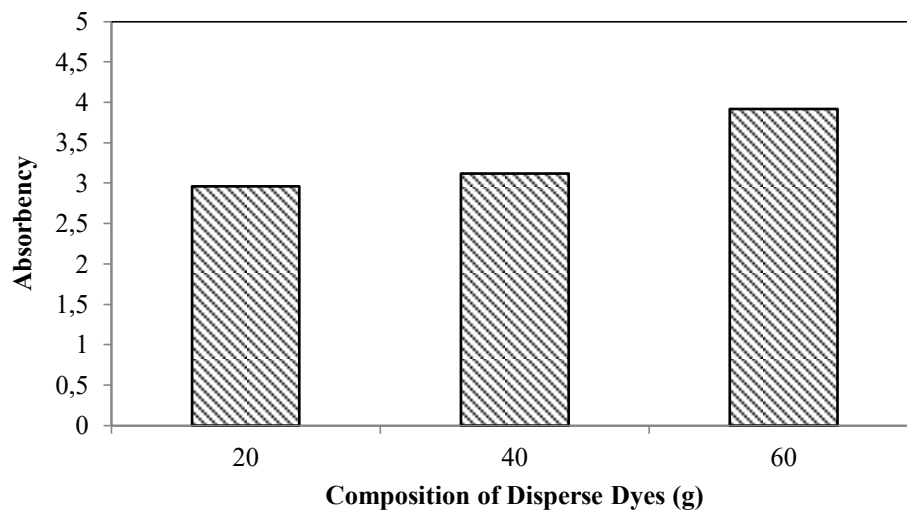


Figure 1. The absorbency of hycon polyester chiffon fabric

Figure 1 explains that the highest mean for the absorption aspect of hycon polyester chiffon fabric was in the composition of 60 grams of disperse dyes with absorbency of 3.92, followed by the composition of 40 grams with absorbency of 3.12 and the lowest absorbency was given by the composition of 20 grams with a mean 2.96. The mean of absorption capacity of hycon polyester chiffon cloth to the overall disperse dye in the disperse dye composition of 20 grams, 40 grams, and 60 grams can be seen in Table 1.

Table 1. Overall mean of absorption aspects of hycon polyester chiffon

	N	mean	Std. Deviation	Std. Error	95% CI for mean		Minimum	Maximum
					Lower Bound	Upper Bound		
20 gram	25	2,4400	.71181	.14236	2.1462	2.7338	1.00	4.00
40 gram	25	3,0000	.40825	.08165	2.8315	3.1685	2.00	4.00
60 gram	25	3,7600	.52281	.10456	3.5442	3.9758	2.00	4.00
Total	75	3,0667	.77692	.08971	2.8879	3.2454	1.00	4.00

Based on the calculation results in Table 1.1, homogeneity was analyzed after determining the mean of the three disperse dyestuff compositions. The homogeneity analysis was examined to test whether the system with three disperse dye compositions have the same variants.

Table 2. Homogeneity test of absorption aspect of hycon polyester chiffon

Levena Statistic	df 1	df 1	Sig.
9,869	2	72	.000

Based on the homogeneity test results given in Table 2, it can be explained that the probability of the hycon polyester chiffon fabric absorption against the disperse dye is 0,000

<0.05. It is therefore H_a is accepted so that system with composition of 20 gram, 40 gram and 60 gram disperse dyes gained different variants. ANOVA analysis was carried out after obtaining the three variants of the disperse dye composition.

Table 3. ANOVA of absorption aspects of hycon polyester chiffon fabric

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	21.947	2	10.973	34.775	.000
Within Groups	22.720	72	.316		
Total	44.667	74			

Table 3 describes that F_{count} (F_o) is 34.775 with α 0.05 (2; 72) is 3.12. Based on the significance level of 0.05 with α 0.000 <0.05, then H_a is accepted, which means that there is a significant effect on the finished ICOLLET in terms of the absorption of the hycon polyester chiffon fabric in the composition of 20 gram, 40 gram, 60 gram disperse dye.

Populations that have the same mean are grouped into one subset. This analysis is called the homogeneous subset, which is an analysis to determine the best disperse dye composition in terms of absorption in hycon polyester chiffon fabric. The third or last subset is the subset with the best value. In Table 4, the three disperse dyestuff compositions are grouped into three subsets.

Table 4. Homogeneous subset absorption aspects absorption aspects of hycon polyester chiffon fabrics

Dye Composition	N	Subset for alpha= .05		
		1	2	3
Tukey HSD 20 gr	25	2.440		
40 gr	25		3.000	
60 gr	25			3.760
Sig.		1.000	1.000	1.000
Duncan 20 gr	25	2.440		
40 gr	25		3.000	
60 gr	25			3.760
Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed

Uses Harmonic Mean Sample Size = 25,000

The first subset was occupied by a 20 gram disperse dye composition with a mean of 2.44. The second subset is occupied by the composition of the disperse dyes of 40 grams with a mean of 3. The third subset is occupied by the composition of the disperse dyes of 60 grams with a mean of 3.76. From these results it can be concluded that the composition of the 60 gram disperse dyes has good absorption compared to the composition of other disperse dyes with a mean of 3.76.

3.1.2 Sharpness motive of ICOLLET

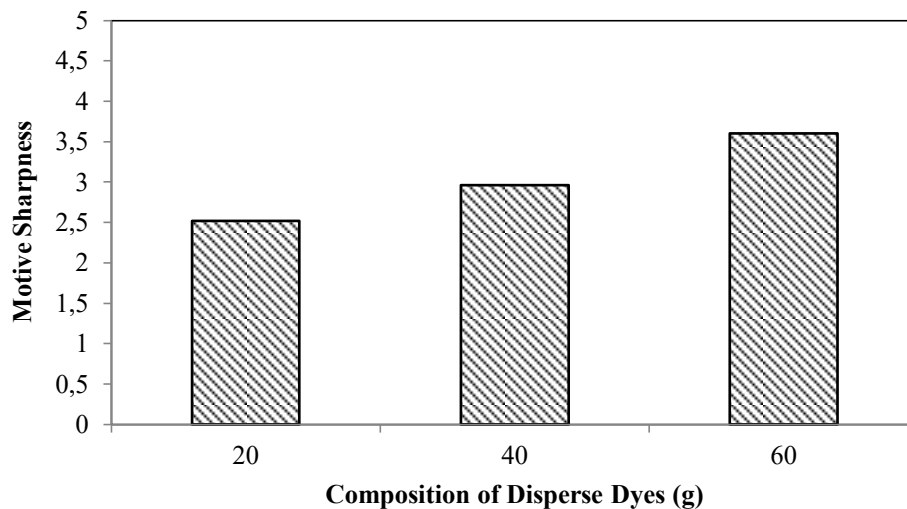


Figure 2. Sharpness motive of ICOLLET

Figure 2 describes that the highest mean for the generated motive of ICOLLET was obtained in the composition of 60 grams of disperse with mean of 3.6, followed by the composition of 40 grams with mean of 3.08, while the lowest mean is in the composition of 20 grams with mean of 2.52. The mean results of the ICOLLET motive in all composition can be seen in Table 5.

Table 5. Overall mean of sharpness motive of ICOLLET

	N	Mean	Std. Deviation	Std. Error	95% CI for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
					20 gram	25		
40 gram	25	3.0800	.75939	.15188	2.7665	3.3935	2.00	4.00
60 gram	25	3.6000	.57735	.11547	3.3617	3.8383	2.00	4.00
Total	75	3.0667	.82746	.09555	2.8763	3.2570	1.00	4.00

Once the mean of disperse dyes composition was determined, the homogeneity was analyzed. The purpose of the homogeneity analysis is to test whether the three disperse dye compositions have the same variants.

Table 6. Homogeneity test for the aspect of sharpness motive of ICOLLET

Leave Statistic	df 1	df 1	Sig
.976	2	72	.382

Based on the results of the homogeneity test in Table 6 it can be described that the probability of sharpness motive of ICOLLET is $0.382 > 0.05$ so that H_a is rejected. It is

therefore the composition of the disperse dyes of 20 grams, 40 grains and 60 grams has the same variants.

Table 7. ANOVA of sharpness motive of ICOLLET

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	14.587	2	7.293	14.554	.000
Within Groups	36.080	72	.501		
Total	50.667	74			

From the ANOVA table it is known that F_{count} (F_o) is 14.554 with α 0.05 (2; 72) is 3.12. Based on the significance level of 0.05 with α 0.000 < 0.05, H_a is accepted which means that there is a significant effect on the ICOLLET finished product with a disperse dye composition of 20 grams, 40 grams, and 60 grams.

Populations that have the same mean are grouped into one subset. This analysis is called the homogeneous subset, namely the analysis to determine the composition of the best disperse dye in the aspect of the finished ICOLLET motive. The third or last subset is the subset with the best value.

Table 8. Homogeneous subset aspects of sharpness motive of ICOLLET

Dyes Composition	N	Subset for alpha= .05		
		1	2	3
Tukey HSD	20 gram	25	2.520	
	40 gram	25		3.080
	60 gram	25		3.600
	Sig.		1.000	1.000
Duncan	20 gram	25	2.520	
	40 gram	25		3.080
	60 gram	25		3.600
	Sig.		1.000	1.000

Means for groups in homogeneous subsets are displayed

Uses Harmonic mean sample size= 25.000

The first subset was occupied by a 20 gram disperse dye composition with a mean of 2.52. The second subset was occupied by a 40 gram disperse dye composition with a mean of 3.08. The third subset was occupied by the composition of the 60 gram disperse dyes with a mean of 3.6. From these results it can be explained that the composition of the 60 gram disperse dyes generated the best result of sharpness motive compared to the composition of the other disperse dyes with a mean of 3.6.

3.2 Discussion

Based on ANOVA calculations on the absorbency aspect of the hycon polyester chiffon fabric to the disperse dye, there is a significant effect on the finished product of ICOLLET on the hycon polyester chiffon fabric. This is because the different compositions used have different concentrations when dissolving in one liter of water. The composition of 20 gram of disperses dyes produced less concentrated absorbency on hycon polyester chiffon fabric. This is because the dyeing solution had

low concentration thus lower dyestuff was absorbed on the hycon polyester chiffon fabric which has transparent characteristics. The non-homogenous mixing of the first and second color was not clearly visible so that the first color was still dominant. The mean composition of the 20 gram disperse dye on the absorption aspect of the hycon polyester chiffon fabric was 2.44. Based on the results of the ANOVA calculation on the aspect of sharpness motive of ICOLLET, there is a significant effect on generated ICOLLET motive. This is because the differences in the composition of the disperse dyes affect the obtained motive. The motive and color blending on the 20 gram disperse dye composition were not clearly visible. This is because the composition of 20 grams was not enough to form motive or to blend with the first dye. The mean composition of the 20 gram disperse dye on the obtained aspect of the motive is 2.53. Among the three aspects, the highest mean of the composition of the disperse dyes is 20 grams, obtained by the aspect of obtained product of the ICOLLET motive with a mean of 2.52. The ICOLLET results on hycon polyester chiffon fabric with 20 gram disperse dye generated the best results in the aspect of the obtained ICOLLET motive.

Based on ANOVA calculations on the absorbency aspect of the hycon polyester chiffon fabric to the disperse dye, there is a significant effect on the finished product of ICOLLET on the hycon polyester chiffon fabric. This is because the different compositions used have different concentrations when immersed in one liter of water. The compositions of 40 grams of disperse dyes generated absorbency on hycon polyester chiffon fabric, which is quite thick. This is because the dyeing solution was in enough concentration that can be absorbed into the hycon polyester chiffon fabric which has transparent characteristics. The mixing of the colors between the first color and the second color can be seen clearly so that the first and second colors can blend and gradate. The mean composition of the 40 gram disperse dye on the absorbency aspect of the hycon polyester chiffon fabric is 3. Based on the calculation of ANOVA on the finished aspect of the ICOLLET motive, there is a significant effect on the obtained result of ICOLLET on the hycon polyester chiffon fabric. This is because the differences in the composition of the disperse dyes affect the obtained motive. The motive and color blending in the composition of the 40 gram disperse dye were clearly visible. This is because the composition of 40 grams has enough density to form a motive and blend with the first dye. The mean composition of the 40 gram disperse dye on the finished aspect of the motive is 3.08. Of the three aspects, the highest mean of the disperse dye composition was 40 grams, namely in the aspect of the finished ICOLLET motive with a mean of 3.08. So the ICOLLET results on hycon polyester chiffon fabric with disperse dye 40 have the best results on the finished ICOLLET motive.

Based on ANOVA calculations on the absorbency aspect of the hycon polyester chiffon fabric to the disperse dye, there is a significant effect on the finished product of ICOLLET on the hycon polyester chiffon fabric. This is because the different compositions used have different concentrations when immersed in one liter of water. The composition of 80 gram disperse dyes produces absorbency in hycon polyester chiffon fabric which is quite thick. This is because the liquid is thick, so it can be absorbed into the hycon polyester chiffon fabric which has transparent characteristics. The mixing of colors between the first color and the second color is not clearly visible so that the first color fades and the second color becomes more dominant. The mean composition of the 60 gram disperse dye on the absorbency aspect of the hycon polyester chiffon fabric is 3.76. Based on the calculation of Anava on the aspect of the finished ICOLLET motive, there is a significant effect on the finished product of ICOLLET on hycon polyester chiffon fabric. This is because the differences in the composition of the disperse dyes affect the finished motive. The motive and color blending in the composition of the 60 gram disperse dye were clearly visible. This is because the composition of 60 grams has a density that can form a motive and blend with the first dye. The mean composition of the 80 gram disperse dye on the aspect of obtained motive is 3.6. Among the three aspects, the highest mean of the disperse dye composition was 60 grams, namely the absorption capacity of the hycon polyester chiffon fabric with a mean of 3.6. The results of sharpness motive of ICOLLET on hycon polyester chiffon fabric with 60 gram disperse dye reached the best results on the absorbency of hycon polyester chiffon fabric.

From the three overall aspects, namely the absorption capacity of the hycon polyester chiffon cloth to the disperse dye, the finished ICOLLET motive and the level of preference showed that the highest

to lowest ICOLLET finished results were the composition of the disperse dyes of 60 grams, 40 grams and 20 grams, respectively. This is because the hycon polyester chiffon, which has dry, light, thin, stiff, and translucent surface characteristics [11] affects the absorption of disperse dyes. Hycon polyester chiffon, which has translucent or transparent characteristics, cannot absorb dyes well even though 30% acetic acid has been added to stabilize the color. Carrier has also been added to open the fiber structure so that the color easily absorbs [3]. The color produced on the hycon polyester chiffon fabric was not as thick as liquid density, so the more dye composition affects the color density of the hycon polyester chiffon fabric. The more disperse dye composition, the resulting color blending in the motive of the first and second colors is very clear. This is because the density of the dye can absorb better the hycon polyester chiffon fabric so that the blending of the second color can look contrast and clear with the first color. The good absorption and the results of the ICOLLET motive affect the level of preference in the ICOLLET results. System with composition of 60 grams resulted the highest compared to the composition of 40 grams and 20 grams.

4. CONCLUSION

From the research and studies that have been done, it can be concluded that:

1. There is an effect of the composition of 20 grams, 40 grams and 60 grams of disperse dyes on the ICOLLET finished product on hycon polyester chiffon fabric.
2. The composition of the 60 gram disperse dyes generated the best absorption and the results are the best motives compared to the composition of the 40 grams and 20 grams of disperse dyes.

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