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ANALYSIS OF DIFFERENT BLEND FABRIC DYEING WITH REACTIVE AND DISPERSE DYES AND EVALUATE COLOR PARAMETERS AND FASTNESS PROPERTIES

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Abstract: *The main object of this researh work is to analyze different blend fabric dyeing with reactive and disperse dyes and evaluate color parameters. In this research work Remazol reactive dye, Tricon diperse dye and four types of blended fabrics were used like as 50/50 polyester viscose blended fabric (Blend A), 65/35 Polyester Cotton s/j blended fabric (Blend B), 60/40 CVC s/j blended fabric (Blend C), and 80/20 chief value cotton (CVC) s/j blended fabric (Blend D) for dyeing with light, medium & dark shade. The different blend fabrics were dyed by batch process with the help of lab dyeing machine keeping material to liquor ratio 1:10. Spectrophotometer was used to find out the color strength and amount of dye in the fabrics before and after soap wash. Beside this washing and rubbing fastness levels of the dyed blended fabrics were investigate. It was found that, considering all the blends the k/s value and fastness properties of blend D is better for light, medium and dark shade. But if it is considered only dark shade, then k/s value of blend B is higher than all the blends.*

Key words: *blended fabrics, color strength, washing and rubbing fastness, Spectrophotometer, cotton and polyester dyeing.*

1. INTRODUCTION

The dyeing of the polyester and cotton, polyester and viscose blend fabric has becomes a challenge to the modern textile industries due to its variation in color value, shade depth, tensile strength and surface residual weight loss. These blends are famous due to their aesthetic value and user friendly performance [1]. Blended is the sequence of processes required to convert two or more kind of staple fibers into a single yarn or two or more kind of yarn into a fabric composed of an intimate mixture of the component fiber or fabric [2, 3]. Cotton fabrics are known to have been in use at least for 7000 years. This dominance of cotton fiber is mainly due to its natural comfort, performance, and appearance [4]. In recent years, the cotton/polyester blends are considered as the most widely used fabrics [5]. Polyester fibers have a hydrophobic character, and swell to a very small extent in the water bath. Hence the penetration of the dyestuff molecules inside the fibers would be very difficult [6]. Owing to this phenomenon, the dyestuff molecules first absorbed on the fiber surface may diffuse into the fiber interior. Subsequently, the bonding interactions between the dyestuff & cellulose may be formed [7].

Four fabric structures were dyed with three different shade % by Remazol reactive dye and Tricon disperse dye. Finally, spectrophotometer was used to find out the color strength and amount of dye present in the dyed samples. Color fastness to wash [8], color fastness to rubbing [9] for all dyed fabrics were determined. Samples dyeing with the Remazol & Tricon showed superior rubbing fastness & wash fastness with a standard color yield. Here Blend D fabric shows better depth of shade in reactive dyeing for all shades and all blended fabric structures.

2. EXPERIMENTAL METHODOLOGY

2.1 Materials and Reagents.

To complete this research work four types of blended fabrics were used like as 50/50 polyester viscose blended fabric (Blend A), 65/35 PC s/j blended fabric (Blend B), 60/40 CVC s/j blended fabric (Blend C), and 80/20 CVC s/j blended fabric (Blend D). Dyes used for polyester part dyeing included Tricon yellow Br.SP-3RT, Tricon red-SP-2RT and Tricon blue-EACT. Also dyes used for cotton part dyeing included Ana: yellow-3RS, Ana: Red-3BS and Remazol blue RR. Other chemicals Salt, Soda, Wetting agent and Sequestering agent were used. Some instrument i.e Electric balance, Scissor, Sample dyeing machine, hot wash machine, Pipette, Dryer and Spectrophotometer with color match software were used to complete this research work.

2.2. Collection of materilas.

All the fabrics (5gm of each fabric), dyes, chemicals and auxiliaries were collected from the Trust knitwear LTD, Gazipur, Bangladesh.

2.3. Preparation of Sample and stock solution:

In this research work blended fabrics were prepared according to standard from Trust Knitwear Industries Ltd. Also 0.5% stock solution of Remazol red, yellow, and blue was prepared.

2.4. Analytical Procedures:

2.4.1. Procedure for dyeing

The different blend fabric were dyed by batch process with the help of lab dyeing machine keeping material to liquor ratio 1:10 for the mentioned shade percentage in the table -1 and table 2. During dyeing standard method were followed as per prescribes by the manufacturers. At first, marked 12(4X3) dyeing pot for the 4 samples and 3 shade. As this research is on the blend fabric i.e fabric composition is polyester and cotton or viscose. At first polyester part is dyed according to the recipe mentioned in the table 1 and then cotton or viscose part is dyed according to the recipe mentioned in the table 2. After dyeing the samples were treated as washing, neutralized and drying sequencially.

Table 1: *Recipe using for blended fabric dyeing (polyester part)*

Dyes and chemicals	**Light shade**	**Medium Shade**	**Dark Shade**
Tricon yellow SP.RST	0.1%	0.4%	1.0%
Tricon Red SP.2RT	0.2%	0.66%	1.74%
Tricon blue EACT	0.001%	0.0024%	0.0046%
Dispersing agent	2g/L	2 g/L	2 g/L
Acetic acid, Wetting agent, Sequestering agent, Anti-creasing agent and Leveling agent were used 1g/L. material to liquor ratio = 1 :10; temperature: 120^0C, Time 40 minutes and fabric weight 5 gm (these parameters were used for three shades).			

Table 2: *Recipe using for blended fabric dyeing (cotton part)*

Dyes and chemicals	**Light shade**	**Medium Shade**	**Dark Shade**
Ana: yellow 3RS	0.1%	0.3%	0.9%
Ana: Red 3BS	0.2%	0.88%	1.8%
Remzol blue RR	0.001%	0.002%	0.0024%
Glauber salt	20g/L	30 g/L	50 g/L
Soda ash	5g/L	8 g/L	12 g/L
Wetting agent, Sequestering agent, Anti-creasing agent and Leveling agent were used 1g/L. material to liquor ratio = 1 :10; temperature: 80^0C, Time 60 minutes and fabric weight 5 gm (these parameters were used for three shades).			

2.4.2. Measurement of color strength (K/S)

To determine the color strength spectrophotometer (Data-color International SF 600 plus, D65) was used. The color strength (K/S) and CIELAB values of dyed cotton and polyester samples were measured at the respective wavelength.

2.4.3. Determination of amount of hue at dyed sample:

Spectrophotometer was also used to determine the amount of hue present in the dyed sample as well as also evaluate the dye loss% for different blend fabric for different shade%.

2.4.4. Measurement of Color Fastness to wash:

According to the ISO standards ISO105-C10:2006 method [10] was followed for wash fastness test. A specimen of 10 × 4cm was attached with a multifiber fabric strip. The change in color and degree of staining was evaluated visually using geometric grey scale.

2.4.5. Measurement of Color Fastness to rubbing:

Color Fastness to Rubbing ISO standards ISO105-X12:2001[9] method was followed for rubbing fastness test. Finally removed the rubbing cloth and color transfer was evaluated by using grey scale for staining

3. RESULTS AND DISCUSSION

Spectrophotometer was used to determine the color strength and amount of hue of different blend fabrics individually. The effects of color strength, amount of hue and fastness properties on different blend fabrics for diferent shade% are discussed below sequentially.

3.1. Effect of different blend and shade% on k/s value

Effects of different blend and shade% on k/s value are shown in the Table 3 and Fig.1. Here k/s values of four types of blend fabrics are compared for Light, Medium and Dark shade. In case of blend A and blend B, the k/s value of blend B is better. Considering all the blends the k/s value of blend D is better for light, medium and dark shade. But if it is considered only dark shade, then k/s value of blend B is higher than all the blends.

Table 3: *Effect of k/s value on different blend and shade%*

Fabric structure	K/S Value		
	Light	Medium	Dark
Blend A	3.19	5.16	15.65
Blend B	3.92	5.99	21.75
Blend C	2.59	5.75	19.07
Blend D	4.16	6.43	19.93

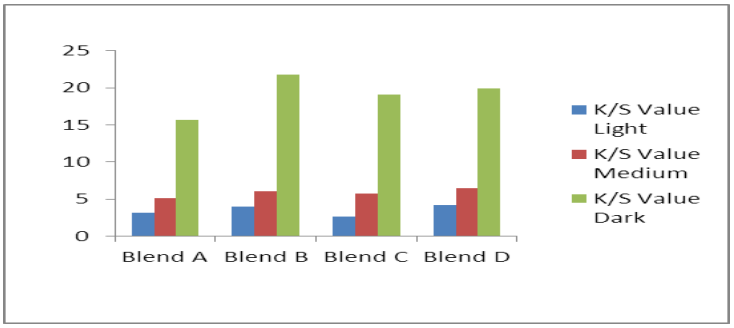

Fig. 1: *Effect of k/s value on different blend and shade%*

3.2. Effect of different blend and shade% on amount of hue at dyed sample

Table 4 described the Effect of different blend and shade% on amount of hue at dyed sample. Amount of hue at dyed fabric was taken before wash and after wash. Amount of hue absorbed by the fabrics and hue loss are described for individual blends and shade% in the table 4.

Table 4: *Effect of different blend and shade% on amount of hue at dyed sample*

Shade %	Fabric structure	Hue	Amount	Hue at fabric		Hue loss	
				Before wash	After wash	Before wash	After wash
Light	Blend A	Y	0.1	0.09	0.07	0.01	0.03
		R	0.2	0.080	0.078	0.12	0.122
		B	0.001	0.0005	0.0002	0.0005	0.0008
	Blend B	Y	0.1	0.075	0.023	0.025	0.077
		R	0.2	0.194	0.188	0.006	0.012
		B	0.001	0.0008	0.0006	0.0002	0.0004
	Blend C	Y	0.1	0.073	0.017	0.027	0.083
		R	0.2	0.17	0.17	0.03	0.03
		B	0.001	0.0004	0.0003	0.0006	0.0007
	Blend D	Y	0.1	0.0549	0.0545	0.0451	0.0455
		R	0.2	0.1677	0.1665	0.0323	0.0335
		B	0.001	0.0007	0.0005	0.0003	0.0005
Medium	Blend A	Y	0.3	0.087	0.054	0.213	0.246
		R	0.88	0.130	0.284	0.75	0.596
		B	0.002	0.0009	0.0004	0.0011	0.0016
	Blend B	Y	0.3	0.125	0.099	0.175	0.201
		R	0.88	0.713	0.158	0.167	0.722
		B	0.002			0.002	0.002
	Blend C	Y	0.3	0.0553	0.052	0.2447	0.248
		R	0.88	0.832	0.79	0.048	0.09
		B	0.002	0.0018	0.0015	0.0002	0.0005
	Blend D	Y	0.3	0.213	0.190	0.087	0.11
		R	0.88	0.705	0.639	0.175	0.241
		B	0.002	0.0009	0.0005	0.0011	0.0015
	Blend A	Y	0.9	0.834	0.402	0.066	0.498
		R	1.8	1.36	1.221	0.44	0.579
		B	0.0024	0.0016	0.0014	0.0008	0.001
	Blend B	Y	0.9	0.45	0.24	0.45	0.66
		R	1.8	1.37	1.27	0.43	0.53

Dark		B	0.0024	0.0007	0.0015	0.0017	0.0009
	Blend C	Y	0.9	0.624	0.59	0.276	0.31
		R	1.8	1.607	1.26	0.193	0.54
		B	0.0024	0.0020	0.0017	0.0004	0.0007
	Blend D	Y	0.9	0.785	0.6899	0.115	0.2101
		R	1.8	1.5627	1.5199	0.2373	0.2801
		B	0.0024			0.0024	0.0024
Y= **Ana: yellow 3RS, R= Ana: Red 3BS, B= Remzol blue RR**							

3.3. Effect of different blend and shade% on wash fastness

Effect of different blend and shade% on wash fastness are shown in the table 5. In case of light shade it was observed that, Blend A, Blend B, Blend C and Blend D all fabrics are good to excellent washing fastness range 4 to 5. Considering the dark shade it was observed that, Blend C and Blend D has good to excellent washing fastness range 4 to 5, Only Blend A and Blend B fabric gives wash fastness range 3 to 4 and 2 to 3.

Table 5. *Colour fastness to wash for different type of blended fabrics*

Fabric structure	Shade%	Color staining						Color change
		acetate	cotton	polyamide	polyester	acrylic	wool	
Blended A	Light	4/5	4/5	4/5	4/5	4/5	4/5	4/5
	Medium	4/5	4/5	4/5	4/5	4/5	4/5	4/5
	Dark	3/4	4/5	4/5	4/5	4/5	4/5	3/4
Blended B	Light	4/5	4/5	4/5	4/5	4/5	4/5	4/5
	Medium	4/5	4/5	4/5	4/5	4/5	4/5	4/5
	Dark	4/5	2/3	4/5	4/5	4/5	4/5	2/3
Blended C	Light	4/5	4/5	4/5	4/5	4/5	4/5	4/5
	Medium	4/5	4	4/5	4/5	4/5	4/5	4
	Dark	4/5	4	4/5	4/5	4/5	4/5	4
Blended D	Light	4/5	4/5	4/5	4/5	4/5	4/5	4/5
	Medium	4/5	4/5	4/5	4/5	4/5	4/5	4/5
	Dark	4/5	3/4	4/5	4/5	4/5	4/5	3/4

3.4. Effect of blends and shade% on rubbing fastness

Table 6 and Fig. 2 described the effect of blends and shade% on rubbing fastness. It was found common for the entire shade% and blends wet rubbing fastness rating is lower than dry rubbing rating. Among the entire shade%, dark shade is very good to excellent for dry rubbing. Besides this considering different blends, Blend D showed better rubbing fatsness for both dry and wet condition in compare to other blends.

Table 6.*Effect of blends and shade% on rubbing fastness*

Shade %	**Blend A**		**Blend B**		**Blend C**		**Blend D**	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Light	4/5	3	4/5	3/4	4/5	3	4/5	3/4
Medium	4	2/3	4	3	4	3	4/5	3
Dark	4	2	4/5	2	4/5	2/3	4	3/4

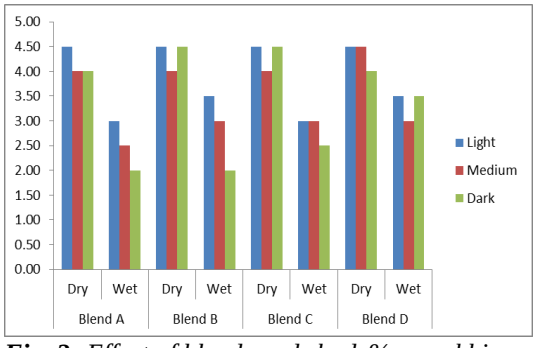

Fig. 2: *Effect of blends and shade% on rubbing fastnes*

4.CONCLUSION

This study was planned to compare the color strength between four types of blend fabrics as well as to check the fastness properties among blend fabrics with different composition. In this research work it was found that, with the increment of shade%, color fastness properties are affected for different blend fabric structures. Again it was also observed with the increment of shade % of cotton-viscose blend fabric a considerable change on color strength was found for different fabric structures. It is also concluded that, Blend D (80/20 chief value cotton (CVC) s/j blended fabric) is better than other three blend fabrics. Here Blend D fabric shows better depth of shade in reactive dyeing for all shades and all blended fabric structures.

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