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INVESTIGATION OF COLOR PARAMETERS AND FASTNESS PROPERTIES ON DIFFERENT KNITTED FABRIC STRUCTURES DYED WITH REACTIVE DYES

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Abstract: *The main objective of this paper was to analyze various color parameters and measure the fastness properties on different fabric structure like as plain single jersey, single lacoste, Terry fleece and heavy single jersey. Color has a semantic content which touching directly our sentimental world. It has a significant influence on the aesthetic properties of textiles. Color is the result of dyeing a textile material depends on the chemical structure of the dyes and the physical and chemical properties. In this research work the author use spectrophotometer to find out the color parameters among different fabric structures that were dyed with the same recipe. For this study dyeing was carried out on different fabric structures for light, medium, dark and extra dark shade. Remazol Yellow RR, Remazol Red RR, Remazol Blue RR reactive dye was used for dyeing. Heavy jersey Fabric was taken as a standard and different color parameters like as DL*, Da*, Db* and DL*, Dc*, Dh* were measured. Before measuring the color parameters different fastness properties were tested also. This study comparatively discusses on the different colour parameters and fastness properties of plain single jersey, single lacoste, Terry fleece and heavy single jersey made from 100% cotton fibre. As colour parameters are important term in wet processing and dyeing quality depends on this parameters. In this research work the Author analysis the colour parameters among different fabric structure. Standard recipe for light, Medium, Deep & extra deep Shade was used for this study.*

Key words: *Spectrophotometer, aesthetic properties, Remazol Dye, Terry fleece and heavy single jersey.*

1. INTRODUCTION

The use of knitted fabric has been rapidly increasing in world wide. Both men & women feel comfortable wearing knitted fabric for their shape fitting properties, softer handle, bulkier nature and high extension at low tension compared to woven fabric [1].Samples showed evidence of more redness and yellowness than the standard. Saturation level of dye also influenced positively in most cases i.e more intensive in higher dye concentration and fabric GSM.

Cotton today is the most used textile fiber in the world. Its current market share is 56% for all fibers used for apparel and home furnishings and sold in the U.S. Another contribution is attributed to nonwoven textiles and personal care items. Current estimates for world productions are about 25 million tones or 110 million bales annually, accounting for 2.5% of the world's arable land. China is the world's largest producer of cotton, but most of this is used domestically. The United States has been the largest exporter for many years [2].

In recent years, reactive dyes have been most commonly used the reactive dyes are the best for cotton for its wide range of application and better fastness properties [3]. There for 50% of cellulosic fibers are dyed with reactive dyes. Share of reactive dyes among all textile dyes is 29%. Due to their strong interaction with many surfaces of synthetic and natural fabrics, reactive dyes are used for dyeing wool, cotton, nylon, silk, and modified acrylics [4]. In Bangladeshi wet processing industries, reactive dyes are extremely used. The reactive site of the dyes reacts with functional group on fiber under influence of heat and alkali [6]. Fiber reactive dyes react with the cellulosic fiber in the presence of alkali to form a strong covalent chemical bond between a carbon atom of the dye molecule and an oxygen atom of the hydroxyl group in the cellulose. Reactive dyes are popular in textile manufacturing due to their fastness properties[7].

In this research Work we use cotton weft knitted (plain single jersey, single lacoste, fleece and heavy single jersey) fabric & reactive dyes. All of the samples were dyed by reactive dyes with different amount of shade% with the help of Remazol Red RR, Remazol blue RR and Remazol yellow RR. After completing dyeing different parameters like as DL*, Da*, Db*, DC* and DH* were observed.

2. MATERIAL AND METHOD:

2.1. Instruments: following are the instruments that were used during research work:
Electric Balance, Scissor, Beaker, Sample dyeing Machine, Hot wash Machine, Pipette, squeezer Machine, Dryer and Spectrophotometer with colour I match software etc.

2.2. Dye Stuff and Chemicals: The chemicals and dye stuff were collected from N.A.Z Ltd. Reactive Dye (Remazol Red RR, Remazol Blue RR, Remazol Yellow RR), Electrolyte (Gluber salt Na_2SO4. 10 H_2O), Alkali: (Soda ash-Na_2CO_3 and coustic soda NaOH), Soaping agent (SW CONE), Acetic Acid (100%), Wetting agent and Sequestering agent etc were used.

2.3 Sample preparation: In this research work I have used various weft knitted fabric samples that were prepared from N.A.Z LTD . Four types of samples were prepared including plain single jersey, single lacoste, fleece and heavy single jersey. These fabrics were made from cotton yarn,

2.2: Methodology:

2.2.1: Preparation of 0.5% stock solution: 0.5% stock solution(0.5 gm each dye mixed with 100 ml water.) was prepared for Remazol Yellow RR, Remazol Red RR, Remazol Blue RR.

2.2.2: Dyeing of Samples with Reactive Dyes: In this research work, four types of weft knitted fabric were dyed with different depth of shade%. These are:

Table 1*: Different shade% applied on weft knitted fabric*

Fabric structure	**Shade% (red 0.056+yellow 0.26+blue 0.125)**	**Shade% (red 0.11+ yellow 0.54+blue 0.262)**	**Shade% (red 0.19+ yellow 0.97+blue 0.47)**	**Shade% (red 0.24+ yellow 1.26+blue 0.61)**
plain single jersey	0.44%	0.91%	1.63%	2.11%
single lacoste	0.44%	0.91%	1.63%	2.11%
Terry fleece	0.44%	0.91%	1.63%	2.11%
heavy single jersey	0.44%	0.91%	1.63%	2.11%

The different weft knitted fabric were dyed by batch process with the help of lab dyeing machine keeping material to liquor ratio 1:10 for the above mentioned shade percentage. During dyeing standard method were followed as per prescribes by the manufacturers. At first we marked 16(4*4) dyeing pot for the 4 samples and 4 shade. The pH of the dye bath was adjusted by soda ash. Set the bath with substrate at room temperature 40°c and add sample, dyes, soda ash, Sequestering Agent, Wetting Agent, Anti Creasing Agent, Leveling Agent and salt. Then raise the temperature at 60°c at 1°/minute. Run the dyeing for 60 minutes at as same temperature 60°c. Decrease the temperature from 60°c to room temperature. After this dropped the samples from bath and rinsed and then carried on after treatment process. After dyeing the samples were washed by hot water, detergent & finally rinsed. Then the samples washed with cold water & neutralized by 1g/l acetic acid (100%) for 10 minutes. Dry the sample by incubator (dryer). Then take the spectrophotometer reading for different color parameters.

2.2.3: Color Fastness Measurement:

In this research work, three types of fastness properties were measured [8-10] like as Color fastness to wash (ISO 105 C04 B2S), Color fastness to water (ISO 105 E01) and Color fastness to rubbing (ISO 105 X12)

2.2.4: Color parameters measurement:

Color iMatch was used for taking different color parameter (CIE L*a*b* and CIE L*C*h°) under the D65 and 10 degree Observer.

3. RESULTS AND DISCUSSION:

3.1: Analysis of Fastness Properties: different color fastness properties like as color fastness to wash, water and rubbing were measured according to ISO standard. The results are as follows:

Table 2: *Color fastness to wash for different knitted samples dyed with different shade%*

Fabric	Shade%	Color Staining						Color
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool	
plain single jersey	0.44%	4-5	4-5	4-5	4-5	4-5	4-5	4-5
	0.91%	4-5	4	4-5	4-5	4-5	4	4-5
	1.63%	4-5	4	4	4-5	4	4	4
	2.11%	4	4	4	4	4	4	4
single lacoste	0.44%	4-5	4	4-5	4-5	4-5	4-5	4-5
	0.91%	4-5	4	4-5	4-5	4-5	4	4-5
	1.63%	4-5	4	4	4-5	4	4	4
	2.11%	4	4	4	4	4	4	4
Terry fleece	0.44%	4-5	4-5	4-5	4-5	4-5	4-5	4-5
	0.91%	4-5	4	4-5	4-5	4-5	4	4-5
	1.63%	4-5	4	4	4-5	4	4	4
	2.11%	4	4	4	4	4	4	4
heavy single jersey	0.44%	4-5	4-5	4-5	4-5	4-5	4-5	4-5
	0.91%	4-5	4	4-5	4-5	4-5	4	4-5
	1.63%	4-5	4	4	4-5	4	4	4
	2.11%	4	4	4	4	4	4	4

From the table, the results of Color fastness to wash of cotton knitted fabric for different dept of shade have been showed. Wash fastness of cotton knitted fabric decrease with the increases of shade. Here for color staining cotton and wool show considerable color change but Acetate, Nylon, polyester, Acrylic are almost same.

Table 3: *Color fastness to water for different knitted samples dyed with different shade%*

Fabric	Shade%	Color Staining						Color
		Acetate	Cotton	Nylon	Polyester	Acrylic	Wool	
plain single jersey	0.44%	4-5	4	4-5	4-5	4-5	4-5	4-5
	0.91%	4-5	4	4-5	4-5	4-5	4	4
	1.63%	4-5	4	4	4-5	4	4	4
	2.11%	4	4	4	4-5	4	4	4
single lacoste	0.44%	4-5	4-5	4-5	4-5	4-5	4-5	4-5
	0.91%	4-5	4	4-5	4-5	4-5	4	4
	1.63%	4-5	4	4	4-5	4	4	4
	2.11%	4	4	4	4-5	4	4	4
Terry fleece	0.44%	4-5	4-5	4-5	4-5	4-5	4-5	4-5
	0.91%	4-5	4	4-5	4-5	4-5	4	4
	1.63%	4-5	4	4	4-5	4	4	4
	2.11%	4	4	4	4-5	4	4	4
heavy single jersey	0.44%	4-5	4-5	4-5	4-5	4-5	4-5	4-5
	0.91%	4-5	4	4-5	4-5	4-5	4	4
	1.63%	4-5	4	4	4-5	4	4	4
	2.11%	4	4	4	4-5	4	4	4

It is seen from the above result of Color fastness to water of cotton knitted fabric for different shade%. Water fastness of cotton knitted fabric decrease with the increases of shade%.

Table 4: *Color fastness to rubbing for different knitted samples dyed with different shade%*

Fabric structure	Shade%	Dry Rubbing	Wet Rubbing
Plain single jersey	0.44%	4-5	4
	0.91%	4-5	4
	1.63%	4-5	4
	2.11%	4	3-4
Single lacoste	0.44%	4-5	4-5
	0.91%	4-5	4
	1.63%	4	4
	2.11%	4	4
Terry fleece	0.44%	4-5	4-5
	0.91%	4-5	4
	1.63%	4	4
	2.11%	4	4
Heavy single jersey	0.44%	4-5	4-5
	0.91%	4-5	4-5
	1.63%	4	4
	2.11%	4	4

It is seen from the above result of Color fastness to rubbing (dry & wet) of cotton knitted fabric for different shade are observed and fastness properties decrease with the increases of shade%.

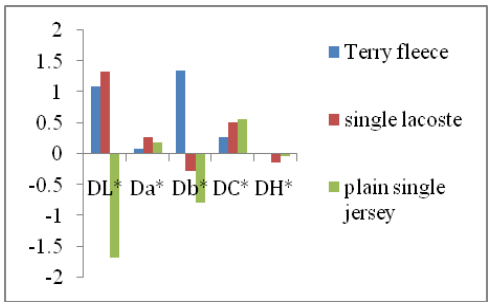

***Fig. 1**: Effect of color parameters on different fabric Structure dyed with 0.44% shade*

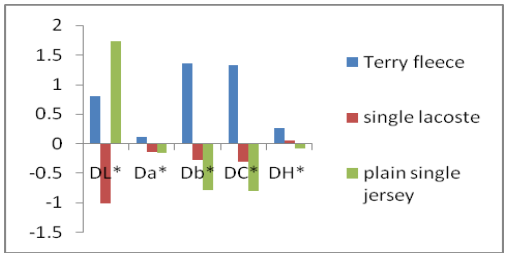

***Fig. 2**: Effect of color parameters on different fabric Structure dyed with* 0.91% shade

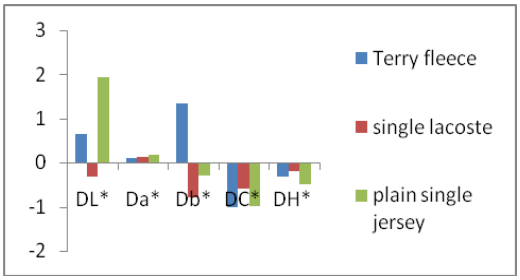

***Fig. 3**: Effect of color parameters on different fabric Structure dyed with* 1.63% shade

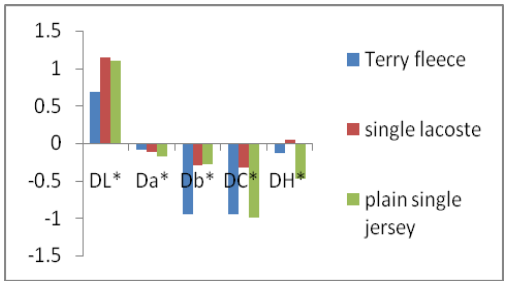

***Fig. 4**: Effect of color parameters on different fabric Structure dyed with* 2.11% shade

It is seen from the above graph that the effect of different color parameters varies from fabric to fabric. It is also observed from the graph DL* (lightness or darkness), Da*(reddish or greenish), Db*(yellowish or bluish), DC* (Chroma or saturation) and DH*(Hue) varies with the fabric structure and shade%.

4. CONCLUSIONS

In this research work, it was observed that, with the increase of shade% for different fabric structures, Color fastness properties of weft knitted fabric are affected. Again it was also observed With the increase of shade% of cotton knitted fabric a considerable change were found for different color parameters (CIE L*a*b* and CIE L*C*h°).At last we can say that, there is a considerable Effect of knitted structure were investigated for different color parameters and color fastness to washing, color fastness to rubbing and color fastness to water when cotton knitted fabric were dyed with different shade% i.e 0.44%, 0.91%, 1.63% and 2.11%.

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