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# Coloration technique of turquoise tints with in depth analysis on shade, utility consumption and physico-chemical properties concerning batches of identical hue

Shamim Al Azad[a, c,*], Hridam Deb[b,c], Md. Abdul Mueeid Alam[b,c], K. M. Faridul Hasan[b,c],
Mohammad Neaz Morshed[b, c, **], Syed Fakhrul Hassan[c]

**Abstract**— Reactive dyes for turquoise hue have definite properties of larger structure results shade deviation between batches in knit fabric dyeing. Dyeing technique of turquoise color as well as comprehensive analysis on deviations on shade and physico-chemical properties concerning batches of dyed knitted fabric with respective utility consumption has been investigated in this research. To obtain the level and magnitudes of deviation, three batches of cotton knitted fabric dyed with turquoise color having same recipe as well as same condition were examined. Ailment of shade on different stage of knit dyeing with turquoise color also reported. Process chemicals, parameters, process flow and visual analysis on light box as well as spectrophotometer analysis of all three samples was supplemented. In addition, physical and chemical test of sample dyed fabric such as color fastness to wash, color fastness to rubbing was tested under the ISO 3, ISO 105 E04, and ISO- 105-AO3 method respectively. Besides color strength as well as utility and time consumption of each batch have an inclusive investigation. After widespread analysis of the samples a considerable shade deviation has been testified which lead to reprocessing. As a result, production rate becomes lower, fabrics damage, production cost, chemicals and water consumption become higher, which upshots ruthless impact on environment through higher pollutants generation.

**Index Terms**—Physico-chemical properties, Shade Deviation, Turquoise Coloration, Knit dyeing

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## 1 Introduction

Dyeing is the process of coloring the textile material with the help of dyes and various types of chemicals. Dyeing process is also known as wet process because the process is saturated with water/solvent. Dyeing process is carried out by using different types of dyes which can impart permanent color [1]. Before dyeing the textile materials need to treat by different processes are known as pre-treatment process. The main purpose of pre-treatment processes is to obtain fabrics "Free from exterior impurities [2]. Batch preparation, Scouring, Bleaching, and Heat setting involves pre-treatment process [3]. Batching is the process to get ready the fabrics which should be dyed and processed for a particular lot of a particular order. In other words- Batching means separation of fabric according to specification, Dyeing machine capacity and availability, urgency of the order. Batch contains body of garments as well as collar-cuffs according to the design [4]. Scouring was performed to remove any impurities present in the fabric. The impurities i.e. oil and wax, lubricants, dirt, surfactants, residual tints etc. [5-7] are removed using an alkaline solution, typically sodium hydroxide, at high temperatures to breakdown or emulsify and saponify the impurities [8]. Bleaching is destruction of natural coloring matters to impart pure, permanent and basic white effects suitable for the production of white finisher, level dyeing and desired printed shade with the minimum or no tendering or without reducing the tensile strength is called bleaching. The mostly use bleaching agent is Hydrogen per Oxide (H2O2), which is also known as universal bleaching agent [9]. Dyeing process is one of the most important part of textile. Different kinds of dyeing method and dyes were applicable for different kinds of fiber. Cotton is the most important natural textile fiber and used to produce apparel, home furnishings, and industrial products [10]. Most of the dyes do not chemically react with the cellulose molecule to affix the color. True chemical reaction between cellulose and the dye molecule occurs with reactive dyes due to the presence of hydroxyl group of cellulose and functional group of dye molecules [8]. The dyestuffs molecules, which contain reactive groups is called reactive dye. Reactive dye is very suitable for cotton fabric because of its very good fastness properties. Reactive dye reacts with OH-group of cotton fabric and form covalent bond [11]. General structure of reactive dye: D-B-Y-X

Where,
D= Chromophore of dye part
B= Bridge (such as, -NH-, -NR- group
Y= Reactive group bearing parts

a School of Textile Chemistry and Chemical Engineering, Wuhan Textile University, China (430300)
b School of Textile Science and Engineering, Wuhan Textile University, China (430200)
c Department of Textile Engineering, Southeast University, Bangladesh (1213)
*, ** Corresponding Author's Email Address: engr.neazmorshed@yahoo.com (Mohammad Neaz Morshed), shamimal.azad@yahoo.com (Shamim Al Azad)

X= Reactive atom or group
Substitution reaction in case of cellulose fiber

$$\text{D-R-Cl + cell-OH} \xrightarrow{\text{NaOH}} \text{D-R-O-cell+NaCl+H2O}$$

Addition reaction in case of cellulose fiber

$$\text{D-F-CH=CH2 + HO-cell} \longrightarrow \text{D-F-CH2-CH2-O-cell}$$

Some of reactive dyes such as turquoise have definite properties which does not mostly yield same shade with the cotton knitted fabric [3, 4]. Structure of knitted fabric resists dye molecules penetrate into the core of cotton fibers. Fabrics having quite relatively compact structure that does not allow proper penetration of dye molecules evenly into fiber polymer system. Due to those problems, the knit fabric processing enterprises experiencing a lot of complex situation. In present days, factories are practicing re-dyeing like topping, stripping and dyeing. As a result, production rate becomes lower, fabrics damage, production cost, chemicals and water consumption become higher, and as a result pollutants generation goes higher [3]. This study reported the shade deviation of cotton knitted fabric dyed with reactive turquoise color and explored its consequence to discover a way reduce the utility consumption as well as increase productivity as an approach to clean manufacturing.

## 2 Experimental

### 2.1 Materials

The investigation has been carried out with 100% cotton knitted single jersey fabric. The yarn count was 24s/1 combed yarn, the fabric weight per unit area was 150 g/m2, course density was 12 courses/cm and wales's density was 11 wales/cm. The fabric was scoured and bleached by caustic soda and H2O2 in a single bath stage with the standard recipe. The fabrics were dyed with turquoise reactive dye.

### 2.2 Equipment's

The research investigated the sample directly taken from production line. DATACOLOR D650 spectrophotometer was used to measure the color deviation. VERIVADE Light box was cast-off to visual assessment under D65 and TL83 Light source. For experiment purpose some other valuable equipment's to get our desired result has been used are shown in Table 1. (List of equipment's used in experiment)

Table 1: List of equipment's used in experiment

| Machine Name | Model | Company | Country |
|---|---|---|---|
| Dyeing Machine | Athena 2 | Schlavos | Greece |
| GSM Tester | n/a | James H Heal and Co. Ltd | England |
| Grey Scale | 267A+267C | James H Heal and Co. Ltd | England |
| Crock Meter | 670 | James H Heal and Co. Ltd | England |
| Perspirometer | SDLMG2098 | SDL Textile Machine Co. | England |
| Counting glass | ISO-105A02 | MESDAN | Italy |
| Hydro Extractor | NH-EX10 | Nisho apparel machinery | UK |
| Color Fastness tester(Rota wash) | SDLM228B | SDL Textile Machine Co. | England |
| Electrical balance | BJ-1000C | Precisa | Switzerland |

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### Chemicals

Following chemicals shown in table 2 has been used. Reactive turquoise color of famous brand from chemical store was used.

Table 2: Chemicals and Auxiliaries used for reactive turquoise dyeing

| Chemical and Auxiliaries Name | Function |
|---|---|
| Feloson NOF | Detergent |
| Sirrix 2UD | Sequestering agent |
| Centafoam SC | Antifoaming agent |
| H2O2 | Hydrogen Per-oxide |
| Alkali | Caustic soda flax |
| Imacol C2G | Anticreasing agent |
| Centableach SB and SOF | Stabilizer |
| Centalizer ASB and Crocks | Per-oxide Killer |
| Acid | Acetic acid |
| Bio-Polish 80L | Enzyme |
| Drimazin E2R and 200 BF | Leveling agent |
| Electrolyte and Fixation Agent | Salt and Soda |
| Sandoper Sp | Soaping agent |
| Sandofix EC | Fixing agent |
| Softener W | Softener |

### 2.4 Methods

This research completely conducted with bulk processing of fabric dyeing. Dyeing of cotton knitted fabric after required pre-treatment was done on dyes manufacturer given process flow chart with maintaining the mentioned parameters. Then three consecutive sample of three batches of dyed knitted fabric was collected and analyzed in light box and Spectrophotometer. The reading of water, steam and electricity flow meter for each batch installed in the machine was stored.

#### 2.4.1 Method of dyeing with turquoise color.

The fabric to be dyed requires scouring and bleaching as a pretreatment. Turquoise color requires relatively more atten-

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tion to its processing. Neutralization after scouring and further bleaching and bio polishing process the fabric will be ready for died. To dye cotton knitted fabric with turquoise color requires high temperature migration for shade evenness. Figure 1, 2, 3 and Table 3, 4, 5 describes the dyeing process of knit dyeing with turquoise color.

### 2.4.1.1 Pretreatment method

Before dyeing the cotton knitted fabric go through combined scouring and bleaching process on 95°C for 50 mins. Oil wax, and other impurities been separated by this process [5]. As yarn hair is a matter of concern in all the premise of processing, it had also worse effect on shade deviation. To overcome this unwanted problem, protruding yarn in the surface of the fabric need to be removed. Bio polishing is a process to remove the protruding hair from the surface of the yarn by treating with enzyme at 55°C for 55 mins. The pretreatment process curve shown in figure-1 and figure-2.

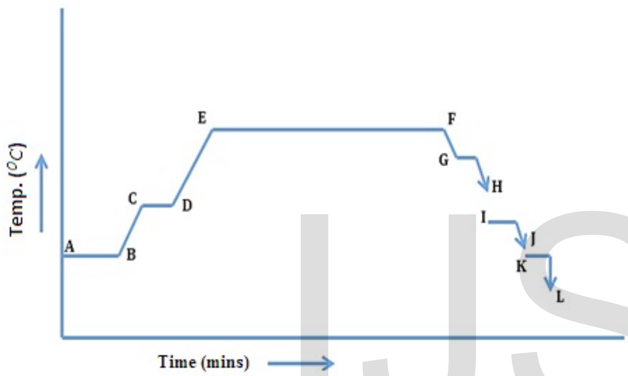


Figure 1: Combine scouring and Bleaching Process curve

Table 3: Description of Combine scouring and Bleaching Process curve

| Line | Process | Temperature (OC) | Run Time (min) |
|---|---|---|---|
| A-B | Fill<br>Load<br>Caustic Soda and Auxiliaries inject | 40<br>40<br>40 | 2<br>5<br>3 |
| B-C | Temperature increase at 5OC/min | 60 | 3 |
| C-D | H2O2 dosing | 60 | 3 |
| D-E | Temperature increase at 3OC/min | 95 | 15 |
| E-F | Combined Scoring and Bleaching | 95 | 50 |
| F-G | Temperature Decrease at 3OC/min | 80 | 5 |
| G-H | Rinse | 50 | 5 |
| I-J | Temperature Control<br>Rinse | 50 | 10<br>5 |
| K-L | Temperature Control<br>Drain | 41 | 10 |

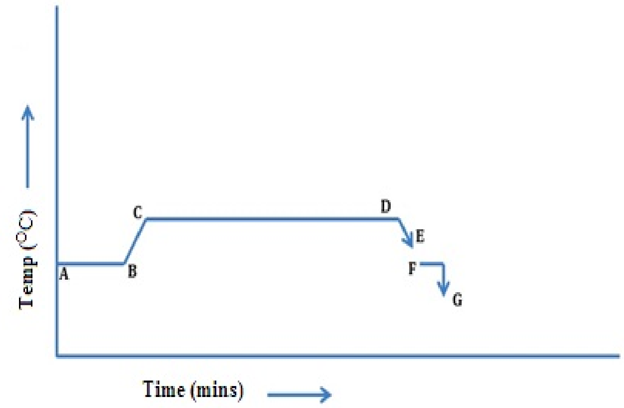


Figure 2: Process curve of bio-polish

Table 4: Description of Process curve of bio-polish

| Line | Process | Temperature (OC) | Time (min) |
|---|---|---|---|
| A-B | Fill<br>Acid inject | 40<br>40 | 2<br>5 |
| B-C | Temperature increase at 5OC/min | 55 | 5 |
| C-D | Enzyme + H2O2 Killer dosing<br>Enzymatic Treatment<br>Sample Check | 55<br>55 | 3<br>50 |
| D-E | Rinse | 55 | 5 |
| F-G | Temperature Control at 5OC/min<br>Drain | 41 | 5 |

### 2.4.1.2 Dyeing method

The most complex situation for textile coloration is dying. And dyeing with turquoise color are even more complex to achieve exact shade on batch to batch. Figure 3 showing the process curve for dyeing of turquoise color.

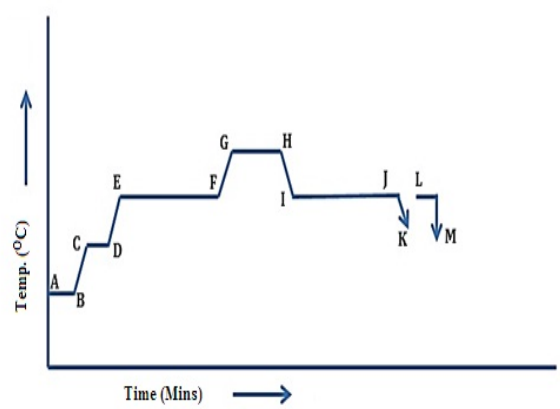


Figure 3: Process curve of dyeing with turquoise color.

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Table 5: Description of Process curve of dyeing with turquoise color.

| Line | Process | Temperature ($^{O}C$) | Time (min) |
|---|---|---|---|
| **A-B** | Fill | 40 | 2 |
| B-C | Temperature increase at 5OC/min | 60 | 5 |
| | PH Check | | |
| C-D | 2/3 of Leveling agent inject | 60 | 4 |
| D-E | Temperature increase at 3OC/min | 80 | 3 |
| E-F | Color + 1/3 of leveling | 80 | 30 |
| | agent dosing | 80 | 10 |
| | Run | 80 | 10 |
| | Salt dosing | | 10 |
| | Run | | |
| F-G | Temperature increase at 1OC/min | 95 | 20 |
| G-H | Run | 95 | 20 |
| H-I | Temperature decrease at 1OC/min | 80 | 9 |
| I-J | Run | 80 | 9 |
| | Soda dosing | 80 | 45 |
| | Run | | 40 |
| | Sample | | |
| J-K | Rinse | 60 | 5 |
| L-M | Temperature Control at 5OC/min | 60 | 5 |
| | Drain | | |

### 2.4.3 Shade development method

Turquoise color often creates uneven and variable shade under same parameter. To avoid this output shade of turquoise color develops under continuous shade development process. Figure 4 shows the shade development sequence for turquoise color.

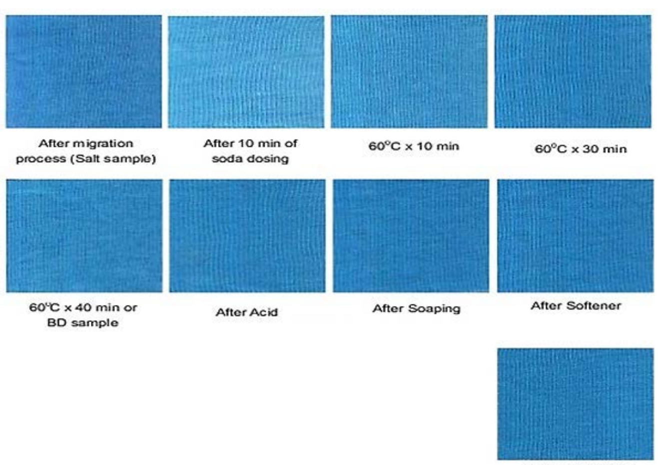


Figure 4: Shade development process of turquoise color

### 2.4.2 Test methods

#### 2.4.2.1 Evaluation of color fastness to wash test

As the sample to be tested is in fabric form a piece measuring 10cm by 4cm was cut from each of the dyed fabrics. The specimen to be tested was placed between two specified pieces of undyed cloth measuring 5cm by 4cm, and the three pieces were held together by stitching round the edges, leaving 5cm by 4cm of the dyed sample exposed. The pieces of the undyed cloth enable the degree of staining during test to the assessed. For ISO3, the sample was washed with 5g/l of soap and 2g/l of soda ash in a solution of liquor ratio 50:1, at a temperature of 60□C for 30mins, followed by rinsing and drying. The change in color of the tested specimen and the staining of the adjacent undyed cloths were assessed with the appropriate grey scales.

#### 2.4.2.2 Evaluation of color fastness to light fastness test

The artificial light source method of determination of light fastness was used in this study. The specimen and the blue standard were exposed behind a glass and inserted into the light fastness testing machine. Exposure was carried out for 48hrs. Exposure was terminated after the contrast between the exposed and the unexposed portion of the specimen is equal to the grades on the grey scale, for assessing change in color. Change in color was assessed by comparing the tested fabric and original fabric under a white light with the blue standard as reference

#### 2.4.2.3 Evaluation of color fastness to rubbing test

This test method is designed to determine the degree of color transfer from the surface of textile floor coverings to other surfaces by rubbing. Color fastness to rubbing (dry and wet) was assessed as per ISO 105 E04 method using a manually operated crock meter and grey scale as per ISO- 105-AO3 (extent of staining). Here, Specimen size at least 50 x 140 mm, Vertical Load - 9 +/- 0.2 N ,Finger Diameter – 16 mm Position warp parallel to long dimension for one specimen and weft parallel to long dimension for other specimen or diagonally. Rubbing distance: 104 +/- 3mm. Evaluation is done by Grey scale in a dyed color matching cabinet and rate from 1 to 5.

#### 2.5.6 Evaluation of color fastness to perspiration test

Color fastness to rubbing (dry and wet) was assessed as per ISO 105 E04 method. Sample size will be 10 CM * 4 CM then Wet-0ut the composite test sample in mentioned alkaline or acidic solution at room temperature. The Material ration will be 1:50 and leave for 30 minutes. Then Pour off excess solution and place the composite sample between two glass plate or acrylic plate under a pressure of 4.5 KG and place in an oven for 4 hours at 37+- and 2 degree centigrade temperature. Then Remove the specimen and hang to dry in warn air not exceeding 60 Degree centigrade. Evaluation is done by Grey scale in a dyed color matching cabinet and rate from 1 to 5.

#### 2.5.7 Estimation of color strength (K/S value)

The K/S values were calculated by The Kubelka Munk equation [13] is shown in (1)

$$K/s = ((1-R\lambda_{max})^2)/2R\lambda_{max} \quad (1)$$

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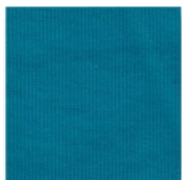
K is the absorption coefficient and S is the scattering co efficient.

## 3. Result and Discussion

### 3.1 Visual analysis

Among three sample of three different batches of knitted fabric dyed with same turquoise color and chemical keeping the parameters same have been examined under light box. From the samples we made a standard and the batch -A is considered as the standard and the other two samples of Batch-B and Batch-C is compared with the standard to get the deviation between the batches. In the light box under the D-65 light, we compared the samples. Visually, it is found that, the batch C is a little bit yellowish than the other two shades.



A: Standard Sample A B. Sample B

C. Sample C

Figure 5: Batch to batch Shade Sample (A: Standard Sample A , B. Sample B and C Sample C )

### 3.2 Spectrophotometer Analysis

Turquoise color has a yellowish effect. When the fabric starts to absorb Turquoise color, the shade gets a yellowish tone. The fabric at around 90o C starts to absorb Turquoise color. In the batch C, the fabric was in the hot temperature (80-90oC) for more time than the standard one. That's why the spectrophotometer is expressing that more yellow. Table 6 and Table 7 shows the spectrometer report for two sample compared with standardize sample where figure 6 and figure 7 displaying graphical illustration for both D65 and TL83 Light source along with analysis of color deviation.

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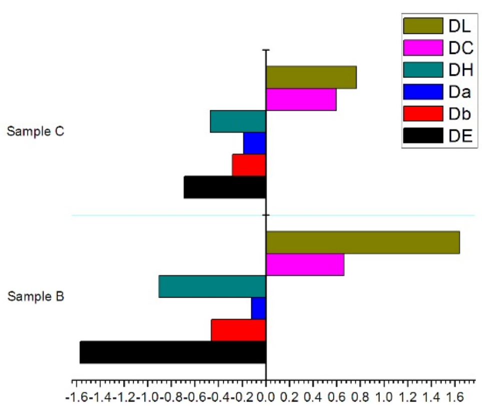
Table 6: Comparative data of Spectrophotometer for two batches Under D65 light

| Samples | DL | DC | DH | Da | Db | DE | Status |
|---|---|---|---|---|---|---|---|
| *Sample B* | −1.57 | −0.46 | −0.12 | −0.90 | 0.66 | 1.64 | Fail |
| *Sample C* | −0.69 | −0.28 | −0.19 | −0.47 | 0.60 | 0.77 | Warn |



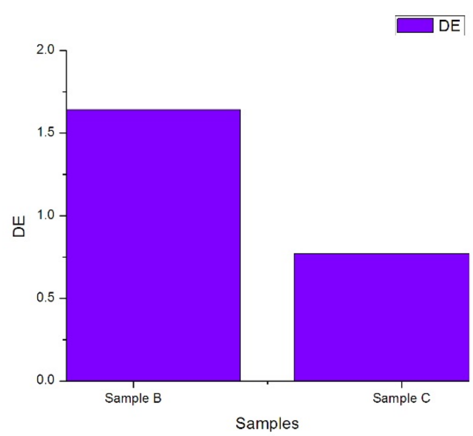




Figure 6: Data analysis for two batches under D65 light source

Comparing the visual result with the spectrophotometer data, we can get the following result. Then according to the DATACOLOR report we can see that, the 'Total color deviation' of the batch B is 1.64, which is greater than 1 and we know if the DE is not less than 1.0, then the DE fails and the shade is unacceptable. So this shade is unacceptable according to the spectrophotometer data under D65Light source. Besides under light source of TL83 total color deviation found 1.82 which is unacceptable and DL, DC, DH, Da, Db found -1.69, -0.65, -0.17, -0.45, 0.74 respectively. This indicated the visible difference between shades. On the other hand the 'Total color deviation' of the batch C is 0.84 under TL83 light source. So this shade is acceptable upon warning comparing with the standard. It can also see that the Batch B is darker, less saturated (DC=-0.45) and more Blue. And the Batch C is darker, less saturated (DC=-0.45) and more Yellow in the TL83 light. Under D65 C sample shows a total deviation of 0.77 which is acceptable where it's DL, DC, DH, Da, Db founds -0.69, -0.28, -0.19, -0.47, 0.60 respectively. So the shade is near about the standard one but has some noticeable variations.

Table 7: Comparative data of Spectrophotometer for two batches Under TL83 light

| Samples | DL | DC | DH | Da | Db | DE | Status |
|---|---|---|---|---|---|---|---|
| Sample B | -1.69 | -0.65 | -0.17 | -0.45 | 0.74 | 1.82 | Fail |
| Sample C | -0.71 | -0.45 | -0.07 | -0.79 | 0.78 | 0.84 | Warn |

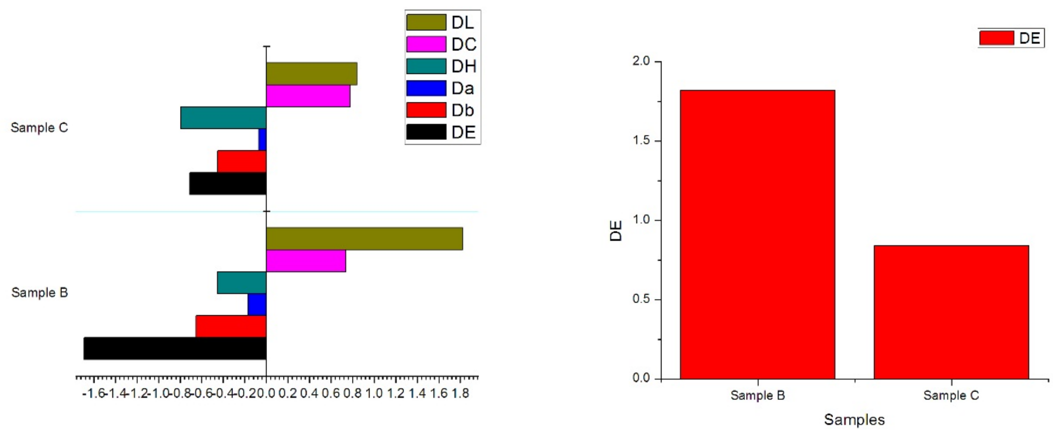



Figure 7: Data analysis for two batches underTL83 light source

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Spectrophotometer analysis of this three batches of sample dyed with turquoise color indicated the visible variations on shades. The variation of shades will partake in consequences on other properties of fabric including physical and chemical tests.

### 3.3 Color strength (K/S) values analysis

Color strength (K/S) values of three dyed samples are shown in Figure 8. The results indicates the variation on Color strength for all three samples. Where Sample C shows visible difference with Sample A and Sample B.

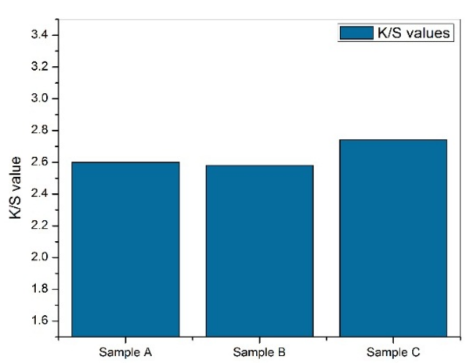


Figure 8: Analysis of K/S values of three samples

## 3.4 Physical Tests

Due to shade deviation most of the time buyer reject the shade with batch to batch shade variation, uneven shade and so on. Properties of dyed fabric such as color fastness to wash, color fastness to perspiration and color fastness to rubbing. It has been seen that the fastness properties of all three sample to wet and dry rubbing, light as well as water is acceptable in range to good. But still they difference in shade deviation

### 3.4.1. Color Fastness to Wash

Color fastness to wash test (ISO 3) values of three samples are presenting in table-8 and figure 9. There was a little difference in wash fastness test between the samples. This may be occurred due to dye molecules that are loosely attached on the fabric surface that have not been formed any bonds with the fiber polymer system. Thus lower the quality of finished product.

Table 8. Color fastness to wash test (ISO 3) values of three samples

| Sample No | Wash test rating | |
|---|---|---|
| | Staining | color change |
| Sample A | 4 | 4/5 |
| Sample B | 4/5 | 4 |
| Sample C | 4 | 4 |

Keys: 5 = excellent 4 = very good 3 = good 2 = moderate 1 = poor

### 3.4.2. Color fastness to light

Table 9 shows the Color fastness to light test values of three samples. Figure 9 graphical analysis of indicates the light fastness grade. In this research color fastness to light was evaluated for all dyed fabric. Both processes gave almost similar

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result due to the similar bonding of dyes and fibers. The difference noticed is not a prominent, but later on the apparel made by these sample can poses different shade.

Table 9. Color fastness to light test values of three samples

| Sample No | Light Fastness ratting |
|---|---|
| Sample A | 6 |
| Sample B | 7 |
| Sample C | 6 |

Ratings: 8=Outstanding (No fading), 7=Excellent (Very slight fading), 6=Very good (Slight fading), 5=Good (Moderate Fading), 4=Moderate (Appreciable fading), 3=Fair (Significant fading), 2=Poor (Extensive fading), 1=Very poor (Very extensive fading)

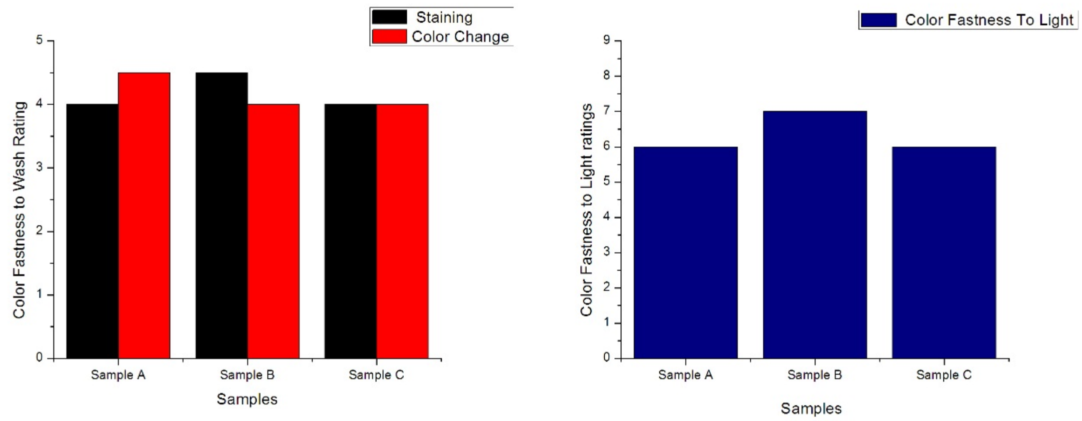


Figure 9: Analysis of color fastness to light (right) and color fastness to wash (left)

### 3.4.3. Color fastness to rubbing

Color fastness to rubbing test in dry and wet condition per ISO 105 E04, ISO- 105-AO3 method displaying on table 10 and 11 respectively. Color fastness to rubbing assessments are done for both fabrics dyed in wet and dry condition. This test was designed to determine the degree of color. The test result for both test is about similar, this is because of similar treatment and similar dyes and fiber used for both samples.

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Table 10. Color fastness to rubbing test in dry condition (ISO 105 E04, ISO- 105-AO3)

| Sample No | Dry Rubbing test rating | |
|---|---|---|
| | Staining | color change |
| Sample A | 3/4 | 4 |
| Sample B | 4/5 | 4 |
| Sample C | 4 | 3/4 |

Table 11. Color fastness to rubbing test in wet condition (ISO 105 E04, ISO- 105-AO3)

| Sample No | Wet Rubbing test rating | |
|---|---|---|
| | Staining | color change |
| Sample A | 4 | 4 |
| Sample B | 3/4 | 4 |
| Sample C | 3/4 | 3/4 |

Keys: 5 = excellent 4 = very good 3 = good 2 = moderate 1 = poor

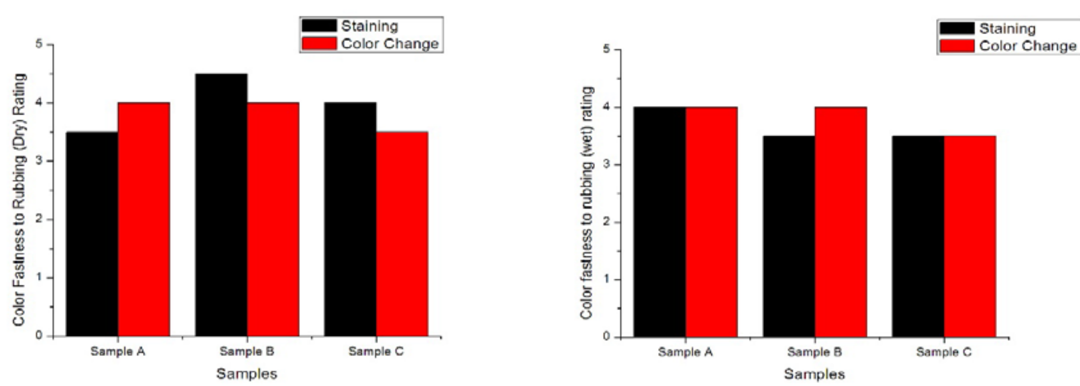


Figure 11: Analysis of color fastness to Dry (left) and Wet (right) rubbing

### 3.4.4. Color fastness to perspiration

Test result on color fastness to perspiration test in acid and alkali condition for three sample shown in table 12 and table 13 in a row. It has been seen that the rating of color fastness to perspiration in both acidic and basic condition shows slight differences in the value which can lead to reprocessing of goods,

Table 12. Color fastness to perspiration test in acid condition

| Sample No | Perspiration test in acid condition rating | |
|---|---|---|
| | Staining | color change |
| Sample A | 4 | 4 |
| Sample B | 3/4 | 4 |
| Sample C | 3/4 | 3 |

Table 13. Color fastness to perspiration test in alkali condition

| Sample No | Perspiration test in acid condition rating | |
|---|---|---|
| | Staining | color change |
| Sample A | 3/4 | 4 |
| Sample B | 3/4 | 4 |
| Sample C | 3 | 3/4 |

Keys: 5 = excellent 4 = very good 3 = good 2 = moderate 1 = poor

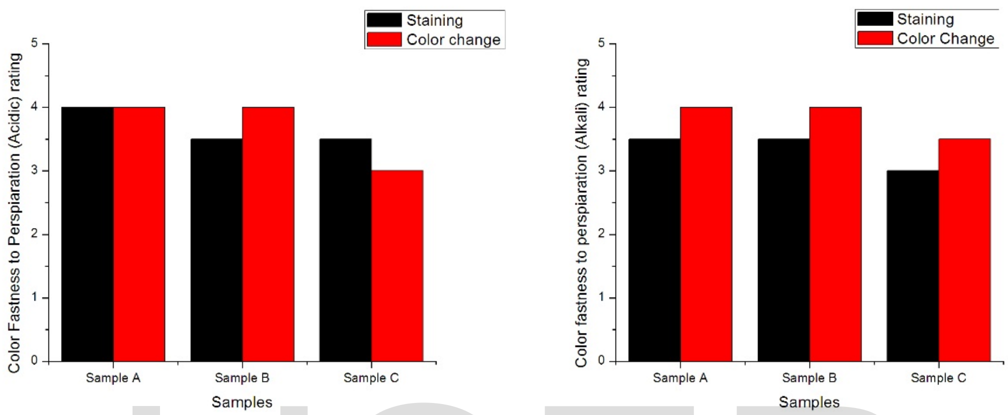


Figure 12: Analysis of color fastness to perspiration in Acidic Condition (left) and Alkali Condition (right)

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### 3.5 Utility and time Consumption

Utility and time consumption of three sample batch has been investigated. Table 14 displays the consumption of time and utilities of a turquoise dyed knitted fabric.

Table 14: Utility consumption analysis of three samples

| Sl. | Shade name | Water (Liter)/kg | Steam (kg)/kg | Electricity (Kwh)/kg | Time (hrs.) /batch |
|---|---|---|---|---|---|
| 1 | Sample A | 105 | 5.56 | 0.289 | 12.58 |
| 2 | Sample B | 115 | 5.84 | 0.299 | 13.00 |
| 3 | Sample C | 120 | 6.20 | 0.370 | 16.10 |

According to experimental result shown in table 15, it has been seen that water consumption for three sample A, B, C is 105 ltr/kg, 115 ltr/kg and 120 ltr/kg respectively. This indicated water required for dyeing with turquoise color is higher than other process [3].

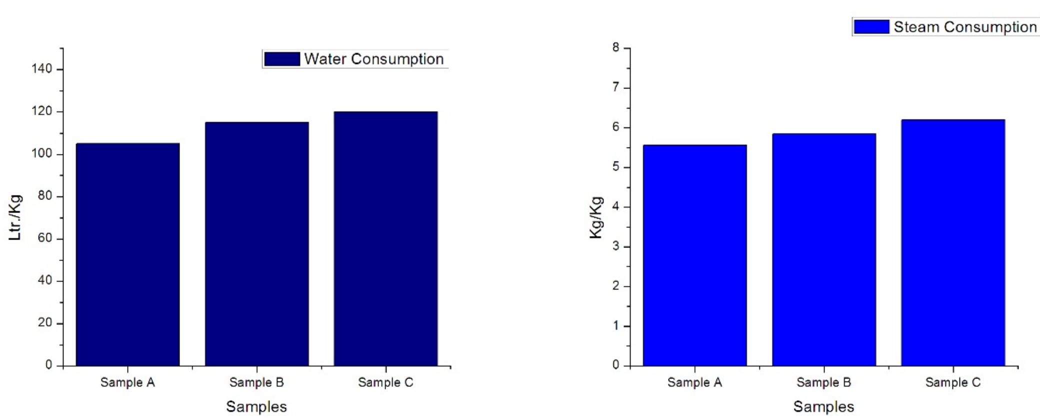


Figure 13: Analysis of water (left) and steam (right) consumption

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On the other hand the steam and electricity consumptions for 5A is 5.56 kg/kg, 0.289 Kwh/kg in turn and for B and C is 5.84, 6.20 and 0.299, 0.370 correspondingly. Time for dyeing this three samples also reported samples 1 takes lowest time about 12.58 hours where sample 2 and sample 3 takes 13 and 16.10 hour in a row.

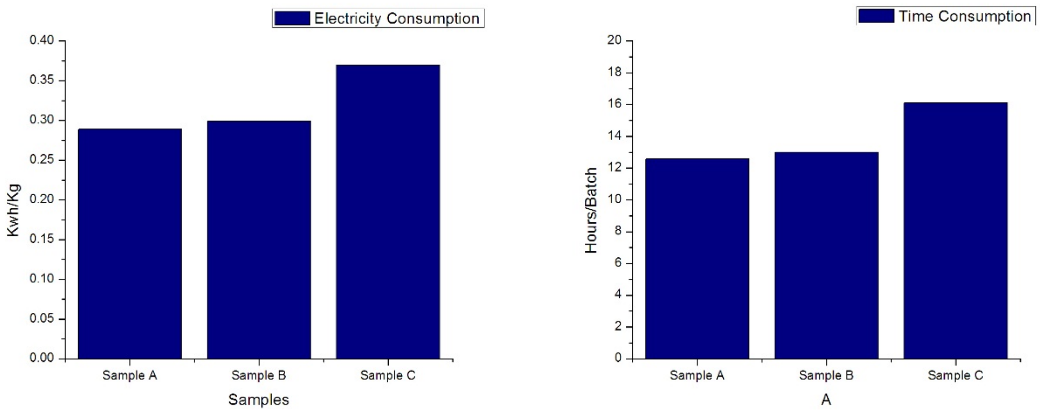


Figure 14: Analysis of electricity (left) and time (right) consumption

All the data directed that, due to complexity of dye migration and bonding of turquoise color several unwanted circumstance can arise. To avoid these stripping process in the preparatory stage before dyeing with the help of Hydrose (Na2S2O4) treatment [12] can be applied to get better result.

### 3.6 Discussion

Due to shade deviation most of the time buyer reject the shade with batch to batch shade variation, uneven shade and so on. Properties of dyed fabric such as color fastness to wash, color fastness to perspiration and color fastness to rubbing. Color fastness to rubbing assessments are done for both fabrics dyed in wet and dry condition. This test was designed to determine the degree of color. The test result for both test is about similar, this is because of similar treatment and similar dyes and fiber used for both samples. In this experiment color fastness to light was evaluated for all dyed fabric. Both processes gave almost similar result due to the similar bonding of dyes and fibers. The difference noticed is not a prominent, but later on the apparel made by these sample can poses different shade. There was a little difference in wash fastness test between the samples. This may be occurred due to dye molecules that are loosely attached on the fabric surface that have not been formed any bonds with the fiber polymer system. Thus lower the quality of finished product.

Generally, the textile industries are contributing relatively high quantity of problematic compounds in the environment, as most of removed before discharge into the water stream. Most of them have either no treatment facilities or have grossly inadequate arrangements. Among all pollutants, color in textile effluent is the main pollutant. The textile dyeing industries uses large volumes of water, steam and electricity and substantial quantities of complex chemicals. Textile dyeing house operating in this sector are facing significant challenges to reduce their natural resources and energy consumption. In particular, the charges incurred for mains water supply and effluent disposal are increasing, and companies need to address these issues to save money and remain sustainable competitiveness. Waste minimization in process industries consists of source reduction and recycling. It is possible to save money by reducing waste treatment and disposal costs, to improve the quality of products, to reduce potential environmental liabilities, to protect public and worker's health, to increase safety and to protect the environment. Waste minimization by source reduction and recycling is the cheapest method for waste reduction. Our previous work on textile waste management [14, 15] was concerning sludge and its sustainable development, but to find out root cause remedies modification from the beginning should adopt has been investigated [16]. Most of the textile industry use excessive wash after dyeing for coloration of turquoise color. Enormous amount of waste water generated through this process upon disposal of these polluted water leads an adverse impact on environment and threaten to eco-friendly and green textile. Since farmers are using water from river for agricultural purposes and the residents of the town are using both the surface and underground waters from the same area as potable water, it is quite unsafe for this discharge into this water body to continue. The ecological and human health safety of continual discharge of this treated textile effluents into surface water are undoubtedly under threat.

## 4 Conclusion

The results of this work focused on the variation on physical and chemical properties among three batches dyed under same condition and having all the parameters same for all. It has been investigated that, having same parameters for same turquoise color the physical and chemical properties changed in a noticeable measure. On the other hand to match a particular color standard all three sample had different time and utility consumption. Due to complexity on achieving particular shade for turquoise color it requires high temperature migration, several rinse and soaping treatment. All of this finding leads to increase effluent load in effluent treatment plant. This research is an instigation to keep away water and environment from pollution by introducing an investigation of conventional dyeing process and its sustainability at the same time importance of modern high exhaustion fixation and low temperature dyes for turquoise color

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