Faculty of Engineering
Department of Textile Engineering

Comparative study between medium brand and hot brand reactive dye for dying cotton fabric

Course Title: Project (Thesis) **Course code:** TE-4214

Submitted By

Md. Masum Hossain	191-23-5533
Sardar Sartaz Sourov	191-23-5539

Supervised By
Tanvir Ahmed Chowdhury
Assistant professor
Department of Textile Engineering, DIU

The report presented in partial Fulfillment of the requirements for the degree of
Bachelor of Science in Textile Engineering
Advance in Wet Processing Technology

Fall- 2021

LETTER OF APPROVAL

01-12-2021

To,

The Head

Department of Textile Engineering

Daffodil International University

102, Shukrabad, Mirpur Road, Dhaka 1207

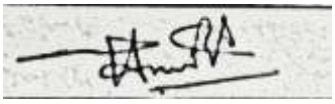
Subject: Approval of Project Report of B.Sc.In TE

Dear Sir,

Assala-mu-alikum sir, I am simply writing to tell you that this task report titled as "Comparative study between medium brand and hot brand reactive dye for dying cotton fabric" has been set up by the under study bearing ID 191-23-5533 and 191-23-5539 is finished for definite assessment. The entire report is readied in light of the best possible examination at Newage Textile Ltd. Furthermore, intrusion through basic examination of observational informational with required possessions. The under study were straight forwardly associated with their undertaking exercises.

Therefore, it will highly be appreciated if you kindly accept this project report and consider it for final evaluation.

Yours Sincerely



Tanvir Ahmed Chowdhury

Assistant Professor

Department of Textile Engineering

Daffodil International University

ACKNOWLEDGEMENT

Above all, first we thanks to Almighty Allah Who gives us ability and power to complete this Thesis and research work. With sincerity, We extent our warm and deep appreciation and gratitude to our supervisor, Tanvir Ahmed Chowdhury, Assistant professor, Department of Textile Engineering of Daffodil International University for this guidance and support to come up with this research work. Been working with him, we have not only earned valuable knowledge, but was also inspired by this innovativeness which helped to enrich our experience to a greater extent. His ideas and way of working of truly remarkable. We believe that this research could not be finished if he did not help us continuously.

We should like to express our heartiest to Mr. Md. Mominur Rahman, Assistant Professor Head (in-charge) of the Department, Textile Engineering of Daffodil International University for his kind help to finish our project and also to other faculty members and the staffs of TE Department of Daffodil International University.

We would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

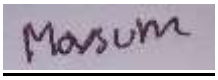
The support and encouragement rendered by, Newage Textile Limited Staffs and Md. Ripon Manager of Lab Section in Newage Textile Ltd. Were very vital in the completion of this project, their guidance and encouragement played a key role in the planning and completion of this project.

Finally, we express our sincere gratitude to our parents and friends for their continuous support, ideas and love during our studies.

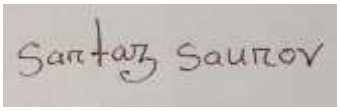
DECLARATION

We hereby declare that, this report has been done under the supervision of Tanvir Ahmed Chowdhury, Assistant professor, Department of Textile, and Daffodil International University. We also declare that neither this internship report nor any part of this internship report has been submitted elsewhere for award of any degree.

Submitted By:



Md. Masum Hossain
ID: 191-23-5533
Department of Textile Engineering
Daffodil International University



Sardar Sartaz Sourov
ID: 191-23-5539
Department of Textile Engineering
Daffodil International University

This projects report is dedicated to our beloved parents and Teachers

ABSTRACT

This report presents comparative study between medium brand color (Normal) reactive dyeing process and hot brand color (Turquoise) reactive dyeing process on cotton fabric. In this report we discuss about turquoise color dye and normal color of reactive dye for dyeing cotton fabric with some physical test. We collect required sample and data from Newage textile Ltd. Here we also comparing the color fastness to wash, color fastness to light, color fastness to rubbing, pilling test, color fastness to perspiration test of turquoise color dyed fabric and normal colored dyed fabric. We know that turquoises is a hot brand dye where normal color dyeing in lower temperature. After all our study is imperative to make a comparison between turquoise dyed fabric and normal color dyed fabric with several test.

TABLE OF CONTANTS

List of Figures

List of the Tables

Chapter 1
Introduction

1.1 Introduction

Dyeing is a process in which color is transformed to a textile material to create permanent or long lasting color. This process is done by different method. There are different types of dyes are used in textile industry for coloration of textile goods. Reactive dye one of them which is suitable for coloration of cellulosic fiber. Reactive dyes are organic colored compounds which are capable for forming covalent bond between reactive group of the dye molecule and nucleophilic group on the polymer chains within the fiber. Here dye contains a reactive group and this group creates covalent bond with the fiber polymer and act as an integral part of fiber.

There are some properties of this dyes these are as follows:

1. It has sulfonic acid group in the molecules and readily soluble in water.
2. Less substantive then direct dyes, hence more salt is required for exhaustion.
3. Dyestuff reacts and combines chemically with cellulose, so called reactive dyes.
4. Easy penetration and good leveling property.
5. Moderate to good light fastness and wash fastness properties.
6. Formation of covalent bond occurs in alkaline medium.
7. These dyes, unlike any others class of dyestuff, react of combine chemically with cellulose and this leading to excellent wash fastness.
8. These dyes give very bright shade such as orange, pink, magenta etc, which were not possible with other class of dyes.
9. They do not react with water nearly as readily as with cellulosic hydroxyl in alkaline conditions so that they can be applied from an aqueous solution.
10. Reactivity of the dyestuff can be reduced when desirable by blocking one of the reactive chlorine atoms giving H-type procions.

Reactive dyes are classified in these ways:

1. On the basis of reactive group
2. On the basis of reactivity

Due to different types of classification dye affinity and fastness of the dye to fiber show different characteristic. Turquoise dye is a hot brand reactive dye which have low affinity and less fastness properties then cold brand reactive dyes. In hot brand dyes high temperature around 70 to 90^{o} is required where cold brand and medium brand are required low temperature.

1.1 Objectives

●To know about hot brand reactive dyes and its brand and classifications.
●To know about the Turquoise color.
●To know the properties of turquoise color.
●To know the dyeing process of turquoise dyes and normal dyes.
●To know the washing, light, rubbing fastness, pilling and perspiration test properties of turquoise and normal reactive color dyes.
●To make the comparison between turquoise (hot brand) and normal (medium brand) color reactive dyes.

1.2 Limitations

●It was not possible to collect all data from dyeing section because of factory limitations.
●It has taken much time to collect data list from employees because they were too much busy for obtaining required production in time.

Chapter 2
Literature Review

2.1 Type of Thesis

Experimental Studies

2.2 Turquoise color

This type of dyes contain low reactivity reactive group. So high temperature is required for dyeing. Turquoise is a color composed of green and blue. Due to low reactivity towards fibers dyeing is carried out at the temperature between 70 to 90^{o} C. These types of dye also require strong alkaline medium the range of p^{H} is around 10.5 – 11.

Example: PROCION H, CIBACRON.

Figure 2.1: Turquoise Color fabric

Turquoise color is obtaining from hot brand reactive dye. These dyes having lower reactivity towards cotton fiber.

Turquoise color mainly invented from reactive dye dyeing system. It is generally hot brand dye and the dyeing process or obtaining process is slightly complex then reactive dye normal color dyeing process. It is mostly produced by 70% blue and 30% green.

Turquoise is sometimes described as a mixture of green color and blue color. It is a mediocre shade of blue green combination.

Normal (medium brand) color Reactive dyes

According to the reactivity of reactive dyes medium brand dyes contains reactive group of high reactivity. So dyeing is done in low temperature. These dyes have good fastness properties and suitable for application on all dyeing process. The dying temperature is around 35 to 60^{o} C.

Example: PROCION M, LIVAFIX E.

Figure 2.2: Normal color Dye

2.3 Turquoise Dyestuff

It is one of the most popular color in present day. Dyeing in turquoise color is very critical. Because of poor washing fastness properties of turquoise dyestuff. Dyeing procedure of turquoise color is slightly different from others dyeing.

2.4 Turquoise Variations

1. Celeste
2. Light Turquoise
3. Turquoise blue
4. Medium Turquoise
5. Dark turquoise

2.4.1 Celeste/Gray Blue

The color Grey blue/celeste is also known as sky bluish Turquoise

Figure 2.3: Grey Blue/Celeste

2.4.2 Light Turquoise

Light turquoise is a lighter tone of turquoise.

Figure 2.4: Light turquoise

2.4.3 Turquoise blue

In 1900, the first turquoise blue was named as color and colored was used in that time firstly.

Figure 2.5: Turquoise blue

2.4.4 Medium turquoise

Figure 2.6: Medium turquoise

2.4.5 Dark turquoise

Figure 2.7: Dark turquoise

2.5 Some turquoise example with features

Turquoise color commonly used in our country. So, some of turquoise dye with its features are mention below:

1. Direct Turquoise Blue
2. Reactive turquoise Blue 21
3. Reactive turquoise Blue H5G

2.5.1 Direct Turquoise Blue

Direct Turquoise Blue is used in different textile factories for coloration.
Features,

- ●Precisely formulated
- ●High solubility
- ●Excellent coloring nature

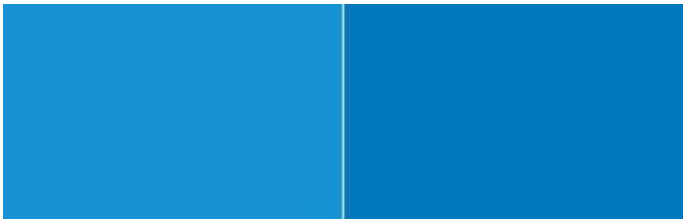


Figure 2.8: Direct Turquoise blue

2.5.2 Reactive turquoise blue 21

Reactive turquoise blue 21 is a chemical dye that is used for dyed materials like cotton, wool, silk and others polyamide textiles.

Features of these dye,

- ●Odorless
- ●Electrolyte stability is in optimum situation
- ●Nonflammable & non hazards
- ●Water soluble

Figure 2.9: Reactive turquoise blue 21

2.5.3 Reactive turquoise blue H5G

Used in textile industries for dyeing linen, cotton, silk and other fibers. It has excellent fastness properties.

Features of this dye,

- ●Excellent solubility
- ●Optimum colorfastness
- ●Suitable for various shade

Application area,

- ●Dyeing
- ●Printing

Figure 2.10: Reactive turquoise H5G

2.6 Dyeing of turquoise various shade

Dyeing of turquoise color is slightly complex than normal color dyeing. Turquoise color dyeing is mainly used for produce a specific color.

Turquoise color has mainly 3 shade namely

- Light shade
- Medium shade
- Dark shade

2.7 Review of the previous studies

There are many researches have been done previously related to turquoise reactive dye. A researches paper- Coloration technique of turquoise tints with in depth analysis on shade, utility consumption and physic chemical properties concerning batches of identical hue, by Shamim al Azad, Hradam Deb, Md. Abdul Mueeid Alam published in February 2, 2017 which is related to turquoise coloration on knit fabric and the development of shade. Here discussed about the color fastness to wash and rubbing fastness of turquoise color.

There has no journal report made based on comparison of turquoise dyes and normal reactive color dyes. But having few journal and book published on based on reactive dyes and turquoise dyeing process.

Chapter 3
Experimental Details

3.1 Equipment List

- ●Beaker
- ●Digital balance
- ●Glass rod
- ●Droppers
- ●Pipette
- ●pot
- ●pot stand
- ●Scissor
- ●Graduated Cylinder
- ●Conical Flask
- ●P^H meter
- ●Crock meter
- ●Crock cloth
- ●Light Box
- ●Gray scales
- ●Multi-fiber
- ●Sample Dyeing machine
- ●Dryer machine
- ●Rota wash machine
- ●Washing machine
- ●Pilling machine
- ●Both-side tap
- ●Light fastness Tester
- ●Spectrophotometer

Textile Materials

We have done all of our experiments by using only one type of textile fabric which is a Rib 2x2 knitted fabric. We collected those fabric from lab section during our internship period.

3.2 Experimental Procedure

Our experimental project based on two different shade percentage of turquoise dyes and normal cold brand dyes which for light and medium shade. Our experimental is about different of Dyeing process and its physical tests between Turquoise and normal reactive dyes. So we first collect 10g sample of Rib 2x2 fabric then we complete dyeing. After dyeing and finishing this fabric, we take different physical test.

3.3 Basic difference between Turquoise dye & Normal reactive dye.

Table 3.1 difference between turquoise dye & normal reactive dye

Sl.no.	Turquoise dyeing	Normal Reactive dyeing
Process	Slightly complex than any other dyeing	More easier then turquoise dyeing
Cost	Comparatively cheap	Comparatively higher then turquoise
Dyeing temp.	High Temperature 70-90^{o}C	Low temperature around 35-60^{o}C
Reactivity	Lower	Higher
Fastness properties	good	Comparatively less
Affinity	Turquoise dye has less affinity but quality of dye and company play an important role for good dye fastness	Good affinity then turquoise

3.4 Turquoise color dyeing process

3.4.1 Recipe

Color name- Angel Blue

Table 3.2 Recipe of turquoise dyeing color (angel blue)

Process parameter	Unit	Stock solution %	Recipe amount	Dossing
Eva. Yellow 3GL	%(owf)	0.01 %	0.0008% (owf)	0.8 ml
Eva. Tur. Blue G	%(owf)	0.5 %	0.194% (owf)	3.88 ml
Dri-Blue HFRL	%(owf)	0.5 %	0.074% (owf)	1.48 ml
Glauber salt	g/L		20	1.4g
Soda	ml/L	10%	3	3 ml
P^H				11-12
Temperature	^oC			90^oC
Time	Minute			120-150
M:L				1:7
Fabric type				Rib 2x2 (knitted)
Sample Weight	g/kg			10g

3.4.2 Calculation

Dye calculation,

$$\frac{\text{Recipe amount x Fabric wet}}{\text{Stock solution \%}}$$

$$= \frac{0.0008 \times 10}{0.01}$$

$$= \frac{0.008}{0.01}$$

$$= 0.8 \text{ ml}$$

Again,

$$= \frac{0.194 \times 10}{0.5}$$

$$= 3.88 \text{ ml}$$

Again,

$$= \frac{0.074 \times 10}{0.5}$$

$$= 1.48 \text{ ml}$$

Total dyestuff we taken,

0.8 + 3.88 + 1.48 = 6.16 ml

Salt-soda,

20/3 (we take this amount of salt soda from turquoise dyes recommended chart)

Soda calculation,

$$= \frac{\text{Recipe amount x fabric wet}}{\text{Stock solution \%}}$$

$$= \frac{3 \times 10}{10}$$

= 3 ml

Salt calculation,

Without stock solution,

$$= \frac{\text{Recipe amount x ratio of liquor x fabric weight}}{1000}$$

$$= \frac{20 \times 7 \times 10}{1000}$$

= 1.4 g

Total fresh water we take,

Total dyestuff + soda – (Liquor ratio x Fabric weight)

= 6.16 + 3 – (7 x 10)

= 60.84

= 61 ml

3.4.3 Flowchart of Turquoise dyeing

Sample cutting (grey fabric)
↓
Sample weight
↓
Pipetting
↓
Salt added
↓
Fabric added
↓
Machine loading
↓
Run for 30 minutes 80^{o}C
↓
Temperature down 40^{o}C
↓
Unload sample
↓
Soda added
↓
Loading and Run for 1 hour at 80^{o}C

↓

Unload and 2% soap solution added

↓

Run for 30 minutes 90^{o}C

↓

Washing with cold water

↓

Squeeze by hand and Dry

Table 3.3: Process Flow-chart of Turquoise dyeing

Figure 3.11: Turquoise color sample

3.5 Normal color Dyeing Process

3.5.1 Recipe

Color name: Comprlile (pp)

Table 3.4 Recipe for normal color reactive dye

Process Parameter	Unit	Stock solution%	Recipe amount	Dossing
Nova Ruby S3R	% (owf)	0.01%	0.0008% (owf)	0.8 ml
Nova Ocean SR	% (owf)	0.5%	0.194% (owf)	3.88 ml
Re. Blue RR	% (owf)	0.5%	0.074% (owf)	1.48 ml
Glauber Salt	g/L			2.8 g
Soda	ml/L	10%	10	10 ml
P^H				11-12
Temperature	^oC			60^o
Time	Minute			120-150
M:L				1:7
Fabric type				Rib 2x2 (knitted)
Fabric weight	g/kg			10 g

3.5.2 Calculation

Dye Calculation

$$= \frac{\text{Recipe amount x fabric weight}}{\text{Stock solution\%}}$$

$$= \frac{0.0008 \times 10}{0.01}$$

$$= 0.8 \text{ ml}$$

Again,

$$= \frac{0.194 \times 10}{0.5}$$

$$= 3.88 \text{ ml}$$

Again,

$$= \frac{0.074 \times 10}{0.5}$$

$$= 1.48 \text{ ml}$$

Total dyestuff we taken,

$$0.8 + 3.88 + 1.48 = 6.16 \text{ ml}$$

Salt-Soda,

40/10 (we take this amount of salt soda from normal reactive dyes recommended chart)

Soda calculation,

$$= \frac{\text{Recipe amount} \times \text{fabric weight}}{\text{Stock solution\%}}$$

$$= \frac{10 \times 10}{10}$$

$$= 10 \text{ ml}$$

Salt calculation,
Without stock solution,

$$= \frac{\text{Recipe amount} \times \text{ratio of liquor} \times \text{fabric weight}}{1000}$$

$$= \frac{40 \times 7 \times 10}{1000}$$

$$= 2.8 \text{ g}$$

Total fresh water we take,

$$\text{Total dyestuff + soda} - (\text{ratio of liquor} \times \text{fabric weight})$$

$$= 6.16 + 10 - (7 \times 10)$$

$$= 53.84$$

$$= 54 \text{ ml}$$

3.5.3 Flowchart of normal color dyeing

Sample cutting (grey fabric)
↓
Sample weight
↓
Pipetting
↓
Salt added
↓
Fabric added
↓
Machine loading
↓
Run for 30 minutes 60^{o}C
↓
Temperature down 40^{o}C
↓
Unload sample
↓
Soda added
↓
Loading and Run for 1 hour at 60^{o}C
↓
Unload and 1% soap solution added
↓
Run for 30 minutes 90^{o}C
↓
Washing with cold water
↓
Squeeze by hand and Dry

Table 3.5: Process Flow-chart of Normal color dyeing

Figure 3.12: Normal Reactive color sample

3.6 Testing of color fastness to Wash

3.6.1 Recipe

ISO-105-C06: 2010.

C_2S Method.

Process Parameter	Unit	Stock solution%	Recipe amount	Dossing
Detergent	g/L	1%	4	20ml
Sodium Perborate	g/L	1%	1	5ml
Steel ball				10
M:L				1:50
Temperature	^oC			60^oC
Time	minute			30

Table 3.6 Recipe for Color fastness to wash

3.6.2 Calculation

Detergent calculation,

$$= \frac{\text{Total liquor} \times \text{Recipe amount}}{\text{Stock solution\%} \times 1000}$$

$$= \frac{50 \times 4}{1\% \times 1000}$$

$$= 20 \text{ ml}$$

Sodium perborate calculation,

$$= \frac{\text{Total liquor} \times \text{Recipe amount}}{\text{Stock solution\%} \times 1000}$$

$$= \frac{50 \times 1}{1\% \times 1000}$$

$$= 5 \text{ ml}$$

Total fresh water we take,

$$= \text{Total Chemical} - (\text{ratio of liquor} \times \text{fabric weight})$$

$$= (20 + 5) - (50 \times 2.571)$$

$$= 25 - 128.55$$

$$= 103.55$$

$$= 104 \text{ ml}$$

3.6.3 Process flow-chart

Sample is collect from dyed sample
↓
Sample and multi-fiber fabric cutting (10 cm x 4 cm)
↓
Sewing both multi-fiber
↓
Test specimen together
↓
Machine loading (Rota wash)
↓
Washed for 30 minutes at 60˚C
↓
Cooing 40^{o}C
↓
Squeezing the sample
↓
Drying
↓
Broken down the stitch and measuring the color change and color staining by grey scale

Table 3.7: Process flowchart of color fastness to wash

3.6.4 Process curve

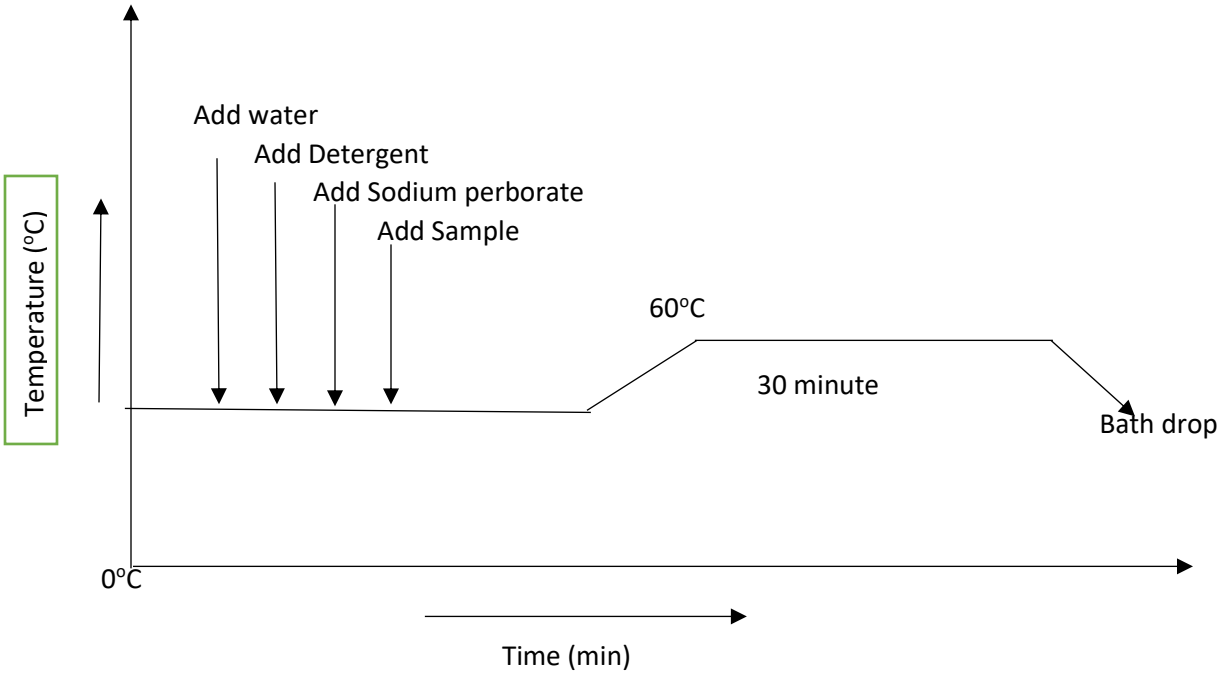


Figure 3.13: Washing Fastness process curved

3.7 Testing of Color Fastness to rubbing

Rubbing Fastness are done by using,

- Dry rub
- Wet rub

3.7.1 Testing procedure

Test specimen 15cm x 5cm is placed on the base of the Crock meter.

↓

White test cloth (5cm x 5cm) without finished cotton fabric is taken.

↓

White test cloth is attached to the finger of the crock meter.

↓

Rubbing is done to and fro, 10 cycles at 10seconds and finger pressure on the specimen is 9N.

↓

Rubbing test is done both for warp way and weft way.

↓

Dry and wet rubbing test, separate sample is used.

↓

For wet rubbing, the sample is dry but crocking cloth is wet. And grade 3 water is used.

Table 3.8: Process flowchart of color fastness to rubbing.

3.7.2 Assessment Technique,

- Place the rubbing cloth in the light box (D65 light) at an incline plane.
- Evaluate the staining using the grey scale. Three unstained rubbing cloths should be placed under the rubbing cloth that is evaluated.
- Carefully remove loose fibers on the rubbing cloth's surface before evaluation.
- The result is the grey scale rating closest to the staining of the rubbing cloth.
- Any dark circle formed around the test area should be discarded.

Figure 3.14: Crock Meter (left) and Light box (right)

3.8 Color fastness to light (in house Method)

To determine the colorfastness and degradation due to the effects of sunlight on textiles.

3.8.1 Testing Procedure

Test sample 10.5cm x 1.5cm is placed on the base on the testing tubes.

↓

Oba free-card (10.5cm x 1.5cm) which is same of the sample

↓

Oba free-card is attached to the sample by staple

↓

Set sample to the tester

↓

Run and check every 8 hours

↓

Sample change grade 5 to grade 4

↓

Process are done.

Table 3.9: Process flowchart of color fastness to light.

3.8.2 Assessment Technique

●The tested sample compared with untested sample under light box using UV light and D65 light source.
●Then test the sample with color change grey scale.
●Now grading the sample.

Figure 3.15: Color fastness to light (in house Method)

3.9 Pilling test

ISO-12945:2000

3.9.1 Equipment list

●Template
●Hole cylinder

●Mounting jack
●Poly uterine tube
●PVC tap
●Pilling swing machine
●Pilling machine
●Pilling assessment viewer

3.9.2 Testing Procedure

●First we do 4 hours conditioning the sample.
●Total 4 sample we have test, 2 length wise and 2 weight wise.
●Sample cutting with template both (length and weight) 125mm x 125mm.
●The samples are then folded face to face and a seam is sewn on the marked line.
●Each specimen is turned inside out and 6mm cut off each end of it thus removing any sewing distortion.
●The fabric tubes made are then mounted on rubber tubes so that the length of tube showing at each end is the same. Each of the loose ends is taped with PVC tape so that 6mm of the rubber tube is left exposed.
●All four specimens are then placed in one pilling box.
●The samples are then tumbled together in a cork-lined box.
●The usual number of revolutions used in the test is 14,400 cycle which speed 60 RPM.

Figure 3.16: Pilling machine

3.9.3 Assessment Technique

- The specimens are removed from the tubes and viewed using Pilling assessment viewer.
- The samples are then given a rating of between 1 and 5.

3.10 Color fastness to Perspiration

The color fastness to perspiration (acid and alkaline) refers to the ability not to fade and not to stain when the dyed fabric is perspired.

ISO-105-E04:2008

3.10.1 Equipment

- Sample fabric
- Multi-fiber
- Per-spirometer
- Acrylic plate
- Digital balance
- Beaker
- P^H Meter
- Agitator
- Oven
- Dryer
- Grey scale

3.10.2 Chemical used in perspiration test

Acid for male- I – Distilled water grade 3.
Ii - L-Histidine mono-hydrochloride monohydrate.
Iii – Sodium chloride.
Iv– Sodium dihydrogen phosphate.
V – Sodium hydroxide.

3.10.3 Recipe

For Acid,

Table 3.10: Recipe of color fastness to Perspiration (Acid).

Process parameter	Unit	Recipe Amount
L-Histidine mono-hydrochloride monohydrate.	g/L	0.5
Sodium chloride.	g/L	5.0
Sodium dihydrogen phosphate.	g/L	2.2
Distilled water	L	1.0
P^H		5.5
Temperature	^oC	37
M:L		1:50
Time	Minute	4 hours 30 minute
Sample size	cm	10 x 4

3.10.4 Calculation

Total Liquor we take,

Fabric weight x 50

= 1.980 x 50

= 99 ml

For alkali,

Table 3.11: Recipe of color fastness to Perspiration (Alkali).

Process parameter	Unit	Recipe Amount
L-Histidine mono-hydrochloride monohydrate.	g/L	0.5
Sodium chloride.	g/L	5.0
Di-Sodium dihydrogen phosphate.	g/L	2.5
Distilled water	L	1.0
P^H		8
Temperature	^oC	37
M:L		1:50
Time	Minute	4 hours 30 minute
Sample size	cm	10 x 4

Calculation

Total Liquor we take,

Fabric weight x 50

= 1.980 x 50

= 99 ml

3.10.5 Flowchart of color fastness to Perspiration.

Sample and multi-fiber cutting (10cm x 4cm)

↓

Attach sample and multi-fiber by sewing with thread

↓

One Ltr solution making with all chemicals

↓

Control the P^H (5.5 for acid and 8 for alkali) acid solution by NaOH

↓

Weight sample and calculation

↓

Wet the sample with solution at M:L=1:50 (Rest sample with solution for 30 minute)

↓

Again weight the sample (Pickup Percentage: 2.0-2.5 times)

↓

Set the sample in per-spirometer

↓

Place the sample on the surface of between acrylic-plate

↓

Now apply a weight of 12.5 kpa for ISO method and lock the screw

↓

Put it inside of oven at 37^{o}C for 4 hours

↓

Unload and unlock the sample and dried 45-50^{o}C

↓

After dried the sample color staining and change grade by grey scale

Table 3.12: Flowchart of color fastness to Perspiration.

Chapter 4
Discussion of Result

4.1.1 Result of Turquoise color fastness to wash

Figure 4.17: Result of turquoise multi-fiber color fastness to wash

Table 4.13: Result of turquoise multi-fiber color fastness to wash

Acetate	Cotton	Nylon	Polyester	acrylic	Wool
4-5	4-5	4-5	4-5	4-5	4-5

Grading for color change: 4-5

4.1.2 Result of Turquoise color fastness to rubbing

Figure 4.18: Result of turquoise color fastness to Rubbing

Grading for wet: 4-5 and
Grading for dry: 4-5

4.1.3 Result of Turquoise Color fastness to light (in house method)

Figure 4.19: Result of turquoise color fastness to light

Grading for color change: 4-5

4.1.4 Result of Turquoise pilling test

Figure 4.20: Result of turquoise pilling test

Grading for pilling: 4-5
Revolution: 14,400

4.1.5 Result of Turquoise Color fastness to Perspiration

Figure 4.21: Result of Turquoise multi-fiber color fastness to perspiration

For alkali,

Table 4.14: Result of Turquoise multi-fiber color fastness to perspiration (Alkali)

Acetate	cotton	nylon	polyester	acrylic	wool
4-5	4-5	4-5	4-5	4-5	4-5

Grading for color change and staining: 4-5

For Acid,

Table 4.15: Result of Turquoise multi-fiber color fastness to perspiration for (Acid)

Acetate	cotton	nylon	polyester	acrylic	wool
4-5	4-5	4-5	4-5	4-5	4-5

Grading for color change and staining: 4-5

4.2.1 Result of Normal reactive color fastness to wash

Figure 4.22: Result of Normal multi-fiber color fastness to Wash

Table 4.16: Result of Normal multi-fiber color fastness to Wash

Acetate	cotton	nylon	polyester	acrylic	wool
4-5	4-5	4-5	4-5	4-5	4-5

Grading for color change and staining: 4-5

4.2.2 Result of Normal reactive color fastness to rubbing

Figure 4.23: Result of Normal multi-fiber color fastness to Rubbing

Table 4.17: Result of Normal multi-fiber color fastness to Rubbing

Dry Rub	Wet Rub
4-5	4-5

4.2.3 Result of normal reactive color fastness to light (in house method)

Figure 4.24: Result of Normal color fastness to Light

Grading for color change: 4-5

4.2.4 Result of normal reactive pilling test

Figure 4.25: Result of Normal color Pilling test

Grading for pilling: 4-5

Revolution: 14,400

4.2.5 Result of normal reactive color fastness to Perspiration

Figure 4.26: Result of Normal multi-fiber color fastness to Perspiration

For Alkali,

Table 4.18: Result of Normal multi-fiber color fastness to Perspiration (Alkali)

Acetate	cotton	nylon	polyester	acrylic	wool
4-5	4-5	4-5	4-5	4-5	4-5

Grading for Perspiration (Alkali): 4-5

For Acid,

Table 4.19: Result of Normal multi-fiber color fastness to Perspiration (Acid)

Acetate	cotton	nylon	polyester	acrylic	wool
4-5	4-5	4-5	4-5	4-5	4-5

Grading for Perspiration (Acid): 4-5

4.3 Compare of the result between Reactive normal color and Turquoise color.

Table 4.20: Compare of color fastness to Wash.

Acetate		Cotton		Nylon	
Tur. Reactive	Nor. Reactive	Tur. Reactive	Nor. Reactive	Tur. Reactive	Nor. Reactive
4-5	4-5	4-5	4-5	4-5	4-5
Polyester		Acrylic		Wool	
Tur. Reactive	Nor. Reactive	Tur. Reactive	Nor. Reactive	Tur. Reactive	Nor. Reactive
4-5	4-5	4-5	4-5	4-5	4-5

For color fastness to wash test, we have seen both sample are same result which is 4-5 grading.

Table 4.21: Compare of color fastness to Rubbing.

Wet Rub		Dry Rub	
Tur. Reactive	Nor. Reactive	Tur. Reactive	Nor. Reactive
4-5	4-5	4-5	4-5

For color fastness to rubbing test, we have seen both sample are same result which is 4-5 grading.

Table 4.22: Compare of color fastness to Light.

Turquoise	In House Method
Grade	4-5
Normal Reactive	In House Method
Grade	4-5

For color fastness to rubbing test, we have seen both sample are same result which is 4-5 grading.

Table 4.23: Compare of Pilling test.

Turquoise	ISO12945:2000
Grade	4-5
Normal Reactive	ISO12945:2000
Grade	4-5

For color fastness to rubbing test, we have seen both sample are same result which is 4-5 grading.

Table 4.24: Compare of color fastness to Perspiration for (Alkali).

Acetate		Cotton		Nylon	
Tur. Reactive	Nor. Reactive	Tur. Reactive	Nor. Reactive	Tur. Reactive	Nor. Reactive
4-5	4-5	4-5	4-5	4-5	4-5
Polyester		Acrylic		Wool	
Tur. Reactive	Nor. Reactive	Tur. Reactive	Nor. Reactive	Tur. Reactive	Nor. Reactive
4-5	4-5	4-5	4-5	4-5	4-5

For color fastness to perspiration test (Alkali), we have seen both sample are same result which is 4-5 grading.

Table 4.25: Compare of color fastness to Perspiration for (Acid).

Acetate		Cotton		Nylon	
Tur. Reactive	Nor. Reactive	Tur. Reactive	Nor. Reactive	Tur. Reactive	Nor. Reactive
4-5	4-5	4-5	4-5	4-5	4-5
Polyester		Acrylic		Wool	
Tur. Reactive	Nor. Reactive	Tur. Reactive	Nor. Reactive	Tur. Reactive	Nor. Reactive
4-5	4-5	4-5	4-5	4-5	4-5

For color fastness to perspiration test (Acid), we have seen both sample are same result which is 4-5 grading.

4.4 Approval for test result from QC and Lab Manager

For Turquoise Lab Test Report 1,

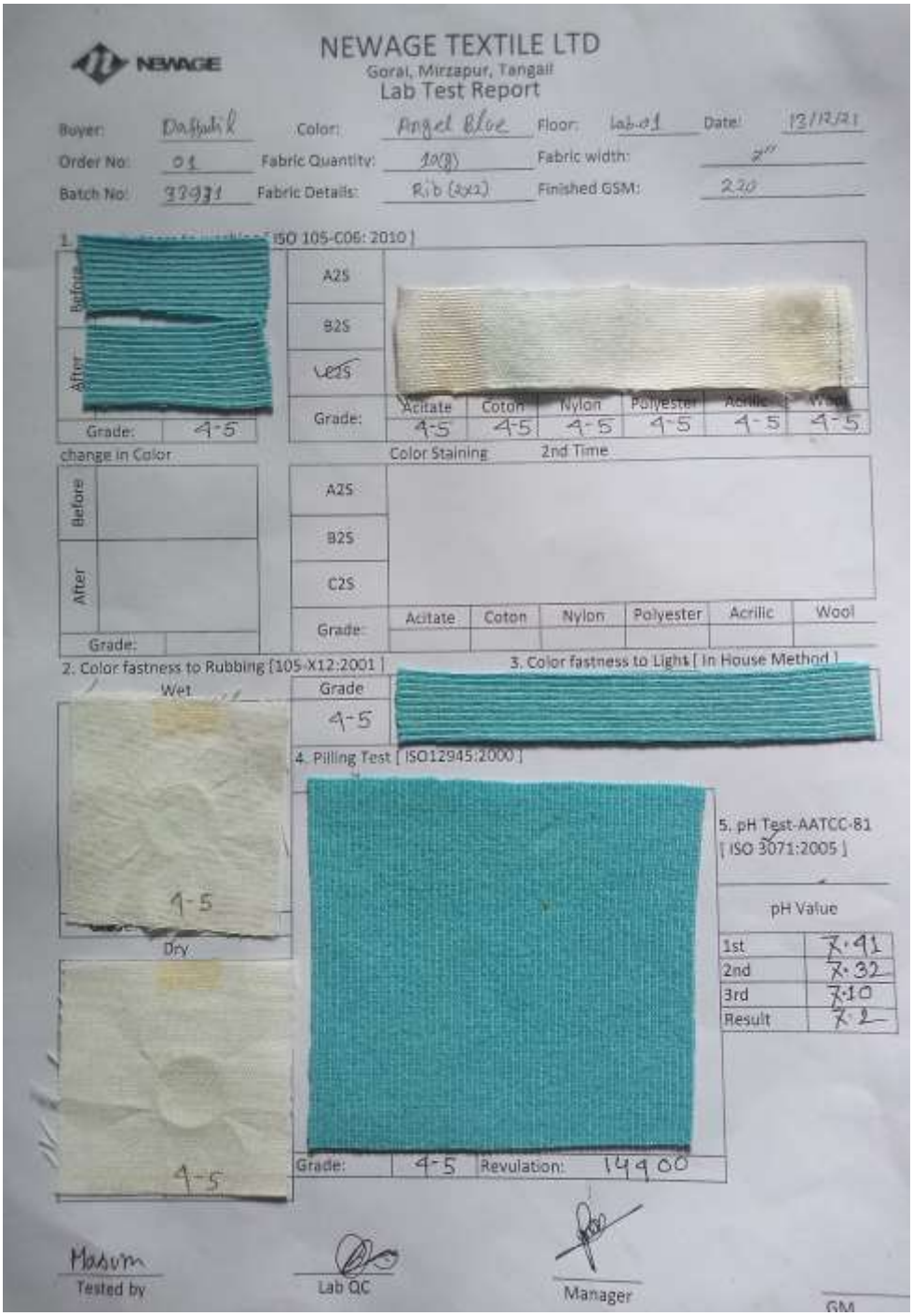
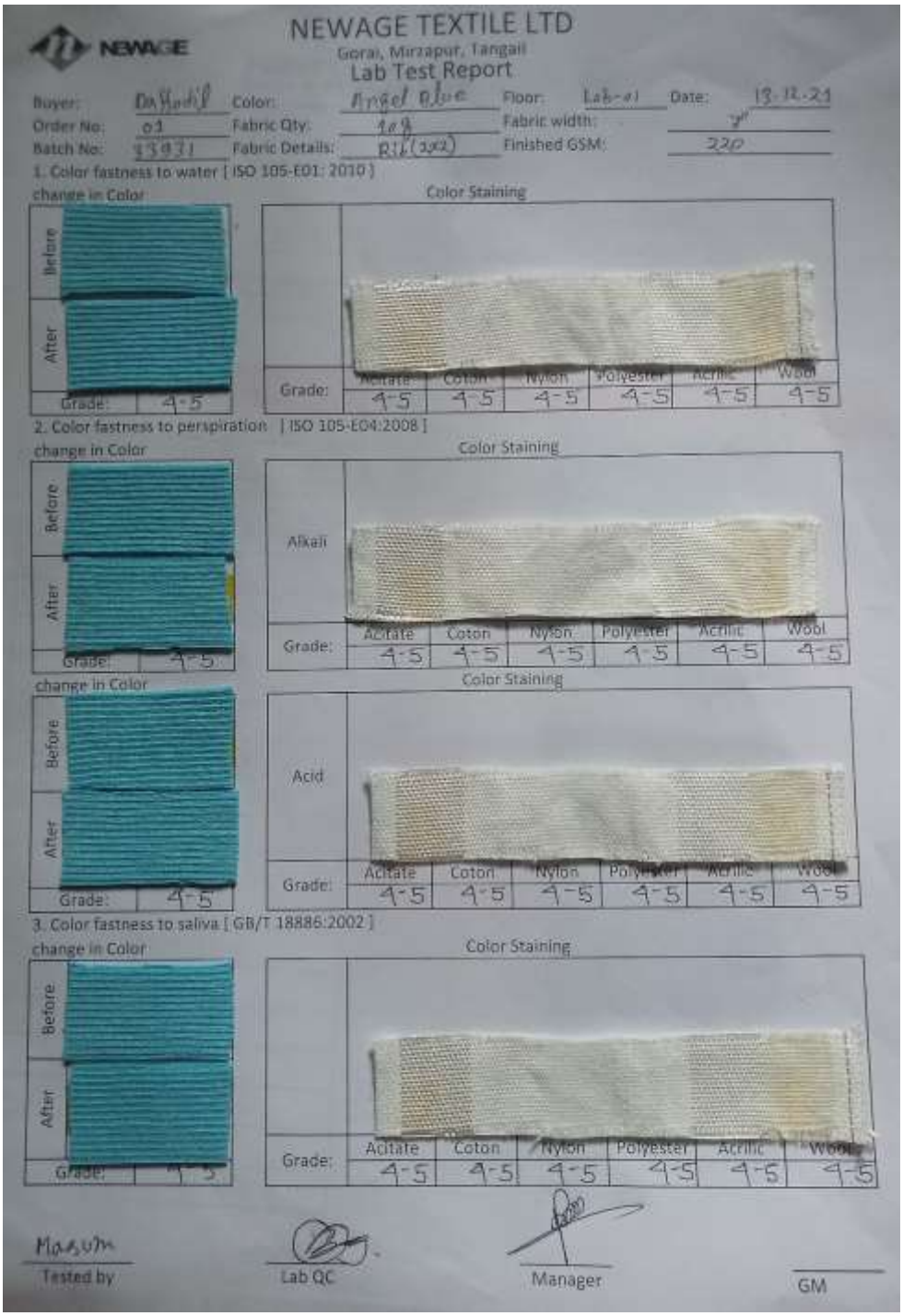


Figure 4.27: Turquoise Lab Test Report 1

For Turquoise Lab Test Report 2,



NEWAGE TEXTILE LTD

Goraj, Mirzapur, Tangail

Lab Test Report

Buyer: Daffodil | Color: Angel Blue | Floor: Lab-01 | Date: 13.12.21

Order No: 01 | Fabric Qty: 109 | Fabric width: 3"

Batch No: 13971 | Fabric Details: RIB(2x2) | Finished GSM: 220

1. Color fastness to water [ISO 105-E01: 2010]

change in Color: Before / After — Grade: 4-5

Color Staining

Grade:	Acetate	Coton	Nylon	Polyester	Acrilic	Wool
	4-5	4-5	4-5	4-5	4-5	4-5

2. Color fastness to perspiration [ISO 105-E04:2008]

change in Color: Before / After — Grade: 4-5

Color Staining — Alkali

Grade:	Acetate	Coton	Nylon	Polyester	Acrilic	Wool
	4-5	4-5	4-5	4-5	4-5	4-5

change in Color: Before / After — Grade: 4-5

Color Staining — Acid

Grade:	Acetate	Coton	Nylon	Polyester	Acrilic	Wool
	4-5	4-5	4-5	4-5	4-5	4-5

3. Color fastness to saliva [GB/T 18886:2002]

change in Color: Before / After — Grade: 4-5

Color Staining

Grade:	Acetate	Coton	Nylon	Polyester	Acrilic	Wool
	4-5	4-5	4-5	4-5	4-5	4-5

Masum — Tested by | Lab QC | Manager | GM

Figure 4.28: Turquoise Lab Test Report 2

For Normal Reactive Lab Test Report 3,

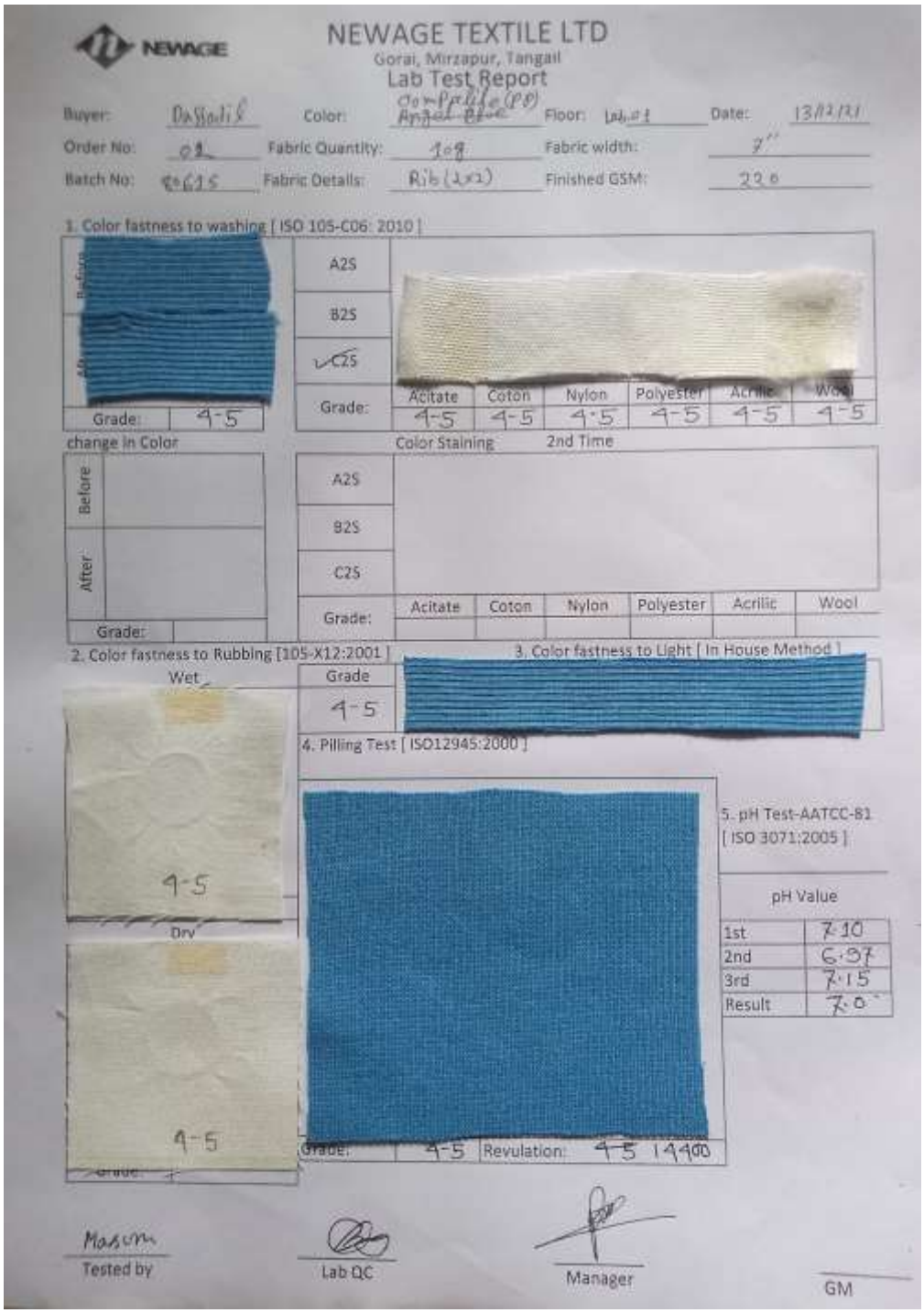
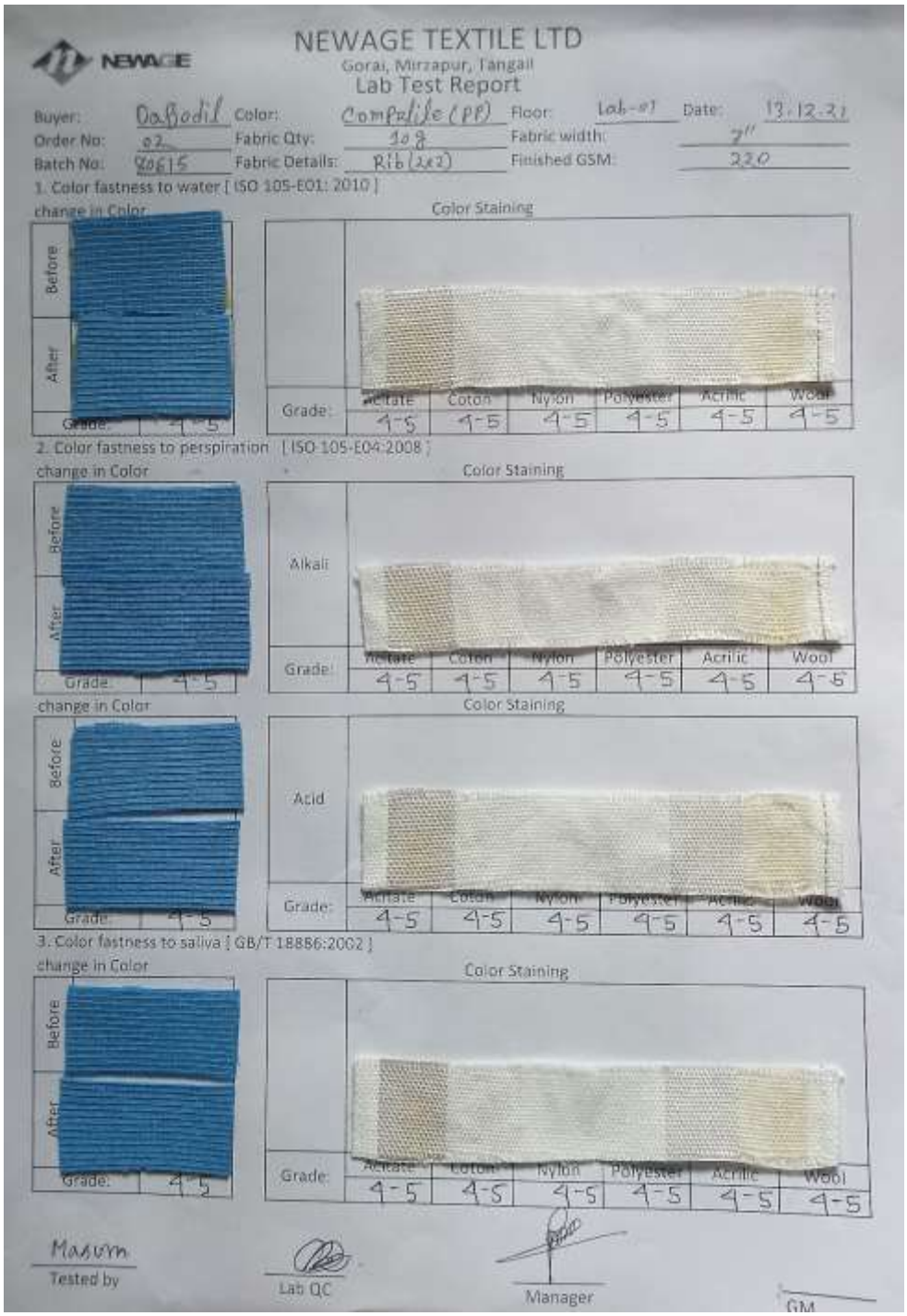


Figure 4.29: Normal Reactive Lab Test Report 3

For Normal Reactive Lab Test Report 4,



NEWAGE TEXTILE LTD

Gorai, Mirzapur, Tangail

Lab Test Report

Buyer: DaBodil Color: Compzlife (PP) Floor: Lab-01 Date: 13.12.21

Order No: 02 Fabric Qty: 10 g Fabric width: 7"

Batch No: 20615 Fabric Details: Rib (2x2) Finished GSM: 220

1. Color fastness to water [ISO 105-E01: 2010]

change in Color

Color Staining

	Acetate	Cotton	Nylon	Polyester	Acrilic	Wool
Grade:	4-5	4-5	4-5	4-5	4-5	4-5

2. Color fastness to perspiration [ISO 105-E04:2008]

change in Color

Color Staining

	Acetate	Cotton	Nylon	Polyester	Acrilic	Wool
Alkali Grade:	4-5	4-5	4-5	4-5	4-5	4-5

change in Color

Color Staining

	Acetate	Cotton	Nylon	Polyester	Acrilic	Wool
Acid Grade:	4-5	4-5	4-5	4-5	4-5	4-5

3. Color fastness to saliva [GB/T 18886:2002]

change in Color

Color Staining

	Acetate	Cotton	Nylon	Polyester	Acrilic	Wool
Grade:	4-5	4-5	4-5	4-5	4-5	4-5

Masum

Tested by

Lab QC

Manager

GM

Figure 4.30: Normal Reactive Lab Test Report 4

4.5 Result of Spectrophotometer

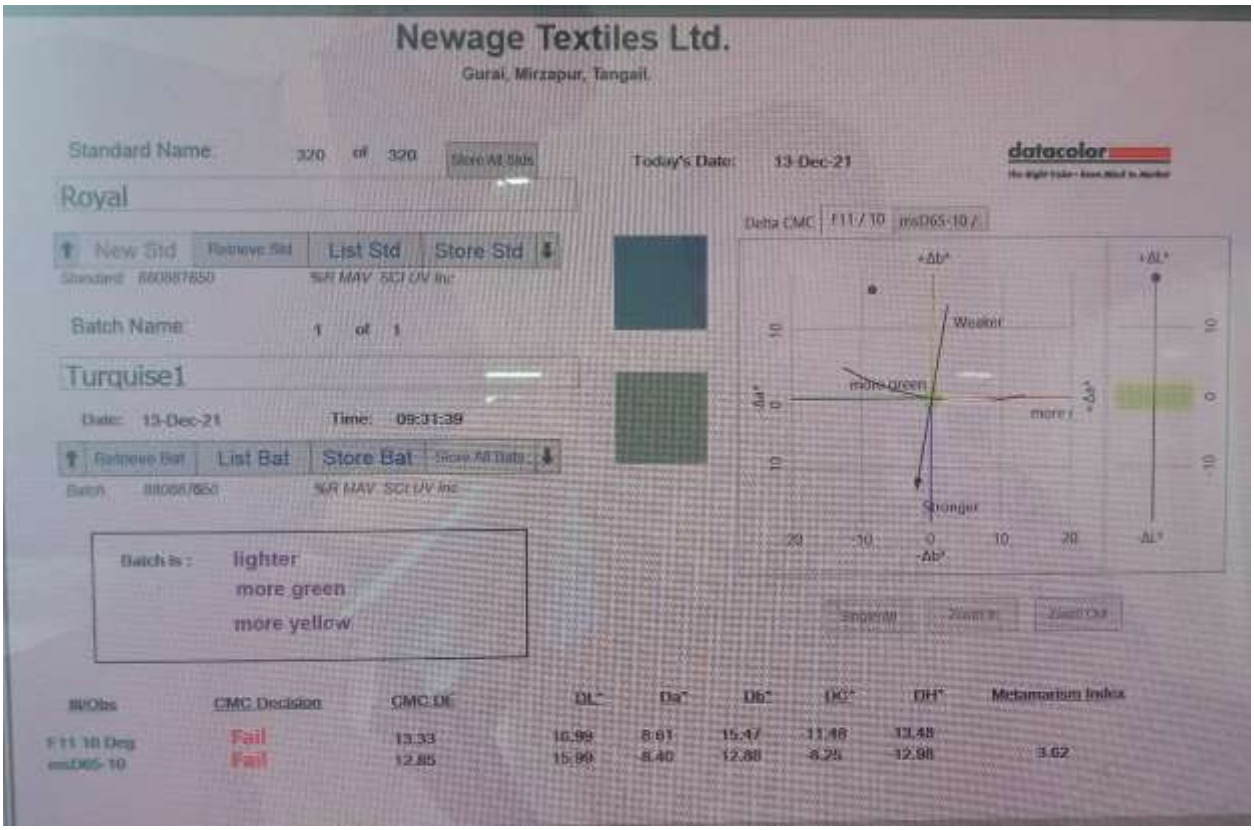


Figure 4.31: Spectrophotometer result

CMC-(Color measurement committee) Test generally done for identify the difference between standard swatch and dyeing fabric (sample).

Sometimes it is difficult to identify the fabric tone, depth, metamerism with our eyes for this reason we make a test using spectrophotometer taking our production shade and standard swatch for easy understanding. This is called CMC test.

Functions of Spectrophotometer,

1. Color difference.
2. Pass/Fall analysis
3. Fastness rating
4. Metamerism
5. Shade library
6. Cost comparison
7. Color match production

8. Reflectance curve

Compare with Standard swatch (Normal Reactive color) and Batch swatch (Turquoise color)

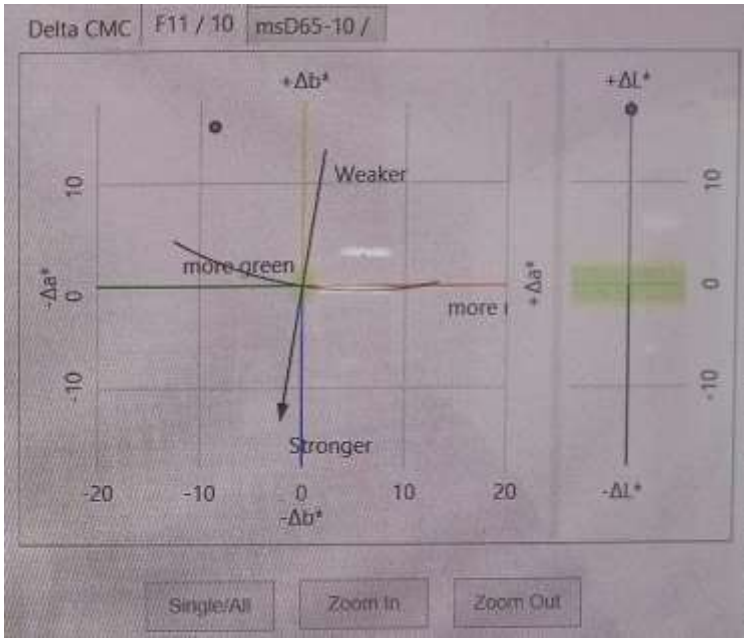


Figure 4.51: Spectrophotometer curve

In this test we use F11 and msD65 Light source.

DE-(color difference) Range = 0 to 0.75 Pass
= 0.75 to 1 commercially pass (warn)
= 1 to above Fail

In our test we have found F11-DE = 13.33
And D65 = 12.85 that's mean Far more then fail (**Shade not ok)**.

DL- (Difference in lightness/Darkness value)
+ = Lighter and - = Darker
In our test we have found F11 = 16.99 x 10 = 169.9% lighter
And D65 = 15.99 x 10 = 159.9% lighter

Da- (Difference on Red/Green axis)
+ = Redder and - = Greener
In our test we have found F11 = -8.61 x 10 = -86.1% greenish
And D65 = -8.40 x 10 = -84% greenish

Db- (Difference on yellow/blue axis)

+ = yellower and - = bluer

In our test we have found F11 = 15.47 x 10 = 154.7% yellowish

And D65 = 12.88 x 10 = 128.8% yellowish

Dc- (Difference in Chroma)

+ = brighter and - = duller

In our test we have found F11 = -11.48 x 10 = -114.8% duller

And D65 = -8.25 x 10 = -82.5% duller

DH- (Difference in Hue)

Our two sample Difference in F11 light source = -13.48 x 10 = -134.8%

And D65 = -12.98 x 10 = -129.8%

Metamerism - is a phenomenon that occurs when two colors appear to match under one lighting condition, but not when the light changes.

If metamerism value Less Then0.50 = Pass/shade ok

More Then0.50 = Fail/shade no ok

In our test we have found Metamerism value = 3.62 that's mean far more then fail (**shade not ok**).

Now we can say it is not possible to match between Turquoise color and Normal Reactive color Because Turquoise color are too light tone and Normal Reactive are darker then turquoise. They have their own speciality.

Chapter 5
Conclusion

Conclusion

We know that now a day's reactive dye is the most popular dyes to dye the cellulosic fibers because of great affinity towards cellulosic fiber. By forming covalent bond reactive dye molecule linkage with fiber structure and show moderate to good fastness properties. According to the reactivity of these dye turquoise dye which is hot brand dye has less affinity than medium brand dye. So during dyeing with turquoise dye due to less affinity high temperature is required for color producing to the fabric where medium brand required less temperature than hot brand dye. This poor affinity to fiber also cause of weak color fastness properties for the fabric and for good affinity of cold brand dyes its showing better fastness properties than turquoise dye.

●For light shade both dye show almost similar fastness properties but in medium and dark shade we see the difference.

●And the other test like Fastness to Rubbing we are not found any difference between them.

●Fastness to light test we are also not found any difference.

●Pilling test, same as previous test no difference.

●fastness to Perspiration for Acid and Alkali they also shows similar fastness properties.

●In spectrophotometer test we are trying to see how far their shade and we found too much difference.

Quality of dye and company play an important role for good dye fastness. We hope that this work will be imperative and helpful for the readers and industry people to do further work with turquoise.

References

1. https://en.wikipedia.org/wiki/Turquoise_(color)

2. https://www.sciencedirect.com/topics/engineering/reactive-dye

3. https://www.productip.com/kb/productipedia/compliance-resources/colour-fastness-of-textiles

Turnitin Originality Report

Processed on: 19-Apr-2022 14:57 +06
ID: 1814361079
Word Count: 6789
Submitted: 1

Project Report of Masum By Sourov Masum

Similarity Index	Similarity by Source	
24%	Internet Sources:	19%
	Publications:	5%
	Student Papers:	15%

5% match (student papers from 13-Apr-2018)
Submitted to Daffodil International University on 2018-04-13

2% match (student papers from 17-Apr-2018)
Submitted to Daffodil International University on 2018-04-17

2% match (Internet from 07-Feb-2020)
https://www.textilemates.com/reactive-dyes/

2% match (Internet from 11-Feb-2019)
https://pt.scribd.com/document/72849145/Natural-Dyes

1% match (student papers from 09-Apr-2018)
Submitted to Daffodil International University on 2018-04-09

1% match (student papers from 10-Apr-2018)
Submitted to Daffodil International University on 2018-04-10

1% match (student papers from 13-Apr-2018)
Submitted to Daffodil International University on 2018-04-13

1% match (student papers from 04-May-2021)
Submitted to Manchester Metropolitan University on 2021-05-04

1% match (Internet from 22-Dec-2019)
http://dspace.library.daffodilvarsity.edu.bd:8080/handle/20.500.11948/3108?show=full

1% match (Internet from 07-Jun-2019)
http://diantextile.blogspot.com/2016/09/colour-fastness-to-rubbing-test-purpose.html

1% match (Internet from 06-Dec-2019)
https://diutestudents.blogspot.com/2017/01/color-fastness.html

1% match (publications)
Md. Zayedul Hasan, A. K. M. Ayatullah Hosne Asif, Abdur Razzaque, Md. Rakibul Hasan, Sudip Sur, Md. Omar Faruque. "An Experimental Investigation of Different Washing Processes on Various Properties of Stretch Denim Fabric", Journal of Materials Science and Chemical Engineering, 2021

1% match (publications)
M. Ramesh Kumar, T. Sathish Kumar, C. Prakash, M. Jayakumari. "Investigation on fastness properties of plated interlock knitted fabrics", Cleaner Engineering and Technology, 2022

< 1% match (student papers from 11-Apr-2018)
Submitted to Daffodil International University on 2018-04-11

< 1% match (student papers from 11-Apr-2018)
Submitted to Daffodil International University on 2018-04-11

< 1% match (student papers from 09-Apr-2018)
Submitted to Daffodil International University on 2018-04-09

< 1% match (student papers from 11-Apr-2018)
Submitted to Daffodil International University on 2018-04-11

< 1% match (student papers from 11-Apr-2018)
Submitted to Daffodil International University on 2018-04-11

< 1% match (Internet from 02-Apr-2021)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/20.500.11948/1515/P05957.pdf?isAllowed=y&sequence=3

< 1% match (Internet from 14-Dec-2021)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/5609/171-23-4889%20%2817_%29%20Clearence.pdf?isAllowed=y&sequence=1

< 1% match (Internet from 02-Apr-2021)
http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/5228/161-23-4604%20%2817%25%29.pdf?isAllowed=y&sequence=1

< 1% match (Internet from 19-Apr-2022)
https://www.slideshare.net/morshed15/project-report-on-study-on-the-effects-of-sanforizing-machine-on-the-properties-of-woven-fabric-by-morshed

< 1% match (Internet from 19-Apr-2022)
https://www.slideshare.net/shouravdas1/thesis-78821801

< 1% match (Internet from 09-Apr-2021)
https://www.slideshare.net/eyusufmiah/wet-processing-technology

< 1% match (Internet from 30-May-2019)
https://www.textileflowchart.com/2015/06/flow-chart-of-turquoise-dyeing-process.html

< 1% match (Internet from 02-Feb-2021)
https://www.ijser.org/research-paper-publishing-february-2017_page4.aspx

< 1% match (publications)
Gilda Santos, Rita Marques, Sofia Silva, Juliana Oliveira, Pegui Castro, Carla Pereira, Manuel Pinheiro. "Innovative High-Visibility Protective Clothing Development", Textiles, 2021

< 1% match (Internet from 11-Jan-2022)
https://www.coursehero.com/file/91194704/Vocabulary-docx/

< 1% match (publications)
P. Bhat, A. Basu. "Advanced testing of silk fibers, yarns, and fabrics", Elsevier BV, 2015

< 1% match ()
Deb, Hridam, Morshed, Mohammad Neaz, Azad, Shamim Al, Mia, Md Shipan. "Level and Magnitudes of Shade Deviation and Subsequent Environmental Challenges of Turquoise Colorants", American Journal of Energy and Environment, 2017

< 1% match (student papers from 10-Sep-2020)
Submitted to muetjamshoro on 2020-09-10

< 1% match (publications)
S CHATTOPADHYAY, N PAN, A DAY. "Reuse of reactive dyes for dyeing of jute fabric", Bioresource Technology, 2006

Faculty of Engineering Department of Textile Engineering Comparative study between medium brand and hot brand reactive dye for dying cotton fabric Course Title: Project (Thesis) Course code: TE-4214 Submitted By Md. Masum Hossain 191-23-5533 Sardar Sartaz Sourov 191-23-5539 Supervised By Tanvir Ahmed Chowdhury Assistant professor Department of Textile Engineering, DIU The report presented in partial Fulfillment of the requirements for the degree of Bachelor of Science in Textile Engineering Advance in Wet Processing Technology Fall- 2021 LETTER OF APPROVAL 01-12-2021 To, The Head Department of Textile Engineering Daffodil International University 102, Shukrabad, Mirpur Road, Dhaka 1207 Subject: Approval of Project Report of B.Sc.In TE Dear Sir, Assala-mu-alikum sir, I am simply writing to tell you that this task report titled as "Comparative study between medium brand and hot brand reactive dye for dying cotton fabric" has been set up by the under study bearing ID 191-23-5533 and 191-23-5539 is finished for definite assessment. The entire report is readied in light of the best possible examination at Newage Textile Ltd. Furthermore, intrusion through basic examination of observational informational with required possessions. The under study were straight forwardly associated with their undertaking exercises. Therefore, it will highly be appreciated if you kindly accept this project report and consider it for final evaluation. Yours Sincerely ---------- Tanvir Ahmed Chowdhury Assistant Professor Department of Textile Engineering Daffodil International University "©Daffodil International University" ii ACKNOWLEDGEMENT Above all, first we thanks to Almighty Allah Who gives us ability and power to complete this Thesis and research work. With sincerity, We extent our warm and deep appreciation and gratitude to our supervisor, Tanvir Ahmed Chowdhury, Assistant professor, Department of Textile Engineering of Daffodil International University for this guidance and support to come up with this research work. Been working with him, we have not only earned valuable knowledge, but was also inspired by this innovativeness which helped to enrich our experience to a greater extent. His ideas and way of working of truly remarkable. We believe that this research could not be finished if he did not help us continuously. We should like to express our heartiest to Mr. Md. Mominur Rahman, Assistant Professor Head (in-charge) of the Department, Textile Engineering of Daffodil International University for his kind help to finish our project and also to other faculty members and the staffs of TE Department of Daffodil International University. We would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work. The support and encouragement rendered by, Newage Textile Limited Staffs and Md. Ripon Manager of Lab

Section in Newage Textile Ltd. Were very vital in the completion of this project, their guidance and encouragement played a key role in the planning and completion of this project. Finally, we express our sincere gratitude to our parents and friends for their continuous support, ideas and love during our studies. "©Daffodil International University" iii DECLARATION We hereby declare that, this report has been done under the supervision of Tanvir Ahmed Chowdhury, Assistant professor, Department of Textile, and Daffodil International University. We also declare that neither this internship report nor any part of this internship report has been submitted elsewhere for award of any degree. Submitted By: ---------- Md. Masum Hossain ID: 191-23-5533 Department of Textile Engineering Daffodil International University ---------- Sardar Sartaz Sourov ID: 191-23-5539 Department of Textile Engineering Daffodil International University "©Daffodil International University" iv This projects report is dedicated to our beloved parents and Teachers v ABSTRACT This report presents comparative study between medium brand color (Normal) reactive dyeing process and hot brand color (Turquoise) reactive dyeing process on cotton fabric. In this report we discuss about turquoise color dye and normal color of reactive dye for dyeing cotton fabric with some physical test. We collect required sample and data from Newage textile Ltd. Here we also comparing the color fastness to wash, color fastness to light, color fastness to rubbing, pilling test, color fastness to perspiration test of turquoise color dyed fabric and normal colored dyed fabric. We know that turquoises is a hot brand dye where normal color dyeing in lower temperature. After all our study is imperative to make a comparison between turquoise dyed fabric and normal color dyed fabric with several test. vi TABLE OF CONTANTS Letter of approval----------

Light turquoise 7 Figure 2.5: Turquoise blue 7 Figure 2.6: Medium turquoise 8 Figure 2.7: Dark turquoise 8 Figure 2.8: Direct Turquoise blue 9 Figure 2.9: Reactive turquoise blue 21 9 Figure 2.10: Reactive turquoise H5G 10 Figure 3.11: Turquoise color sample 18 Figure 3.12: Normal Reactive color sample 23 Figure 3.13: Washing Fastness process curved 26 Figure 3.14: Crock Meter (left) and Light box (right) 28 Figure 3.15: Color fastness to light (in house Method) 29 Figure 3.16: Pilling machine 30 Figure 4.17: Result of turquoise multi-fiber color fastness to wash 37 Figure 4.18: Result of turquoise color fastness to Rubbing 37 Figure 4.19: Result of turquoise color fastness to light 38 Figure 4.20: Result of turquoise pilling test 38 Figure 4.21: Result of Turquoise multi-fiber color fastness to perspiration 39 Figure 4.22: Result of Normal multi-fiber color fastness to Wash 40 Figure 4.23: Result of Normal multi-fiber color fastness to Rubbing 41 Figure 4.24: Result of Normal color fastness to Light 42 Figure 4.25: Result of Normal color Pilling test 42 Figure 4.26: Result of Normal multi-fiber color fastness to Perspiration 43 Figure 4.27: Turquoise Lab Test Report 1 46 Figure 4.28: Turquoise Lab Test Report 2 47 Figure 4.29: Normal Reactive Lab Test Report 3 48 Figure 4.30: Normal Reactive Lab Test Report 4 49 Figure 4.31: Spectrophotometer result 50 Figure 4.51: Spectrophotometer curve 51 x List of the Tables Title of the Table with Table Number Page No. Table 3.1 difference between turquoise dye & normal reactive dye 13 Table 3.2 Recipe of turquoise dyeing color (angel blue) 14 Table 3.3: Process Flow-chart of Turquoise dyeing 18 Table 3.4 Recipe for normal color reactive dye 19 Table 3.5: Process Flow-chart of Normal color dyeing 22 Table 3.6 Recipe for Color fastness to wash 23 Table 3.7: Process flowchart of color fastness to wash 25 Table 3.8: Process flowchart of color fastness to rubbing. 27 Table 3.9: Process flowchart of color fastness to light. 28 Table 3.10: Recipe of color fastness to Perspiration (Acid). 32 Table 3.11: Recipe of color fastness to Perspiration (Alkali). 33 Table 3.12: Flowchart of color fastness to Perspiration. 35 Table 4.13: Result of turquoise multi-fiber color fastness to wash 37 Table 4.14: Result of Turquoise multi-fiber color fastness to perspiration (Alkali) 39 Table 4.15: Result of Turquoise multi-fiber color fastness to perspiration for (Acid) 40 Table 4.16: Result of Normal multi-fiber color fastness to Wash 40 Table 4.17: Result of Normal multi-fiber color fastness to Rubbing 41 Table 4.18: Result of Normal multi-fiber color fastness to Perspiration (Alkali) 43 Table 4.19: Result of Normal multi-fiber color fastness to Perspiration (Acid) 43 Table 4.20: Compare of color fastness to Wash. 44 Table 4.21: Compare of color fastness to Rubbing. 44 Table 4.22: Compare of color fastness to Light. 44 Table 4.23: Compare of Pilling Test. 45 Table 4.24: Compare of color fastness to Perspiration for (Alkali). 45 Table 4.25: Compare of color fastness to Perspiration for (Acid). 45 xi Chapter 1 Introduction 1.1 Introduction Dyeing is a process in which color is transformed to a textile material to create permanent or long lasting color. This process is done by different method. There are different types of dyes are used in textile industry for coloration of textile goods. Reactive dye one of them which is suitable for coloration of cellulosic fiber. Reactive dyes are organic colored compounds which are capable for forming covalent bond between reactive group of the dye molecule and nucleophilic group on the polymer chains within the fiber. Here dye contains a reactive group and this group creates covalent bond with the fiber polymer and act as an integral part of fiber. There are some properties of this dyes these are as follows: 1. It has sulfonic acid group in the molecules and readily soluble in water. 2. Less substantive then direct dyes, hence more salt is required for exhaustion. 3. Dyestuff reacts and combines chemically with cellulose, so called reactive dyes. 4. Easy penetration and good leveling property. 5. Moderate to good light fastness and wash fastness properties. 6. Formation of covalent bond occurs in alkaline medium. 7. These dyes, unlike any others class of dyestuff, react of

combine chemically with cellulose and this leading to excellent wash fastness. 8. These dyes give very bright shade such as orange, pink, magenta etc, which were not possible with other class of dyes. 9. They do not react with water nearly as readily as with cellulosic hydroxyl in alkaline conditions so that they can be applied from an aqueous solution. 10. Reactivity of the dyestuff can be reduced when desirable by blocking one of the reactive chlorine atoms giving H-type procions. Reactive dyes are classified in these ways: 1. On the basis of reactive group 2. On the basis of reactivity Due to different types of classification dye affinity and fastness of the dye to fiber show different characteristic. Turquoise dye is a hot brand reactive dye which have low affinity and less fastness properties then cold brand reactive dyes. In hot brand dyes high temperature around 70 to 90o is required where cold brand and medium brand are required low temperature. 1.1 Objectives •To know about hot brand reactive dyes and its brand and classifications. •To know about the Turquoise color. •To know the properties of turquoise color. •To know the dyeing process of turquoise dyes and normal dyes. •To know the washing, light, rubbing fastness, pilling and perspiration test properties of turquoise and normal reactive color dyes. •To make the comparison between turquoise (hot brand) and normal (medium brand) color reactive dyes. 1.2 Limitations •It was not possible to collect all data from dyeing section because of factory limitations. •It has taken much time to collect data list from employees because they were too much busy for obtaining required production in time. Chapter 2 Literature Review 2.1 Type of Thesis Experimental Studies 2.2 Turquoise color This type of dyes contain low reactivity reactive group. So high temperature is required for dyeing. Turquoise is a color composed of green and blue. Due to low reactivity towards fibers dyeing is carried out at the temperature between 70 to 90o C. These types of dye also require strong alkaline medium the range of pH is around 10.5 – 11. Example: PROCION H, CIBACRON. Figure 2.1: Turquoise Color fabric Turquoise color is obtaining from hot brand reactive dye. These dyes having lower reactivity towards cotton fiber. Turquoise color mainly invented from reactive dye dyeing system. It is generally hot brand dye and the dyeing process or obtaining process is slightly complex then reactive dye normal color dyeing process. It is mostly produced by 70% blue and 30% green. Turquoise is sometimes described as a mixture of green color and blue color. It is a mediocre shade of blue green combination. Normal (medium brand) color Reactive dyes According to the reactivity of reactive dyes medium brand dyes contains reactive group of high reactivity. So dyeing is done in low temperature. These dyes have good fastness properties and suitable for application on all dyeing process. The dying temperature is around 35 to 60o C. Example: PROCION M, LIVAFIX E. Figure 2.2: Normal color Dye 2.3 Turquoise Dyestuff It is one of the most popular color in present day. Dyeing in turquoise color is very critical. Because of poor washing fastness properties of turquoise dyestuff. Dyeing procedure of turquoise color is slightly different from others dyeing. 2.4 Turquoise Variations 1. Celeste 2. Light Turquoise 3. Turquoise blue 4. Medium Turquoise 5. Dark turquoise 2.4.1 Celeste/Gray Blue The color Grey blue/celeste is also known as sky bluish Turquoise Figure 2.3: Grey Blue/Celeste 2.4.2 Light Turquoise Light turquoise is a lighter tone of turquoise. Figure 2.4: Light turquoise 2.4.3 Turquoise blue In 1900, the first turquoise blue was named as color and colored was used in that time firstly. Figure 2.5: Turquoise blue 2.4.4 Medium turquoise Figure 2.6: Medium turquoise 2.4.5 Dark turquoise Figure 2.7: Dark turquoise 2.5 Some turquoise example with features Turquoise color commonly used in our country. So, some of turquoise dye with its features are mention below: 1. Direct Turquoise Blue 2. Reactive turquoise Blue 21 3. Reactive turquoise Blue H5G 2.5.1 Direct Turquoise Blue Direct Turquoise Blue is used in different

textile factories for coloration. Features, •Precisely formulated •High solubility •Excellent coloring nature Figure 2.8: Direct Turquoise blue 2.5.2 Reactive turquoise blue 21 Reactive turquoise blue 21 is a chemical dye that is used for dyed materials like cotton, wool, silk and others polyamide textiles. Features of these dye, •Odorless •Electrolyte stability is in optimum situation •Nonflammable & non hazards •Water soluble Figure 2.9: Reactive turquoise blue 21 2.5.3 Reactive turquoise blue H5G Used in textile industries for dyeing linen, cotton, silk and other fibers. It has excellent fastness properties. Features of this dye, •Excellent solubility •Optimum colorfastness •Suitable for various shade Application area, •Dyeing •Printing Figure 2.10: Reactive turquoise H5G 2.6 Dyeing of turquoise various shade Dyeing of turquoise color is slightly complex than normal color dyeing. Turquoise color dyeing is mainly used for produce a specific color. Turquoise color has mainly 3 shade namely •Light shade •Medium shade •Dark shade 2.7 Review of the previous studies There are many researches have been done previously related to turquoise reactive dye. A researches paper- Coloration technique of turquoise tints with in depth analysis on shade, utility consumption and physic chemical properties concerning batches of identical hue, by Shamim al Azad, Hradam Deb, Md. Abdul Mueeid Alam published in February 2, 2017 which is related to turquoise coloration on knit fabric and the development of shade. Here discussed about the color fastness to wash and rubbing fastness of turquoise color. There has no journal report made based on comparison of turquoise dyes and normal reactive color dyes. But having few journal and book published on based on reactive dyes and turquoise dyeing process. Chapter 3 Experimental Details 3.1 Equipment List •Beaker •Digital balance •Glass rod •Droppers •Pipette •pot •pot stand •Scissor •Graduated Cylinder •Conical Flask •PH meter •Crock meter •Crock cloth •Light Box •Gray scales •Multi-fiber •Sample Dyeing machine •Dryer machine •Rota wash machine •Washing machine •Pilling machine •Both-side tap •Light fastness Tester •Spectrophotometer Textile Materials We have done all of our experiments by using only one type of textile fabric which is a Rib 2x2 knitted fabric. We collected those fabric from lab section during our internship period. 3.2 Experimental Procedure Our experimental project based on two different shade percentage of turquoise dyes and normal cold brand dyes which for light and medium shade. Our experimental is about different of Dyeing process and its physical tests between Turquoise and normal reactive dyes. So we first collect 10g sample of Rib 2x2 fabric then we complete dyeing. After dyeing and finishing this fabric, we take different physical test. 3.3 Basic difference between Turquoise dye & Normal reactive dye. Table 3.1 difference between turquoise dye & normal reactive dye Sl.no. Turquoise dyeing Normal Reactive dyeing Process Slightly complex than any other dyeing More easier then turquoise dyeing Cost Comparatively cheap Comparatively higher then turquoise Dyeing temp. High Temperature 70-90oC Low temperature around 35-60oC Reactivity Lower Higher Fastness properties good Comparatively less Affinity Turquoise dye has less affinity but quality of dye and company play an important role for good dye fastness Good affinity then turquoise 3.4 Turquoise color dyeing process 3.4.1 Recipe Color name- Angel Blue Table 3.2 Recipe of turquoise dyeing color (angel blue) Process parameter Unit Stock solution % Recipe amount Dossing Eva. Yellow 3GL %(owf) 0.01 % 0.0008% (owf) 0.8 ml Eva. Tur. Blue G %(owf) 0.5 % 0.194% (owf) 3.88 ml Dri-Blue HFRL %(owf) 0.5 % 0.074% (owf) 1.48 ml Glauber salt g/L 20 1.4g Soda ml/L 10% 3 3 ml PH 11-12 Temperature oC 90oC Time Minute 120-150 M:L 1:7 Fabric type Rib 2x2 (knitted) Sample Weight g/kg 10g 3.4.2 Calculation Dye calculation, Recipe amount x Fabric wet ---------- --- Stock solution % 0.0008 x 10 = ---------- 0.01 0.008 = ---------- 0.01 = 0.8 ml Again, Again, 0.194 x 10 = ---------- 0.5 = 3.88 ml 0.074 x 10 = ----------

--------- 0.5 = 1.48 ml Total dyestuff we taken, 0.8 + 3.88 + 1.48 = 6.16 ml Salt-soda, 20/3 (we take this amount of salt soda from turquoise dyes recommended chart) Soda calculation, Recipe amount x fabric wet = --------- ---------- Stock solution % 3 x 10 = ---------- --- 10 = 3 ml Salt calculation, Without stock solution, Recipe amount x ratio of liquor x fabric weight = ---------- ---------- 1000 20 x 7 x 10 = ---------- 1000 = 1.4 g Total fresh water we take, Total dyestuff + soda – (Liquor ratio x Fabric weight) = 6.16 + 3 – (7 x 10) = 60.84 = 61 ml 3.4.3 Flowchart of Turquoise dyeing Sample cutting (grey fabric) ↓ Sample weight ↓ Pipetting ↓ Salt added ↓ Fabric added ↓ Machine loading ↓ Run for 30 minutes 80oC ↓ Temperature down 40oC ↓ Unload sample ↓ Soda added ↓ Loading and Run for 1 hour at 80oC ↓ Unload and 2% soap solution added ↓ Run for 30 minutes 90oC ↓ Washing with cold water ↓ Squeeze by hand and Dry Table 3.3: Process Flow-chart of Turquoise dyeing Figure 3.11: Turquoise color sample 3.5 Normal color Dyeing Process 3.5.1 Recipe Color name: Comprlile (pp) Table 3.4 Recipe for normal color reactive dye Process Parameter Unit Stock solution% Recipe amount Dossing Nova Ruby S3R % (owf) 0.01% 0.0008% (owf) 0.8 ml Nova Ocean SR % (owf) 0.5% 0.194% (owf) 3.88 ml Re. Blue RR % (owf) 0.5% 0.074% (owf) 1.48 ml Glauber Salt g/L 2.8 g Soda ml/L 10% 10 10 ml PH 11-12 Temperature oC 60o Time Minute 120-150 M:L 1:7 Fabric type Rib 2x2 (knitted) Fabric weight g/kg 10 g 3.5.2 Calculation Dye Calculation Recipe amount x fabric weight = ---------- Stock solution% Again, Again, 0.0008 x 10 = ---------- 0.01 = 0.8 ml 0.194 x 10 = ---------- 0.5 = 3.88 ml 0.074 x 10 = ---------- --- 0.5 = 1.48 ml Total dyestuff we taken, 0.8 + 3.88 + 1.48 = 6.16 ml Salt-Soda, 40/10 (we take this amount of salt soda from normal reactive dyes recommended chart) Soda calculation, Recipe amount x fabric weight = ------ ---------- Stock solution% 10 x 10 = ---------- ------ 10 = 10 ml Salt calculation, Without stock solution, Recipe amount x ratio of liquor x fabric weight = ---------- ---------- 1000 40 x 7 x 10 = ---------- 1000 = 2.8 g Total fresh water we take, Total dyestuff + soda – (ratio of liquor x fabric weight) = 6.16 + 10 – (7 x 10) = 53.84 = 54 ml 3.5.3 Flowchart of normal color dyeing Sample cutting (grey fabric) ↓ Sample weight ↓ Pipetting ↓ Salt added ↓ Fabric added ↓ Machine loading ↓ Run for 30 minutes 60oC ↓ Temperature down 40oC ↓ Unload sample ↓ Soda added ↓ Loading and Run for 1 hour at 60oC ↓ Unload and 1% soap solution added ↓ Run for 30 minutes 90oC ↓ Washing with cold water ↓ Squeeze by hand and Dry Table 3.5: Process Flow-chart of Normal color dyeing Figure 3.12: Normal Reactive color sample 3.6 Testing of color fastness to Wash 3.6.1 Recipe ISO-105-C06: 2010. C2S Method. Process Parameter Unit Stock solution% Recipe amount Dossing Detergent g/L 1% 4 20ml Sodium Perborate g/L 1% 1 5ml Steel ball 10 M:L 1:50 Temperature oC 60oC Time minute 30 Table 3.6 Recipe for Color fastness to wash 3.6.2 Calculation Detergent calculation, Total liquor x Recipe amount = ---------- Stock solution% x 1000 50 x 4 = ---------- 1% x 1000 = 20 ml Sodium perborate calculation, Total liquor x Recipe amount = ---------- Stock solution% x 1000 50 x 1 = ---------- 1% x 1000 = 5 ml Total fresh water we take, Total Chemical – (ratio of liquor x fabric weight) = (20 + 5) – (50 x 2.571) = 25 – 128.55 = 103.55 = 104 ml 3.6.3 Process flow-chart Sample is collect from dyed sample ↓ Sample and multi-fiber fabric cutting (10 cm x 4 cm) ↓ Sewing both multi-fiber ↓ Test specimen together ↓ Machine loading (Rota wash) ↓ Washed for 30 minutes at 60°C ↓ Cooing 40oC ↓ Squeezing the sample ↓ Drying ↓ Broken down the stitch and measuring the color change and color staining by grey scale Table 3.7: Process flowchart of color fastness to wash 3.6.4 Process curve Add water Add Detergent Add

Sodium perborate Temperature (oC) Add Sample 60oC 30 minute Bath drop 0oC Time (min) Figure 3.13: Washing Fastness process curved 3.7 Testing of Color Fastness to rubbing Rubbing Fastness are done by using, • Dry rub • Wet rub 3.7.1 Testing procedure Test specimen 15cm x 5cm is placed on the base of the Crock meter. ↓ White test cloth (5cm x 5cm) without finished cotton fabric is taken. ↓ White test cloth is attached to the finger of the crock meter. ↓ Rubbing is done to and fro, 10 cycles at 10seconds and finger pressure on the specimen is 9N. ↓ Rubbing test is done both for warp way and weft way. ↓ Dry and wet rubbing test, separate sample is used. ↓ For wet rubbing, the sample is dry but crocking cloth is wet. And grade 3 water is used. Table 3.8: Process flowchart of color fastness to rubbing. 3.7.2 Assessment Technique, • Place the rubbing cloth in the light box (D65 light) at an incline plane. • Evaluate the staining using the grey scale. Three unstained rubbing cloths should be placed under the rubbing cloth that is evaluated. • Carefully remove loose fibers on the rubbing cloth's surface before evaluation. • The result is the grey scale rating closest to the staining of the rubbing cloth. • Any dark circle formed around the test area should be discarded. Figure 3.14: Crock Meter (left) and Light box (right) 3.8 Color fastness to light (in house Method) To determine the colorfastness and degradation due to the effects of sunlight on textiles. 3.8.1 Testing Procedure Test sample 10.5cm x 1.5cm is placed on the base on the testing tubes. ↓ Oba free-card (10.5cm x 1.5cm) which is same of the sample ↓ Oba free-card is attached to the sample by staple ↓ Set sample to the tester ↓ Run and check every 8 hours ↓ Sample change grade 5 to grade 4 ↓ Process are done. Table 3.9: Process flowchart of color fastness to light. 3.8.2 Assessment Technique •The tested sample compared with untested sample under light box using UV light and D65 light source. •Then test the sample with color change grey scale. •Now grading the sample. Figure 3.15: Color fastness to light (in house Method) 3.9 Pilling test ISO-12945:2000 3.9.1 Equipment list •Template •Hole cylinder •Mounting jack •Poly uterine tube •PVC tap •Pilling swing machine •Pilling machine •Pilling assessment viewer 3.9.2 Testing Procedure •First we do 4 hours conditioning the sample. •Total 4 sample we have test, 2 length wise and 2 weight wise. •Sample cutting with template both (length and weight) 125mm x 125mm. •The samples are then folded face to face and a seam is sewn on the marked line. •Each specimen is turned inside out and 6mm cut off each end of it thus removing any sewing distortion. •The fabric tubes made are then mounted on rubber tubes so that the length of tube showing at each end is the same. Each of the loose ends is taped with PVC tape so that 6mm of the rubber tube is left exposed. •All four specimens are then placed in one pilling box. •The samples are then tumbled together in a cork-lined box. •The usual number of revolutions used in the test is 14,400 cycle which speed 60 RPM. Figure 3.16: Pilling machine 3.9.3 Assessment Technique •The specimens are removed from the tubes and viewed using Pilling assessment viewer. •The samples are then given a rating of between 1 and 5. 3.10 Color fastness to Perspiration The color fastness to perspiration (acid and alkaline) refers to the ability not to fade and not to stain when the dyed fabric is perspired. ISO-105-E04:2008 3.10.1 Equipment •Sample fabric •Multi-fiber •Per-spirometer •Acrylic plate •Digital balance •Beaker •PH Meter •Agitator •Oven •Dryer •Grey scale 3.10.2 Chemical used in perspiration test Acid for male- I – Distilled water grade 3. Ii - L-Histidine mono-hydrochloride monohydrate. Iii – Sodium chloride. Iv– Sodium dihydrogen phosphate. V – Sodium hydroxide. 3.10.3 Recipe For Acid, Table 3.10: Recipe of color fastness to Perspiration (Acid). Process parameter Unit Recipe Amount L-Histidine mono-hydrochloride monohydrate. g/L 0.5 Sodium chloride. g/L 5.0 Sodium dihydrogen phosphate. g/L 2.2 Distilled water L 1.0 PH 5.5 Temperature oC 37 M:L 1:50 Time Minute 4 hours 30 minute Sample size cm 10 x 4 3.10.4 Calculation Total Liquor we take, Fabric weight x 50 =

1.980 x 50 = 99 ml For alkali, Table 3.11: Recipe of color fastness to Perspiration (Alkali). Process parameter Unit Recipe Amount L-Histidine mono-hydrochloride monohydrate. g/L 0.5 Sodium chloride. g/L 5.0 Di-Sodium dihydrogen phosphate. g/L 2.5 Distilled water L 1.0 PH 8 Temperature oC 37 M:L 1:50 Time Minute 4 hours 30 minute Sample size cm 10 x 4 Calculation Total Liquor we take, Fabric weight x 50 = 1.980 x 50 = 99 ml 3.10.5 Flowchart of color fastness to Perspiration. Sample and multi-fiber cutting (10cm x 4cm) ↓ Attach sample and multi-fiber by sewing with thread ↓ One Ltr solution making with all chemicals ↓ Control the PH (5.5 for acid and 8 for alkali) acid solution by NaOH ↓ Weight sample and calculation ↓ Wet the sample with solution at M:L=1:50 (Rest sample with solution for 30 minute) ↓ Again weight the sample (Pickup Percentage: 2.0-2.5 times) ↓ Set the sample in per-spirometer ↓ Place the sample on the surface of between acrylic-plate ↓ Now apply a weight of 12.5 kpa for ISO method and lock the screw ↓ Put it inside of oven at 37oC for 4 hours ↓ Unload and unlock the sample and dried 45-50oC ↓ After dried the sample color staining and change grade by grey scale Table 3.12: Flowchart of color fastness to Perspiration. Chapter 4 Discussion of Result 4.1.1 Result of Turquoise color fastness to wash Figure 4.17: Result of turquoise multi-fiber color fastness to wash Table 4.13: Result of turquoise multi-fiber color fastness to wash Acetate Cotton Nylon Polyester acrylic Wool 4-5 4-5 4-5 4-5 4-5 4-5 Grading for color change: 4-5 4.1.2 Result of Turquoise color fastness to rubbing Figure 4.18: Result of turquoise color fastness to Rubbing Grading for wet: 4-5 and Grading for dry: 4-5 4.1.3 Result of Turquoise Color fastness to light (in house method) Figure 4.19: Result of turquoise color fastness to light Grading for color change: 4-5 4.1.4 Result of Turquoise pilling test Figure 4.20: Result of turquoise pilling test Grading for pilling: 4-5 Revolution: 14,400 4.1.5 Result of Turquoise Color fastness to Perspiration Figure 4.21: Result of Turquoise multi-fiber color fastness to perspiration For alkali, Table 4.14: Result of Turquoise multi-fiber color fastness to perspiration (Alkali) Acetate cotton nylon polyester acrylic wool 4-5 4-5 4-5 4-5 4-5 4-5 Grading for color change and staining: 4-5 For Acid, Table 4.15: Result of Turquoise multi-fiber color fastness to perspiration for (Acid) Acetate cotton nylon polyester acrylic wool 4-5 4-5 4-5 4-5 4-5 4-5 Grading for color change and staining: 4-5 4.2.1 Result of Normal reactive color fastness to wash Figure 4.22: Result of Normal multi-fiber color fastness to Wash Table 4.16: Result of Normal multi-fiber color fastness to Wash Acetate cotton nylon polyester acrylic wool 4-5 4-5 4-5 4-5 4-5 4-5 Grading for color change and staining: 4-5 4.2.2 Result of Normal reactive color fastness to rubbing Figure 4.23: Result of Normal multi-fiber color fastness to Rubbing Table 4.17: Result of Normal multi-fiber color fastness to Rubbing Dry Rub Wet Rub 4-5 4-5 4.2.3 Result of normal reactive color fastness to light (in house method) Figure 4.24: Result of Normal color fastness to Light Grading for color change: 4-5 4.2.4 Result of normal reactive pilling test Figure 4.25: Result of Normal color Pilling test Grading for pilling: 4-5 Revolution: 14,400 4.2.5 Result of normal reactive color fastness to Perspiration Figure 4.26: Result of Normal multi-fiber color fastness to Perspiration For Alkali, Table 4.18: Result of Normal multi-fiber color fastness to Perspiration (Alkali) Acetate cotton nylon polyester acrylic wool 4-5 4-5 4-5 4-5 4-5 4-5 Grading for Perspiration (Alkali): 4-5 For Acid, Table 4.19: Result of Normal multi-fiber color fastness to Perspiration (Acid) Acetate cotton nylon polyester acrylic wool 4-5 4-5 4-5 4-5 4-5 4-5 Grading for Perspiration (Acid): 4-5 4.3 Compare of the result between Reactive normal color and Turquoise color. Table 4.20: Compare of color fastness to Wash. Acetate Cotton Nylon Tur. Reactive Nor. Reactive Tur. Reactive Nor. Reactive Tur. Reactive Nor. Reactive 4-5 4-5 4-5 4-5 4-5 4-5 Polyester Acrylic Wool Tur. Reactive Nor. Reactive Tur. Reactive Nor. Reactive Tur. Reactive Nor. Reactive 4-5 4-5 4-5 4-5 4-5 4-5 For color fastness to wash test, we have seen both

sample are same result which is 4-5 grading. Table 4.21: Compare of color fastness to Rubbing. Wet Rub Dry Rub Tur. Reactive Nor. Reactive Tur. Reactive Nor. Reactive 4-5 4-5 4-5 4-5 For color fastness to rubbing test, we have seen both sample are same result which is 4-5 grading. Table 4.22: Compare of color fastness to Light. Turquoise In House Method Grade 4-5 Normal Reactive In House Method Grade 4-5 For color fastness to rubbing test, we have seen both sample are same result which is 4-5 grading. Table 4.23: Compare of Pilling test. Turquoise ISO12945:2000 Grade 4-5 Normal Reactive ISO12945:2000 Grade 4-5 For color fastness to rubbing test, we have seen both sample are same result which is 4-5 grading. Table 4.24: Compare of color fastness to Perspiration for (Alkali). Acetate Cotton Nylon Tur. Reactive Nor. Reactive Tur. Reactive Nor. Reactive Tur. Reactive Nor. Reactive 4-5 4-5 4-5 4-5 4-5 4-5 Polyester Acrylic Wool Tur. Reactive Nor. Reactive Tur. Reactive Nor. Reactive Tur. Reactive Nor. Reactive 4-5 4-5 4-5 4-5 4-5 4-5 For color fastness to perspiration test (Alkali), we have seen both sample are same result which is 4-5 grading. Table 4.25: Compare of color fastness to Perspiration for (Acid). Acetate Cotton Nylon Tur. Reactive Nor. Reactive Tur. Reactive Nor. Reactive Tur. Reactive Nor. Reactive 4-5 4-5 4-5 4-5 4-5 4-5 Polyester Acrylic Wool Tur. Reactive Nor. Reactive Tur. Reactive Nor. Reactive Tur. Reactive Nor. Reactive 4-5 4-5 4-5 4-5 4-5 4-5 For color fastness to perspiration test (Acid), we have seen both sample are same result which is 4-5 grading. 4.4 Approval for test result from QC and Lab Manager For Turquoise Lab Test Report 1, Figure 4.27: Turquoise Lab Test Report 1 For Turquoise Lab Test Report 2, Figure 4.28: Turquoise Lab Test Report 2 For Normal Reactive Lab Test Report 3, Figure 4.29: Normal Reactive Lab Test Report 3 For Normal Reactive Lab Test Report 4, Figure 4.30: Normal Reactive Lab Test Report 4 4.5 Result of Spectrophotometer Figure 4.31: Spectrophotometer result CMC-(Color measurement committee) Test generally done for identify the difference between standard swatch and dyeing fabric (sample). Sometimes it is difficult to identify the fabric tone, depth, metamerism with our eyes for this reason we make a test using spectrophotometer taking our production shade and standard swatch for easy understanding. This is called CMC test. Functions of Spectrophotometer, 1. Color difference. 2. Pass/Fall analysis 3. Fastness rating 4. Metamerism 5. Shade library 6. Cost comparison 7. Color match production 8. Reflectance curve Compare with Standard swatch (Normal Reactive color) and Batch swatch (Turquoise color) Figure 4.51: Spectrophotometer curve In this test we use F11 and msD65 Light source. DE-(color difference) Range = 0 to 0.75 Pass = 0.75 to 1 commercially pass (warn) = 1 to above Fail In our test we have found F11-DE = 13.33 And D65 = 12.85 that's mean Far more then fail (Shade not ok). DL- (Difference in lightness/Darkness value) + = Lighter and - = Darker In our test we have found F11 = 16.99 x 10 = 169.9% lighter And D65 = 15.99 x 10 = 159.9% lighter Da- (Difference on Red/Green axis) + = Redder and - = Greener In our test we have found F11 = -8.61 x 10 = -86.1% greenish And D65 = -8.40 x 10 = -84% greenish Db- (Difference on yellow/blue axis) + = yellower and - = bluer In our test we have found F11 = 15.47 x 10 = 154.7% yellowish And D65 = 12.88 x 10 = 128.8% yellowish Dc- (Difference in Chroma) + = brighter and - = duller In our test we have found F11 = -11.48 x 10 = -114.8% duller And D65 = -8.25 x 10 = -82.5% duller DH- (Difference in Hue) Our two sample Difference in F11 light source = -13.48 x 10 = -134.8% And D65 = -12.98 x 10 = -129.8% Metamerism - is a phenomenon that occurs when two colors appear to match under one lighting condition, but not when the light changes. If metamerism value Less Then0.50 = Pass/shade ok More Then0.50 = Fail/shade no ok In our test we have found Metamerism value = 3.62 that's mean far more then fail (shade not ok). Now we can say it is not possible to match between Turquoise color and Normal Reactive color Because Turquoise color are too light tone and

Normal Reactive are darker then turquoise. They have their own speciality. Chapter 5 Conclusion Conclusion We know that now a day's reactive dye is the most popular dyes to dye the cellulosic fibers because of great affinity towards cellulosic fiber. By forming covalent bond reactive dye molecule linkage with fiber structure and show moderate to good fastness properties. According to the reactivity of these dye turquoise dye which is hot brand dye has less affinity than medium brand dye. So during dyeing with turquoise dye due to less affinity high temperature is required for color producing to the fabric where medium brand required less temperature than hot brand dye. This poor affinity to fiber also cause of weak color fastness properties for the fabric and for good affinity of cold brand dyes its showing better fastness properties than turquoise dye. •For light shade both dye show almost similar fastness properties but in medium and dark shade we see the difference. •And the other test like Fastness to Rubbing we are not found any difference between them. •Fastness to light test we are also not found any difference. •Pilling test, same as previous test no difference. •fastness to Perspiration for Acid and Alkali they also shows similar fastness properties. •In spectrophotometer test we are trying to see how far their shade and we found too much difference. Quality of dye and company play an important role for good dye fastness. We hope that this work will be imperative and helpful for the readers and industry people to do further work with turquoise. References 1. https://en.wikipedia.org/wiki/Turquoise_(color) 2. https://www.sciencedirect.com/topics/engineering/reactive-dye 3. https://www.productip.com/kb/productipedia/compliance-resources/colour-fastness-of-textiles "©Daffodil International University" "©Daffodil International University" "©Daffodil International University" "©Daffodil International University" "©Daffodil International University" "©Daffodil International University" "©Daffodil International University" 1 "©Daffodil International University" 2 "©Daffodil International University" 3 "©Daffodil International University" 4 "©Daffodil International University" 5 "©Daffodil International University" 6 "©Daffodil International University" 7 "©Daffodil International University" 8 "©Daffodil International University" 9 "©Daffodil International University" 10 "©Daffodil International University" 11 "©Daffodil International University" 12 "©Daffodil International University" 13 "©Daffodil International University" 14 "©Daffodil International University" 15 "©Daffodil International University" 16 "©Daffodil International University" 17 "©Daffodil International University" 18 "©Daffodil International University" 19 "©Daffodil International University" 20 "©Daffodil International University" 21 "©Daffodil International University" 22 "©Daffodil International University" 23 "©Daffodil International University" 24 "©Daffodil International University" 25 "©Daffodil International University" 26 "©Daffodil International University" 27 "©Daffodil International University" 28 "©Daffodil International University" 29 "©Daffodil International University" 30 "©Daffodil International University" 31 "©Daffodil International University" 32 "©Daffodil International University" 33 "©Daffodil International University" 34 "©Daffodil International University" 35 "©Daffodil International University" 36 "©Daffodil International University" 37 "©Daffodil International University" 38 "©Daffodil International University" 39 "©Daffodil International University" 40 "©Daffodil International University" 41 "©Daffodil International University" 42 "©Daffodil International University" 43 "©Daffodil International University" 44 "©Daffodil International University" 45 "©Daffodil International University" 46 "©Daffodil International University" 47 "©Daffodil International University" 48 "©Daffodil International University" 49 "©Daffodil International University" 50 "©Daffodil International University" 51 "©Daffodil International University" 52 "©Daffodil

International University” 53 “©Daffodil International University” 54 “©Daffodil International University” 55