



Daffodil
International
University

Faculty of Engineering
Department of Textile Engineering

Project (Thesis) Report on

“Development of Lower M: L in Dyeing Cotton Fabric with Reactive Dye.”

Course Code: TE-4214

Course Title: Project (Thesis)

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A Thesis submitted in partial fulfillment of requirements for the degree of
“Bachelor of Science in Textile Engineering”.

Advance in Textile Wet Processing Technology
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DECLARATION

We, therefore, pronounce that, this task has been finished by us under the **supervision of Mr. Tanvir Ahmed Chowdhury, Assistant Professor, Department of Textile Engineering, Faculty of Engineering, Daffodil International University.** We likewise pronounce that, neither this task nor any piece of this undertaking has been submitted somewhere else for grant of any degree or certificate.

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LETTER OF APPROVAL

This Project (Thesis) report has been prepared by **Showrov Chandra Sarker, (ID: 191-23-589)** & **Hasibur Rahman Sazib, (ID: 191-23-623)** has been partially approved to meet the requirements for the degree of **Bachelor of Science in Textile Engineering**. The mentioned students have completed their Project (Thesis) entitled “**Development of Lower M:L in Dyeing Cotton Fabric with Reactive Rye.**” under my supervision. During the research we found them sincere, hardworking and enthusiastic.



Mr. Tanvir Ahmed Chowdhury

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ABSTRACT

Synthetic dyes are most popular dyes. It produces excellent shade. In this experiment I choose 100% cotton fabric, can be dyed using reactive dyes which can be extract from synthetic polymer substance.

Reactive dye, a chromophore an atom or group that determines the color of a compound in a reactive dye has a substituent that interacts with the substrate. Because of the covalent bonding that takes place throughout the dyeing process, reactive dyes have good fastness qualities. During dyeing process have to maintain proper pH (10-12.5), time, temperature (60°C). Shade match is most important we match the shade by the using spectrophotometer.

Liquor ratio means volume of liquor to be taken in dye bath in proportion to weight of textile. Liquor ratio the term is very important. Because chemicals, dyes and water are directly involved with liquor ratio. The cost of production will be increase and decrease depends on the liquor ratio. Finally, we can say lower liquor ratio decrease the cost of production.

Good fastness properties is define good product quality. Lower liquor ratio does not impact in fastness properties. Color fastness is the resistance of a material to change in any of its color characteristics.

Key words: cotton fabric, reactive dye, fastness test, liquor ratio.



**This Project (Thesis) report is dedicated to
Our beloved Parents and Teachers.**



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CHAPTER-01

INTRODUCTION

1.1 Introduction:

Now a days synthetic dyes are most popular dyes. Reactive dye is one of them. The mechanism of dying process is easy. Reactive dye is comparatively low cost than others dyes and it has excellent fastness properties. Reactive dyes give excellent shade. Reactive dye is suitable for cellulosic fiber like cotton fiber. Reactive dye reacts with the OH group of cotton fiber and make covalent bond. Most of the company use reactive dye for cotton, viscose fabric.

Cotton fiber is natural fiber. It is biodegradable fiber so it not gives harmful effect to our environment. It has good absorbency and it takes 27 times water of its weight. The structure of cotton fiber is kidney shape. Cotton fiber is most popular fiber in over the world.

1.2 Objectives:

Objectives of this study-

- To save dyeing cost
- To get proper shade
- To achieve good quality of fabric
- To reduce water consumption
- To compare between lower and higher liquor ratio of dyed fabric.



CHAPTER-02

LITERATURE REVIEW

2.1 Dyeing:

Applying dyes or pigments to textile materials including fibers, yarns, and fabrics in order to get the desired color and color fastness is known as dyeing. Typically, dyeing is carried out in a customized solution combining dyes and a specific chemical substance. Temperature and time are the two main determining elements in how dye molecules are attached to the fiber through absorption, diffusion, or bonding. Depending on the dye employed, the bond between the dye molecule and the fiber may be strong or weak. [1]



Figure: Dyeing

2.2 Dye:

A dye is a colored material that forms a chemical bond with the fiber. In order to improve the dye's fastness on the fiber, a mordant may be needed while applying dye, which is typically done in an aqueous solution. [2]

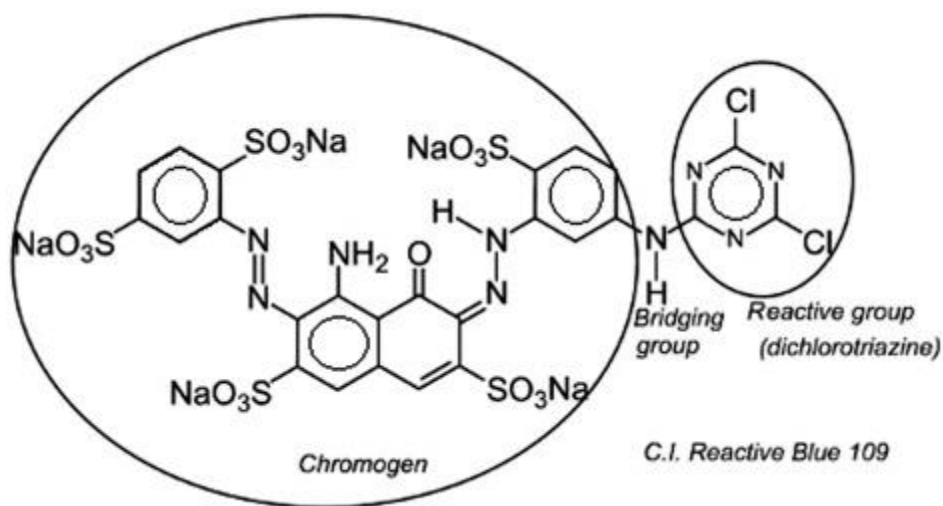
2.2.1 Reactive dye:

Reactive is a natural dye. Reactive dye is a dye that may create a covalent bond with a fiber, providing a long-lasting attachment that cannot be dissolved by repeated boiling water treatments under neutral conditions. As a result, the dyes are incorporated into the fiber, providing exceptional color fastness to washing. [3]



Fig: Reactive dye

2.2.2 Reactive group:



2.2.3 Properties of reactive dye:

- ✓ Reactive dye is anionic in nature.
- ✓ Reactive is water soluble dye.
- ✓ They have excellent light fastness properties.
- ✓ They have better substantivity.
- ✓ Alkaline condition is must require for dyeing.
- ✓ Create covalent bond with the textile fibers.
- ✓ They have moderate rubbing fastness. [4]

2.2.4 Advantage of reactive dye:

- ✓ Reactive dyes produce exceptional shade.
- ✓ Reactive dyes enhance color wash ability more.
- ✓ For coloring cellulose fiber products, reactive dyes are more suitable.
- ✓ Easy method.
- ✓ Low cost. [5]

2.3 What is shade?

Depth of color is called shade. Shade is very important in dyeing, printing, washing as well as textile sector. One of the most essential elements of textile design is color, which significantly influences the finished fabric's overall visual impact. Shade variation of color is the most common problem in textile industry. The variation in shade in textile dyeing mills is caused by a number of factors. [6]

2.3.1 Shade %:

- ✓ Light: 0-0.25.
- ✓ Medium Light: 0.25- 1.4.
- ✓ Medium Dark: 1.4- 3.
- ✓ Dark: 3- 5.

2.4 Cotton:

Cotton fibers are natural fiber and they are soft, cool, known as breathable fibers, and are also absorbent. Water may be held in cotton fibers 24–27 times their own weight. Cotton can be blended with the nylon, polyester, silk etc. [7]



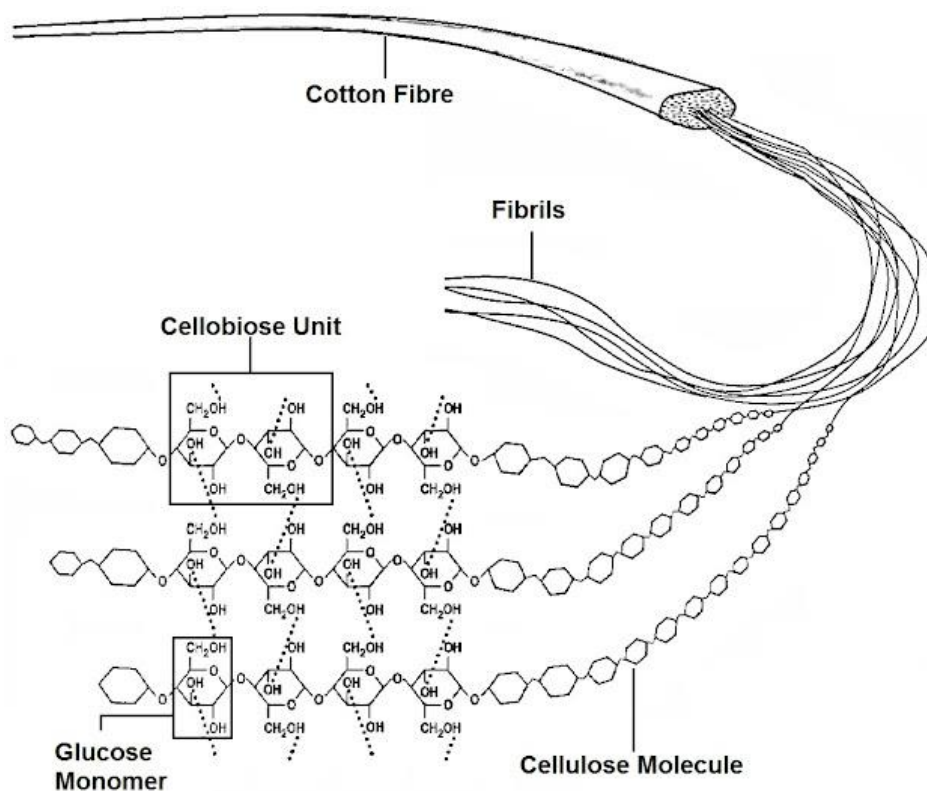
2.4.1 History of cotton:

The Bahama Islands were home to cotton farms when Columbus first arrived in America in 1492. By the year 1500, cotton was well-known on a global scale. It is thought that the first cotton seeds were sown in Virginia in 1607 and Florida in 1556. Cotton was being grown by colonists in Virginia near the James River around 1616. [8]

2.4.2 Chemical composition of cotton:

Cellulose	: 94%
Protein	: 1-1.5%
Pectic acid	: 01%
Mineral substance	: 01%
Acid, sugar, pigments	: 02%
Waxes	: 0.5%

2.4.3 Chemical structure of cotton:





CHAPTER-03

MATERIALS & METHODS

3.1 Materials:

Fabric:

100% cotton single jersey knit fabric is collected from Bengal hurricane dyeing & printing (pvt.) Ltd. The sample was scoured and bleached and its GSM was 160.

Dyes:

Remazol Blue RR, Remazol Red RR and Remazol yellow RR (Reactive dyes) are collected from Bengal hurricane dyeing & printing (pvt.) Ltd.

Multi fiber:

Multi fiber is collected from physical lab of Bengal hurricane dyeing & printing (pvt.) Ltd. It is used for wash fastness of testing fabric. This fabric is ISO certified.

Rubbing cloth:

Rubbing cloth for crock meter construction have 1\1 plain. It's EPI =32 and PPI = 33. This fabric is 100% cotton fabric.

Grey scale:

It is used for measuring color staining and color change.

Light box:

It is used for shade matching.

3.2 Chemicals:

Salt:

We use Glauber salt (Na_2SO_4) for dyes absorption and also salt is used as an electrolyte.

Soda:

Soda ash light (Na_2CO_3) is used for dye fixation.

Labeling agent:

Labeling agent is used for uniform dyeing.

Detergent:

It is used for surface tension of water and also used for soaping agent.

Sodium perborate & ECE phosphate reference detergent B:

These chemicals are used for color fastness to wash testing purpose.

KCl:

It is used for pH testing.

 $C_6H_9O_2N_3 \cdot HCl \cdot H_2O$ & $NaCl$ & $Na_2 \cdot PO_4 \cdot 2H_2O$ & $Na_2HPO_4 \cdot 2H_2O$:

These chemicals are used for color fastness to perspiration testing purpose.

3.3 Tools and machines:

Dyeing machine:

By the Lab dyeing machine we are doing dye the fabric.

Rubbing machine:

By the using crock meter machine we test the rubbing fastness of dyed fabric. Method of testing is ISO 105-X12.

Wash fastness machine:

By the using oven and incubator we test the color fastness to wash of dyed fabric. Method of testing is ISO 105 C06.

Grey scale:

By the using grey scale we can measure the test result.

pH testing machine:

By the using pH meter and shaker machine we did the pH test of this dyed fabric. Method of testing is ISO 3071.

Perspiration fastness machine:

By the using of oven and incubator we test the color fastness to perspiration of dyed fabric. Method of the test is ISO 105-E04.

Pilling testing machine:

We test the pilling of dyed fabric by the using of ICI box pilling machine. Method of pilling test is: ISO 12945-1.

3.4 Working procedure of Dyeing:

3.4.1 Batch: A

Sample -1: (standard)

- Firstly 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Secondly calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.

Sample-2: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-3: (trial)

- Firstly, correction recipe is taken by visually.
- Then 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-4: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-5: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.

- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

3.4.2 Batch: B

Sample-6: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-7: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.

- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-8: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-9: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-10: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-11: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

3.4.3Batch: C

Sample-12: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-13: (trial)

- Firstly, correction recipe is taken by visually
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-14: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.

- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-15: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-16: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.

- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-17: (trial)

- Firstly, correction recipe is taken by visually.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

3.4.4 Batch: D

Sample-18: (trial)

- Firstly, correction recipe is taken by spectrophotometer.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-19: (trial)

- Firstly, correction recipe is taken by spectrophotometer.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60^oc temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-20: (trial)

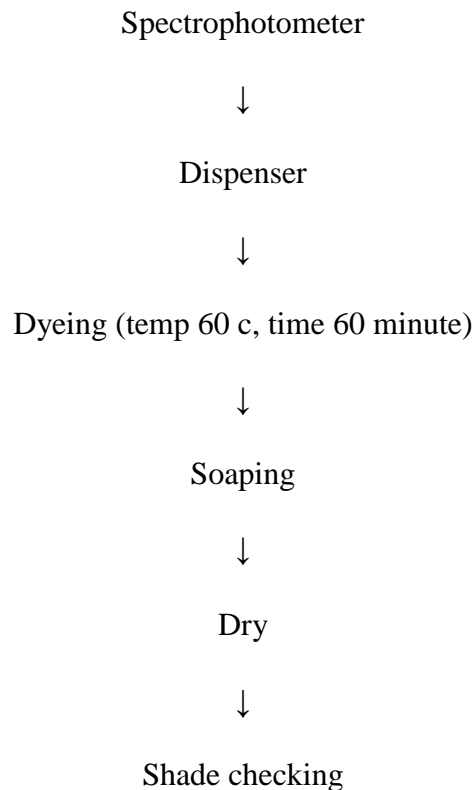
- Firstly, correction recipe is taken by spectrophotometer.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.
- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60^o c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is not matched.

Sample-21: (trial)

- Firstly, correction recipe is taken by spectrophotometer.
- 10 gm scoured, bleached 100% cotton single jersey is taken from the lab.

- Calculation the recipe.
- According to the recipe an auto dispenser machine takes dyes in proper proportion.
- Caustic soda and Glauber salt are taken and mixed with the dyes.
- After that fabric is fed to the machine for dyeing.
- The machine is runed 60° c temperature 60 minutes.
- After dyeing, do the fabric after process with the soap and do the fabric neutral fabric with the acetic acid.
- Lastly, fabric is dried by the oven.
- After that the dyed fabric compared with the standard dyed fabric in light box of different light source (D65 10deg.
- Dyed fabric is **matched**.

3.5 Process sequence of lab dyeing:



3.6 Reflectance value:

Reflectance curve and reflectance value are taken from spectrophotometer. Data tools and data color software are used for this test.

3.7 Different types of Testes:

3.7.1 Color Fastness to Wash:

Method: ISO 105 C06.

Procedure:

- Firstly, dyed sample is collected and conditioning for (25±2°C) to 6 hours.
- Creating a sample that is 04 cm by 10 cm in size.
- Affixing a piece of multi-fiber cloth of the same size to one corner of the specimen.
- Making a solution with sodium perborate 1gm/lt. and ECE detergent 4gm/lt.
- Placing the specimen with the multi-fiber fabric in the Rota wash machine.
- Using hot water to rinse, as appropriate.
- It is done to squeeze the sample with cold water (Hand Wash).
- Then specimen is dried at 60 c temperature in incubator.
- Then, all but one of the shorter ends of the stitching are removed.
- Making a test report and measuring the stains and color change in grey scale.

3.7.2 Color Fastness to Water:

Method: ISO 105 E01.

Procedure:

- Firstly, dyed sample is collected and conditioning for 4.30 to 6 hours.
- Creating a sample that is 04 cm by 10 cm in size.
- Affixing a piece of multi-fiber cloth of the same size to one corner of the specimen.
- Put the specimen in distilled water at room temperature and it will suck water.
- Place it on plates made of acrylic resin, then weigh the plates down.
- Place it in the oven and maintain a 37°C temperature for four hours.
- Open the specimen, then dry it in air that is over 60°C.
- With the use of grey scale, color change is evaluated.

3.7.3 Color Fastness to Perspiration:

Method: ISO 105 E04.

Procedure:

- Firstly, dyed sample is collected and conditioning for 4.30 to 6 hours.
- Creating two (one is for acid medium another is alkaline medium) sample that is 04 cm by 10 cm in size.
- Affixing a piece of multi-fiber cloth of the same size to one corner of the specimen.
- Put two specimens in two petri dish one is acidic and another is alkaline.
- Place it in the oven and maintain a 37°C temperature for four hours.
- Open the specimen, then dry it in air that is over 60°C.
- With the use of grey scale, color change is evaluated.

3.7.4 Color Fastness to Rubbing:

Method: ISO 105-X12.

Procedure

In the tests, the sample being tested is rubbed with both a dry and a wet rubbing cloth. A device known as a crock meter is typically used for this test, which involves rubbing a finger covered in cotton rubbing cloth and maintain 10 cycles at 10 second while maintaining a constant pressure. For pile textiles, a rectangular-shaped finger (19 25.4 mm) is used, while for other fabrics, a cylindrical-shaped finger (16 mm in diameter) is utilized. Both dry and wet cotton rubbing cloths are used for the rubbing tests. Using the staining grey scale, the level of staining on the two cotton rubbing cloths is determined.

3.7.5 pH Test:

Method: ISO 3071.

Procedure:

- Firstly, the dyed fabric should be cut in the ratio of (0.5 X 0.5) cm².
- A solution should be prepared with 7.5 gm of KCl in one liter of water.
- Now, Calibrate the pH meter with the buffer solution (pH- 4; 7; 10).
- Samples of 100ml solution (three per batch) of the prepared solution should be given in conical flasks. Liquor Ratio: 1:50.

- Each conical flask requires 2 gm of sample. Total sample will be 6 gm.
- Now, shake the conical flask for 2 hours with the help of rapid machine.
- Now, the pH should be determined with the help of a pH meter.

3.7.6 Pilling Test:

Method: ISO 12945-1.

Procedure:

- Cut sample fabric first with the template (125 X 125 mm) (from back side, not face).
- Sew the sample through the line.
- 4 tests in total (length and width wise).
- Mount the sample in the tube.
- Use Tape keeping 6 mm uncovered.
- Sample in this way should be rested for 16 hours.
- The sample should be rotated for 4 hours and 14900 cycles.
- The sample should be assessed with ENPA photo scale in Pilling viewing cabinet.

3.8 Ratings of color change & staining:

Grade-1: very poor (great loss in depth).

Grade-2: poor (significant loss).

Grade-3: fair (appreciable loss).

Grade-4: good (slightly loss in depth).

Grade-5: excellent (no change).



CHAPTER-4

EXPERIMENTAL DATA ANALYSIS

4.1 Experimental Data and Analysis:

Dyeing 100% Cotton Single Jersey with Reactive Dye.

4.1.1 Batch: A

Sample No: 01 (Standard)

Table no: 01

Recipe for Dyeing	
M: L	1:8
Sample Weight	10 gm
Remazol Yellow RR	0.345%
Remazol Red RR	0.097%
Remazol Blue RR	0.135
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample:



Sample No: 02

Table no: 02

Recipe For Dyeing	
M:L	1:4
Sample Weight	10 gm
Remazol Yellow RR	0.310%
Remazol Red RR	0.092%
Remazol Blue RR	0.121%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):**Sample No: 03**

Table no: 03

Recipe For Dyeing	
M:L	1:4
Sample Weight	10 gm
Remazol Yellow RR	0.276%
Remazol Red RR	0.082%

Remazol Blue RR	0.108%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):



Sample No: 04

Table no: 04

Recipe For Dyeing	
M:L	1:4
Sample Weight	10 gm
Remazol Yellow RR	0.310%
Remazol Red RR	0.095%
Remazol Blue RR	0.125%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):



Sample No: 05

Table no: 05

Recipe for dyeing	
M:L	1:4
Sample Weight	10 gm
Remazol Yellow RR	0.345%
Remazol Red RR	0.097%
Remazol Blue RR	0.135%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):**4.1.2 Batch: B****Sample No: 06**

Table no: 06

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.345%
Remazol Red RR	0.101%

Remazol Blue RR	0.139%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):



Sample No: 07

Table no: 07

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.345%
Remazol Red RR	0.1038%
Remazol Blue RR	0.135%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):



Sample No: 08

Table no: 08

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.345%
Remazol Red RR	0.0999%
Remazol Blue RR	0.135%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):**Sample No: 09**

Table no: 09

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.345%
Remazol Red RR	0.1067%
Remazol Blue RR	0.128%
Salt	40 gm/L
Soda	10 gm/L

Time	60 min
Temperature	60° C

Sample (not match):



Sample No: 10

Table no: 10

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.345%
Remazol Red RR	0.0999%
Remazol Blue RR	0.137%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):



Sample No: 11

Table no: 11

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.345%
Remazol Red RR	0.104%
Remazol Blue RR	0.121%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):**4.1.3 Batch: C****Sample No: 12**

Table no: 12

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.348%
Remazol Red RR	0.098%
Remazol Blue RR	0.135%
Salt	40 gm/L

Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):



Sample No: 13

Table no: 13

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.348%
Remazol Red RR	0.097%
Remazol Blue RR	0.135%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):



Sample No: 14

Table no: 14

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.348%
Remazol Red RR	0.099%
Remazol Blue RR	0.135%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

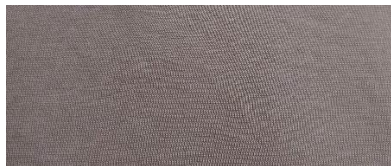
Sample (not match):**Sample No: 15**

Table no: 15

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.345%
Remazol Red RR	0.098%
Remazol Blue RR	0.135%
Salt	40 gm/L
Soda	10 gm/L

Time	60 min
Temperature	60° C

Sample (not match):



Sample No: 16

Table no: 16

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.345%
Remazol Red RR	0.098%
Remazol Blue RR	0.133%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):



Sample No: 17

Table no: 17

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.362%
Remazol Red RR	0.109%
Remazol Blue RR	0.128%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):**4.1.4 Batch: D****Sample: 18**

Table no: 18

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.345%
Remazol Red RR	0.090%
Remazol Blue RR	0.122%

Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):



Sample: 19

Table no: 19

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.35%
Remazol Red RR	0.096%
Remazol Blue RR	0.126%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):



Sample: 20

Table no: 20

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.36%
Remazol Red RR	0.097%
Remazol Blue RR	0.124%
Salt	40 gm/L
Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (not match):**Sample: 21**

Table no: 21

Recipe For Dyeing	
M:L	1:4
Sample Weight	10gm
Remazol Yellow RR	0.33%
Remazol Red RR	0.09%
Remazol Blue RR	0.12%
Salt	40 gm/L

Soda	10 gm/L
Time	60 min
Temperature	60° C

Sample (match):





CHAPTER-05

RESULT & DISCUSSION

5.1 CMC REPORT:

(For sample: 04, batch-D against the sample: 01, batch-A (standard)).

Batch is:

Darker

More Greener

More Bluer

Table no: 22

Ill/Obs	CMC Decision	CMC DE	DL*	Da*	Db*	DC*	DH*	Metamerism Index
F11 10 Deg	Pass	0.26	-0.57	-0.06	-0.02	-0.04	0.05	
msTL84- 10	Pass	0.26	-0.58	-0.04	-0.02	-0.03	0.03	0.02
D65 10 deg	Pass	0.29	-0.56	0.09	-0.01	0.04	-0.09	0.17

5.2 Reflectance value:

This (wavelength vs reflectance) graph is collected from data color:

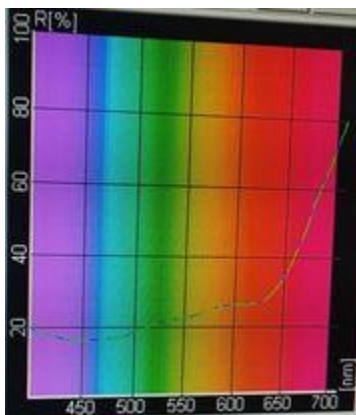


Table no: 23

Wavelength	Reflectance%
450	16
500	18
550	22
600	28
650	36
700	72

From graph, minimum reflectance 16.

$$R_{min} = 16/100$$

$$= 0.16$$

$$\text{Color strength K/S} = (1-R_{min})^2/2R_{min}$$

$$= ((1-0.16) (1-0.16))/2*0.16$$

$$= 0.7056/0.32$$

$$= 2.205$$

5.3 Result of Physical Testing of Sample:

5.3.1 Color Fastness to Wash:

Method: ISO-105 C06

Table no: 24

M:L	Change in Color	Color Staining					
		Acetate	Cotton	Polyamide	Polyester	Acrylic	Wool
1:8	4	4-5	4-5	4-5	4-5	4-5	4-5
1:4	4	4-5	4-5	4-5	4-5	4-5	4-5

There is no change in color & color staining between 1:8 (sample no-01, batch no A) & 1:4 (Sample no-04, batch no D).

5.3.2 Color Fastness to Water:

Method: ISO-105 E01

Table no: 25

M:L	Change in Color	Color Staining					
		Acetate	Cotton	Polyamide	Polyester	Acrylic	Wool
1:8	4-5	4-5	4-5	4-5	4-5	4-5	4-5
1:4	4-5	4-5	4-5	4-5	4-5	4-5	4-5

There is no change in color staining between 1:8 (sample no-01, batch no A) & 1:4 (Sample no-04, batch no D).

5.3.3 Color Fastness to Perspiration:

Method: ISO-105 E04

Table no: 26

M:L	Medium	Color Change	Color Staining					
			Acetate	Cotton	Polyamide	Polyester	Acrylic	Wool
1:8	Acid	4-5	4-5	4-5	4-5	4-5	4-5	4-5
	Alkaline	4-5	4-5	4-5	4-5	4-5	4-5	4-5
1:4	Acid	4-5	4-5	4-5	4-5	4-5	4-5	4-5
	Alkaline	4-5	4-5	4-5	4-5	4-5	4-5	4-5

5.3.4 pH Test:

Method: ISO-3071


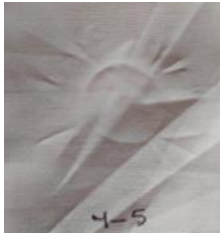

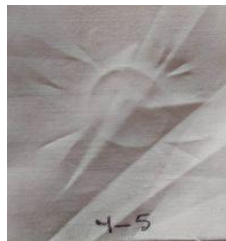
Table no: 27

M:L	pH
1:8	6.70
1:4	6.50

5.3.5 Color Fastness to Rubbing:

Method: ISO-105x12





Table no: 28

M:L	Dry		Wet	
	Rating	Sample	Rating	Sample
1:8	4-5		4-5	
1:4	4-5		4-5	

5.3.6 Pilling Test:

Method: ISO 12945-1

Table no: 29

M:L	Original	Tested
1:8		
1:4		



5.2 Problem:

During doing this experiment we found some problems

1. Uneven shade.
2. Soda mark.
3. Shade matching so difficult.



CHAPTER-06

CONCLUSION

6.1 Conclusion:

In this experiment we use reactive dye, 100% cotton single jersey and many chemicals. We match the shade against the high liquor ratio to lower liquor ratio. And test both sample but there is no change between each other the fastness properties of sample were same.

In this study, we can also see that the impact of liquor ratio of 100% cotton single jersey.

We can see that,

- ✓ By changing the liquor ratio (decrease) the shade% of sample has been changed.
- ✓ There is no change of color fastness result between liquor ratio 1:8 and 1:4. We can say that the testing result of both liquor ratio are same.
- ✓ pH value for different liquor ratio is different.
- ✓ We match the shade by the help of spectrophotometer.



6.2 References:

1. <https://en.wikipedia.org/wiki/Dyeing#:~:text=Dyeing%20is%20the%20application%20of,dyes%20and%20particular%20chemical%20material>.
2. <https://en.wikipedia.org/wiki/Dye>
3. https://www.google.com/search?q=what+is+reactive+dye&rlz=1C1CHBD_enBD959BD959&oq=what+is+reactive+dye+&aqs=chrome..69i57j0i512i3j0i15i22i30j0i22i30i4j0i15i22i30.8184j0j7&sourceid=chrome&ie=UTF-8
4. <https://textilefashionstudy.com/reactive-dyes-definition-classification-properties-and-influencing-factors/>
5. <https://chemwhite.com/properties-of-reactive-dye/>
6. <https://textilelearner.net/fabric-shade-checking-system/>
7. <https://www.sciencedirect.com/science/article/pii/B9781845695392500028>
8. https://www.google.com/search?q=History+of+cotton&rlz=1C1CHBD_enBD959BD959&oq=History+of+cotton+&aqs=chrome..69i57j0i512i9.811j0j15&sourceid=chrome&ie=UTF-8



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