DAFFODIL INTERNATIONAL UNIVERSITY
DHAKA, BANGLADESH

PROJECT

STUDY ON EFFECT OF DYEING IN GSM VARIATION ACCORDING TO THE DEPTH OF SHADE

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DECLARATION

We declare that this Project paper is submitted in partial fulfillment of the requirement of B.SC In Textile Engineering degree of Daffodil International University, Dhaka.

We hereby declare that, this project has been done by us under the **MD.RABIUL ISLAM KHAN,** Lecture Department of TE supervising Teacher Daffodil International University.

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Finally, we would like to convey our acknowledgement that we remain responsible for the inadequacies and errors, which doubtless remain.

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ABSTRACT

At first we collect some of the Dyeing fabric sample samples along with required data which are needed to commence our project work with effective analysis. We also separate the fabrics according to their class so that we can establish an acceptable result which will be perfect for effective use and will help to carry out further activities depending on the established form of work.

During our industrial attachment we manage to watch carefully and effectively the Dyeing fabric sample and his recipe, fabric knit GSM, finished GSM and the major factors which are necessary to know different types of variation and variable on which the whole fabric construction depends. Our efforts were to develop a dependable way so that we can easily visualize or can forecast the resulting fabric specification with required configuration.

We have tried our best to emphasize on the adjustable points on which fabric G.S.M., stitch length, Shrinkage, Shade % & compactness directly or indirectly depend. The theoretical as well as the practical knowledge that we gathered from our classes and in the industry, help us to perform our project with credit and for this we specially convey thanks to our honorable teachers.

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CHAPTER 1

GENERAL INTRODUCTION

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Textiles and clothing will always be essential goods for human beings. Spinning and weaving were the main activities that drove the Industrial Revolution in the 18th century. Since then the textile industry has been a leading industry in the initial phase of industrialization in many countries in different periods of time in the world.

Fabric is a manufactured assembly of fibers and yarns that has substantial surface area in relation to its thickness and sufficient cohesion to give the assembly useful mechanical strength. Fabrics are most commonly woven or knitted but the term includes assemblies produced by felting, lace making, net making, non woven processes and tufting. Our project basically is on knitted fabric specification and machines which are related to knitted fabric production.

The title of our project work is STUDY ON EFFECT OF DYEING IN GSM VARIATION ACCORDING TO THE DEPTH OF SHADE.

A precise statement of a set of requirement to be satisfied by a materials, product, and system or service that indicates the procedures for determining whether each of the requirements is satisfied. In the analysis of Dyeing fabric sample and his recipe, Fabric knit GSM, Fabric finished GSM, yarn count (warp & weft), and Fabric width but in case of GSM of knitted fabrics, Shade percentage of dyed Fabric , Shrinkage and stitch length are mainly considered.

Our target is to find out the easy process to get decision about GSM variation depth of shade, yarn count selection, stitch length selection, Dying Process & recipe. We strongly think that by this process we can get decision about yarn count, Fabric GSM, Dying process & shade percentage for the single jersey, and Rib fabric.

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CHAPTER 2

LITERATURE REVIEW

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GSM:

Fabric GSM means grams per square meter of a Knit, Woven or Non woven fabric. It is essential to know the weight of the fabric before manufacturing and after getting the finished fabric.GSM varies from fabric to fabric especially with the count of fabric. Through Pretreatment, Dyeing & Finishing GSM changes to a greater extent.

GSM = grams per square meter

- Cut a 1 meter by 1 meter of fabric and weigh it in grams
- weigh the fabric in grams (G)
- measure the length in meters (L) and width in meters (W).

Some Terminology of knitted fabric:

There are different types related parameters are mentioned below:

1. Wales per inch
2. Course per inch
3. Stitch length
4. Yarn count
5. Yarn twist
6. Twist liveliness
7. Yarn type
8. Gram per square meter (GSM)

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9. Spirality

10. Shrinkage

11. Area density

12. Fabric thickness

GSM:

There are some formulas for calculating the GSM of a knitted fabric:

Direct system GSM calculation formula is given below:

In Tex system:

$$GSM = \frac{\text{CPI} \times \text{WPI} \times \text{ Stitch length(mm)} \times \text{ 39.37} \times \text{ 39.37 } \times \text{ Tex}}{1000 \times 1000}$$

In Denier system:

$$GSM = \frac{\text{WPI} \times \text{CPI} \times \text{ Stitch length} \times \text{ 39.37} \times \text{ 39.37 } \times \text{ conut in Denier}}{1000 \times 9000}$$

In Woolen system:

$$GSM = \frac{\text{WPI} \times \text{CPI} \times \text{ Stitch length(mm)} \times \text{ 39.37} \times \text{ 39.37 } \times \text{Woolen conut} \times 453.6}{1000 \times 256 \times 0.9144}$$

Indirect system GSM calculation formula is given below:

In English (Ne) system:

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$$GSM = \frac{\text{WPI} \times \text{CPI} \times \text{ Stitch length} \times \text{ 39.37} \times \text{ 39.37 } \times \text{ 453.6}}{1000 \times 840 \ \times \text{conut in Ne } \times 0.9144}$$

In Metric system:

$$GSM = \frac{\text{WPI} \times \text{CPI} \times \text{ Stitch length(mm)} \times \text{ 39.37} \times \text{ 39.37 } \times \text{ 1000}}{1000 \times 1000 \times \text{count in Nm}}$$

Measurement of GSM:

GSM is a very important parameter for specified a certain quality of knitted fabric. The production of knitted fabric is calculated in weight. The GSM cutter is very popular and easy usable GSM testing instrument used in most knitted factory. But the construction of this cutters very simple. It is circular disk of 100 square cm area with sharp blade attached to its edge. So100 square cm of fabric can easily cut by it and weighted at the electric balance to get GSM reading.

Another formula is the following

$$GSM = \frac{\text{Ks } \times \text{Tex}}{\text{Stitch length(mm)}}$$

Where, Ks are a constant. Its value is different for different fabric structure and fabric type. Ks is calculated and estimated as below:

$$\text{Ks} = \frac{\text{GSM } \times \text{Stitch length}}{\text{Tex}}$$

Fabric	Colour	Value of ks
Single jersey	Average	19.55
Single jersey	Average	22.4
Double lacoste	Average	25
Polo interlock	Average	39.3
1×1 Rib	Average	24.5
1×1 Rib	Average	26.5

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2×1 Rib	Average	28.3
Flat back rib		81
3 Thread fleece		40.92

COMMENT:

It is very convenient to determine the stitch length against the required GSM by using the value of Ks. We could not determine the value of Ks for other decorative fabric. It requires large time and industry.

GSM DEPENDS ON:

- . TYPE OF YARN:

The main material for knitting process is yarn. The quality of knitted yarn should be like as follows:

Parameters	**30/1 Cotton Combed**		**30/1 Cotton Carded**		**30/1 poly Cotton**	
	Best	Acceptable limit	Best	Acceptable limit	Best	Acceptable Limit
Uniformity %	9-9.5	9.7-10.2	11.5-12.1	12.8-13.5	9.5-9.8	10.4-10.7

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Thin (-50%)	0	3-5	16.22	50-60	2-3	7-10
Thin (+50%)	7-12	32-43	75-90	250-300	15-20	34.42
Neps (+200%)	38-47	73-88	140-175	300-380	30-45	48-58
Hairiness	4.0-4.4	4.6-4.9	4.75-5.1	5.5-5.8	4-4.44	4.45-4.8
Tenacity(CN/tex)	21.8-22.6	18.4-18.9	16.7-17.6	16.2-15.4	25.5-24	23.4-22.1
Elongation	6.7-6.9	6.2-6.4	7.3-7.08	6.6-6.4	14.7-13.7	11.8-11.2

- YARN COUNT:

The following counts of yarn that are widely used for knitting process are given:

a) Cotton: 20/1, 24/1, 26/1, 28/1, 30/1, 34/1, 40/1 Ne.

b) Terylene cotton: 20/1, 24/1, 26/1, 28/1, 30/1 Ne.

c) CVC: 26/1, 28/1, 30/1, 34/1 Ne.

d) Spandex: 40D, 70D.

e) Polyester: 75D, 150D etc.

Other parameters are:

- Stitch length
- Fabric Structure.

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- Finishing process.
- Depth of shade.
- Stitch density.
- Machine gauge

Relation between Yarn Count, Fabric Type, Stitch Length and Finish Gsm:

Fabric Type	Yarn count	Stitch length (mm)	Color	D×G	Finished diameter(inch)	Finished GSM
plain s/j	18S/l	2.94	white	26×24	30	220-230
„	20s/l	2.98	white	30×24	33.5	200-210
„	24s/l	2.68	white	30×24	32	175-185
„	26s/l	2.66	white	30×24	31	160-170
„	28s/l	2.70	Avg	26×24	25	150-160
„	30s/l	2.68	Avg	30×24	30	130-140
„	34s/l	2.40	Avg	26×24	24	125-135
„	40s/l	2.44	Avg	24×24	20	100-110
single lacost	18s/l	3.00	Avg	30×24	46	245-255
„	24s/l	2.64	Avg	30×24	40	210-215
„	26s/l	2.60	Avg	30×24	36	200-210
„	30s/l	2.50	Avg	30×24	33	180-190
1×1 rib	26s/l	2.50	Avg	40×18	41	2470
„	24s/l	2.75	Avg	30×18	64	235
„	26s/l	2.45	Avg	40×18	40	245
„	26s/l	2.55	Avg	40×18	47	235
„	26s/l	2.65	Avg	32×18	32	230
„	36s/l	2.65	Avg	32×18	33	170
„	24s/l	2.95	Avg	34×18	32	220

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„	24s/l	2.90	Avg	40×18	38	225
„	28s/l	2.40	Avg	30×24	38.5	232
2×1 l rib	34s/l	2.60	Avg	40×18	23	190
„	34s/l	2.70	Avg	32×18	20	185
2×2 Rib	40s/l	2.76	Avg	30×20	35T	160
„	28s/l	2.87	Avg	34×18	32T	260
„	26s/l	3.25	Avg	34×18	31T	205
„	24s/l	3.50	Avg	34×18	31.5T	285
„	20s/l	3.25	Avg	34×20	55(op)	260
2×2 L/Rib	20/l+40D	3.10	Avg	30×18	18T	390
„	24/l+40D	2.90	Avg	30×18	18T	320
„	30/l+70D	2.90	Avg	30×18	18T	320
„	30/l+40D	2.98	Avg	30×18	18T	240
„	30/l+40D	2.80	Avg	30×18	18T	240

By the following three tables, we can summarize the above data:

FOR SINGLE JERSEY:

FINISHED GSM	COUNT	FINISHED DIA
140	30/1	Machine dia = Finished dia

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160	26/1	Machine dia+1 = Finished dia
180	24/1	Machine dia+2 = Finished dia
200	20/1	Machine dia+3 = Finished dia
220	18/1	Machine dia+4 = Finished dia

For 1×1 Rib

FINISHED GSM	COUNT	Gauge
150-200	30/1	18
210-220	28/1	18
220-230	26/1	18
240-250	24/1	18
280-300	20/1	18

For plain interlock

FINISHED GSM	count	gauge
200	40/1	24
180	40/1	24
220-230	34/1	24
240-250	30/1	24

N.B:

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If the fabric is to be Enzyme washed, the stitch length should be kept (10%) less than the normal range. Because, enzyme wash reduces the total weight of the fabric by removing the floating fiber and hairy fiber.

For light color, the finished GSM varies 1-2% from grey GSM.

For average color, the finished GSM varies 2-4%

If the GSM varies 25-30%, it is not only necessary to control the VDQ pulley dia but also yarn tension & take-up roller.

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CHAPTER 3

TERMINOLOGY & DEFINITION

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TERMINOLOGY AND DEFINITION OF DIFFERENT KEYWORDS ARE DISCUSSED BELOW:

1. WALES PER INCH:

Wales per inch means how many numbers of Wales are present in one inch, it is very important for calculation of knitted fabric GSM and fabric properties.

CALCULATION OF WALES PER INCH:

We calculated the number of Wales in 10 inch fabric unraveling the yarn. Then we divide the no of total Wales by 10 inch to getting the Wales per inch.

2. COURSES PER INCH:

Courses per inch mean how many numbers of courses are present in one inch. It is also very important for calculation of knitted fabric GSM.

CALCULATION OF COURSE PER INCH:

We calculated the number of course in five inch with the help of counting glass and needle. Then we divide the total no of course by five inch to getting the course per inch.

3. STITCH LENGTH:

Is the theoretically is as Stitch length is theoretically a single length of yarn which includes one needle loop and adjacent needle loops on either side of it. Loop exits in course in course length and it is that which influence fabric dimension and other properties including weight. In order to determine the stitch length, we count 100 no Wales or stitch and count its length by hanging the yarn on the stitch counter. The reading is found in mm unit.

Adjusting Straight Stitch Length:

We can set the Straight stitch values for stitch length.

To adjust Straight stitch length

1. Select the object.

2. Right-click Straight.

The Object Properties dialog opens

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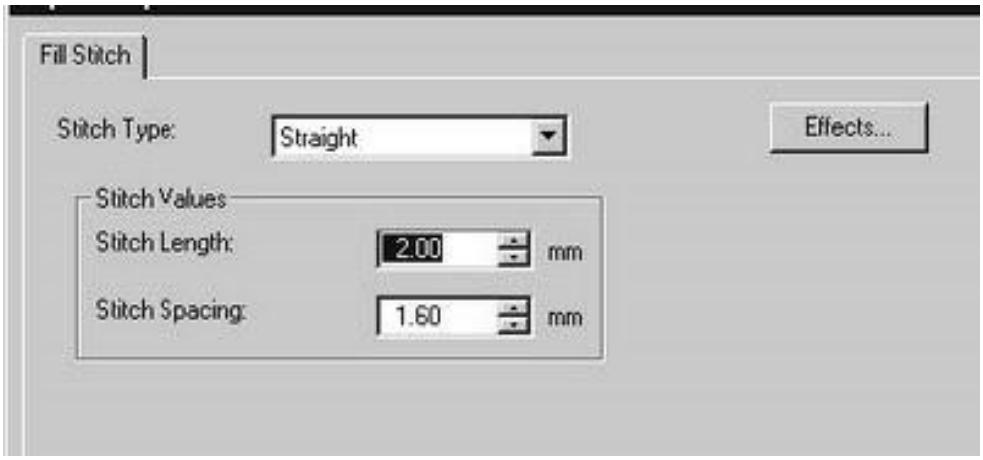
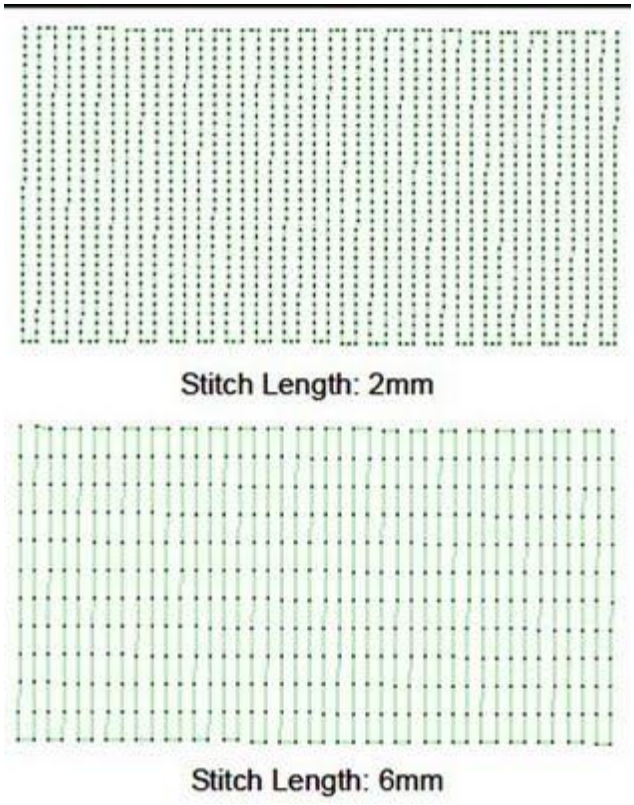


3. Adjust stitch settings in the Stitch Values panel:

• Stitch Length: This sets the length of each stitch



4. YARN COUNT:

Yarn count is a numerical expression of fineness or coarseness of yarn.Yarn count is calculated in two systems:

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a. Direct system

b. Indirect system

They are described below:

Direct system:

In this system the count lf yarn express the no. wt. units in one length unit. In direct system "higher the count, coarser the yarn" This system is used for thrown silk, artificial silk, jute etc and count calculation formula is the following:

$$\text{Count} == \frac{W \times l}{w \times L}$$

Here, W = weight of sample.

L = length of sample.

w = unit weight in system.

l = unit length in system

Indirect system:

In this system the count of yarn express the no of unit length per unit weight. In this system

Higher the yarn counts finer the yarn. It is generally used for cotton, worsted, woolen, linen etc and the yarn count calculation formula is the following:

$$\text{Count} == \frac{L \times w}{W \times l}$$

Here, W = weight of sample.

L = length of sample.

w = unit weight in system

l = unit length in system

MEASUREMENT OF YARN COUNT:

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We have fallowed a different way to find out the count of the yarn. At first we unravel a considerable no yarn from the fabric. Then we measured the total length of the yarn and measured the weight of that no of yarn. From these weights, we find out the count of the yarn. The equation we followed is as follow:

$$\text{Count} = \frac{\text{n} \times \text{l} \times 453.6}{\text{Wt} \times 36 \times 840}$$

Where, n= number of yarn in bundle.

L= length of yarn.

Wt= weight of yarn

Fabric width:

Fabric width can be calculated by the following formula:

$$\text{Fabric width} = \frac{\text{Course length} \times \text{Stitch length}}{\text{Kw}}$$

$$= \frac{\pi \times \text{d} \times \text{G} \times \text{Stitch length}}{\text{Kw}}$$

Where, Stitch length is in cm

D = Machine diameter,

G = Machine Gauge and

Kw = 38 (for dry relaxed state)

= 41 (for wet relaxed state)

= 42.2 (for finished relaxed stat

5. Yarn Twist:

Yarn Twist is the measure of the spiral given to a yarn in order to hold the constituent fibers or threads together.

According to textile institute “Twist is the spiral disposition of the components of a thread which is usually the result of the relative rotation of the two ends”.

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TPI greatly influenced the fabric Spirality.

Amount of Yarn Twist:

The amount of twist in a thread means the number of turns of twist per unit length in the twisted condition.

If “n” be the number of turns of twist in “l”(small l) inch of yarn, then the amount of twist will be T= n/l .

6: TWIST LIVELINESS

The tendency for a torsion texturized yarn to resume its twisted shape.

The Tendency of a Yam is To Twist or Untwist Spontaneously.

Examples Of Effects Which May Be Caused By Twist Liveliness Include Snarling Of Yarns During Processing And Spirality In Knitted Fabrics. Higher amount of twist leads high liveliness and creates fabric Spirality.

7. Type of yarn:

Are very much responsible for fabric GSM shrinkage and Spirality. Ring yarn and rotor, 100% cotton yarn, blended yarn, synthetic yarn give different property on gray and finished fabric.

8. GSM: Fabric GSM means grams per square meter of a knit, woven or non woven fabric.

9. Shrinkage:

A dimensional change resulting in a decrease in the length or width of a specimen subjected to specified condition is known shrinkage.

10. Spirality:

If the wales of the knitted fabric are not perpendicular to the course and skew to the right or left Spirality occurs in the fabric. This creates serious problem, especially in the apparel industry.

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CHAPTER 4

MATERAIAL AND METHODS

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ACTUAL DETERMINATION OF FABRIC GSM AND YARN COUNT FROM THECOLLECTED FABRIC:

S/N	CONUT	G.S.M
01	**36.74**	**116**
02	**32.13**	**134.33**
03	**30.87**	**172.33**
04	**37.77**	**121.33**
05	**31.63**	**139.33**
06	**28.8**	**142.63**
07	**27.12**	**176.67**
08	**35.29**	**154.33**
09	**29.99**	**165.33**
10	**26.97**	**168.33**
11	**32.13**	**134.33**
12	**32.92**	**139.33**
13	**25.57**	**181.67**
14	**22.71**	**138.33**

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Preparation and storage of stock dyes and chemicals

Available stock solution:

Red-0.1%, 0.5%, 1%, 2%

Yellow-0.1%, 0.5%, 1.0%, 2.0%,

Blue- 0.1%, 0.5%, 1.0%, 2.0%.

Preparation:

To prepare 0.1% stock solution, it necessary to mix 0.1 gm dye with 100cc water.

To prepare 0.5% stock solution, it necessary to mix 0.5 gm dye with 100cc water.

To prepare 1.0% & 2.0% stock solution similar procedure is followed.

To prepare 10% stock solution of soda ash, it necessary to mix 10 gm soda with 100cc water.

Recipe calculation

$$\text{Amount of dye solution} = \frac{\text{Fabric weight x Shade\%}}{\text{Stock solution\%}}$$

Liquor ratio=1:7

Sample weight= 5 gm

Example-

Recipe:

Remazol Torq G= 0.52%

Remazol Blue RR= 0.032%

Remazol Yellow RR= 0.0052%

Gluber Sault=40 gm/L

Soda ash= 8 gm/L

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Leveling agent= 1%

Calculation:

Rem Torq G $= \frac{0.52 \text{ X } 5}{0.1}$ =26 cc

Rem Blue RR $= \frac{0.032 \text{ x } 5}{0.1}$=1.6 cc

Rem Yellow RR $= \frac{0.0052 \ X \ 5}{0.1}$ =0.26

Salt $= \frac{40\text{X } 35}{1000}$ =1.4 gm

Soda $= \frac{8 \text{ X}35}{1000}$ = .28 gm

Leveling agent $= \frac{1 \text{ X}35}{1000}$=.035 gm

Total chemical= (6+1.6+.26)=7.86

Amount of water=35-7.86) =27.14cc

Method of Scouring and Bleaching:

Scouring & Bleaching**:**

Scouring is the process by which all natural & adventitious impurities such as oil, wax, fat, etc are removed to produce hydrophilic & clean textile material. It is the vital of wet processing.

Shortly we are defined - Scouring is a process by which we remove natural & added impurities from fabric or Textile raw materials. It is also called "KIERING" Kier boiling "Boiling out" etc.

Bleaching generally removes all impurities as the natural coloring matters which have to be broken down by bleaching either with an oxidizing or a reducing agent. Almost invariably the oxidizing agents give a more permanent white when the color is acted upon by a reducing agent; there is always the possibility that the oxygen in the air may deoxidize it to its original state.

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Thus, bleaches can be classified as either oxidizing agents or reducing agents.

The purpose of bleaching includes the removal of the various natural, added or acquired impurities form the grey cloth as efficiently as possible, with minimum or no damage to the fibre and leaving the fabrics and leaving the fabrics in a perfectly white state.

The removal of cotton wax, natural fats and added fatty matter and other impurities from the resized fabrics during the scouring process earned out in a kier leaves the material in a more absorbent condition than the grey fabric.

The process by which natural color bodies are completely removed and permanent whiteness effects are produced on fabric is called bleaching. Scouring was done in combine with bleaching process to remove impurities from cotton fabric. Following recipe has been introduced for those

RECIPE:

Detergent (Map: CRC) -0.3g/l

Stabilizer (Map: LC) -0.3 g/l

Bleaching Agent (H_2O_2) -3 g/l

Alkali (NOAH) -1.5g/l

Antricreasing Agent (ACN) -1 g/l

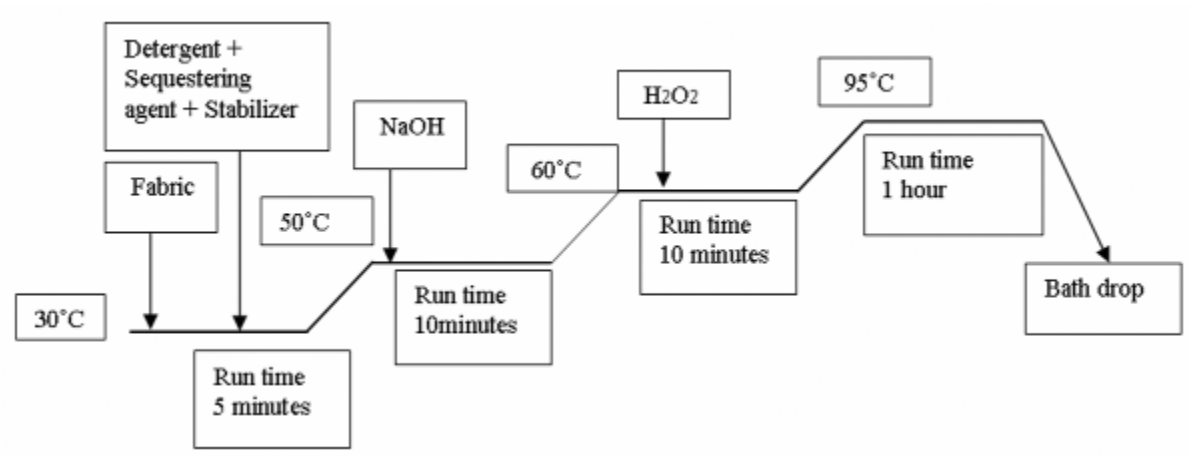
Temperature - 98°C

Time – 40hour

Material: Liquor – 1:7

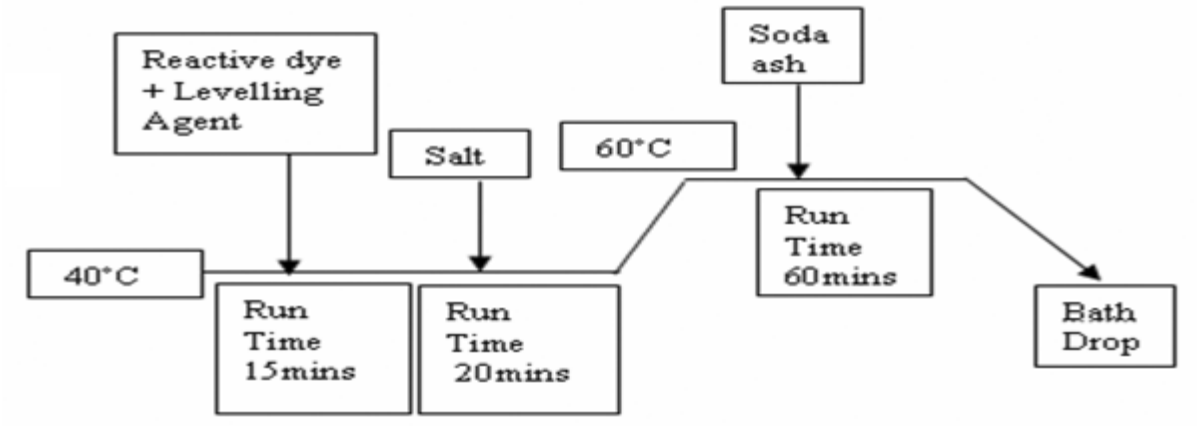
Temperature of Scouring & Bleaching (Deep shade): 98°C×30min

Temperature of Scouring & Bleaching (Light shade): 98°C×40-50min



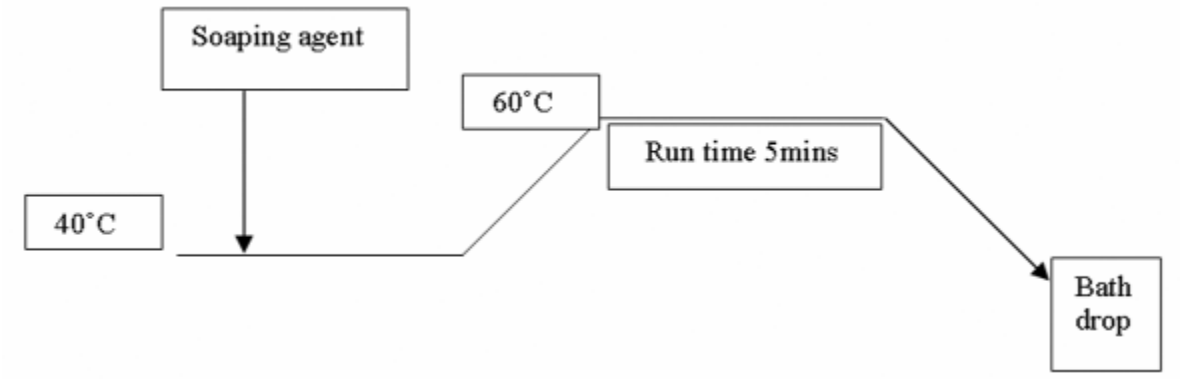
Method of dyeing:

In this investigation reactive dyes of red hue have been taken for dyeing the bleached fabric with shade 0.5% and 1.5%. Dye-A, Dye-B and Dye-C have been collected from three reactive dyestuff manufacturers.



Method of soaping

After dyeing soaping treatment was carried out on dyed samples with recipe mentione



Method of neutralization

After the soaping treatment, neutralization has been performed on dyed fabric at normal temperature with 0.5 g/l acetic acid to remove the residual alkalinity if present in fabric.

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Method of fixing:

Fixing is done by using fixing agent after soaping process. Following recipe & procedure was used for the fixation of reactive dyes with fibre.

Fixing agent – 1 g/l

Temperature - 45°C

Time – 10 minute

Material: Liquor – 1:7

PRODUCTION PLANNING AND SEQUENCE OF OPERATION:

Flow chart of dyeing

Grey fabric receive from knitting section

↓

Batching

↓

Selection machine no

↓

Fabric loading

↓

Select production program

↓

Pretreatment

↓

Select recipe for dyeing

↓

Recipe confirm by DGM/S.E

↓

Dyeing

↓

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After treatment

↓

Unload

Temperature:

-For cotton fabric scouring: 98ºC

- For cotton dyeing: 60^0C

- Polyester dying: 100^0-130^0C

Time:

- for white fabric 4-5hrs
- for 100%cotton 8-10hrs
- For 100% polyester 5hrs
- CVC/2parts 13-14 hrs

M: L ratio:

- For Dyeing M: L ratio maintained 1:7

Pretreatment process:

Wetting agent .3 g/l

↓

Stabilizer .3 g/l

↓

Ant creasing agent 1 g/l

↓

Caustic dosing 1.5 g/l (65℃*5´)

↓

H202 3 g/l (98℃*4´)

↓ PH=10.5˜11

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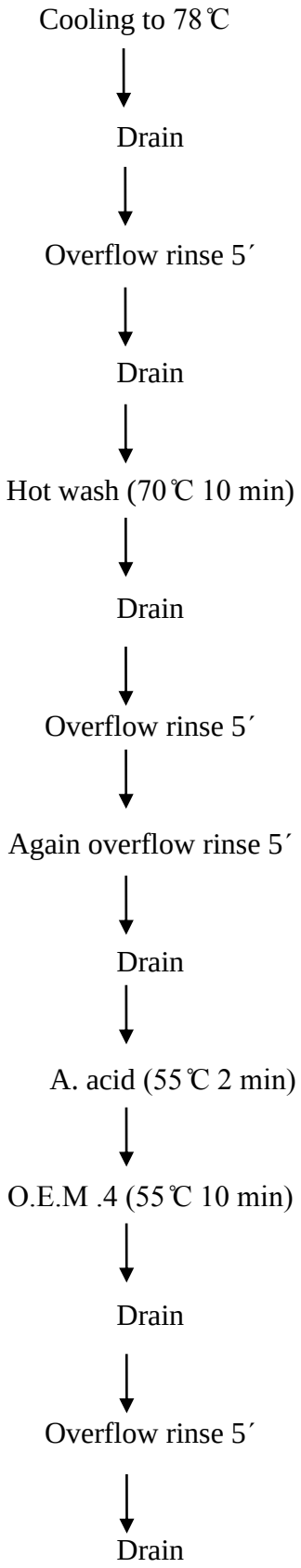

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Various types of shade

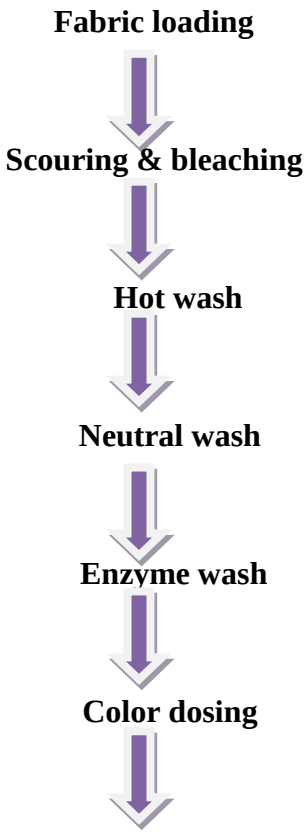
- Light
- Medium
- Dark
- White
- Black

Color or salt which should be dosed/dissolved first

- In case of 0-1.0 %(light)shade colour is dosed first then salt dissolving is performed.
- In case of 1-2.5% (medium) shade salt is dissolved at first then colour is dosing.
- In case of 3 & above %(dark) shade salt is dissolved at first then colour is dosing.

Dyeing procedure:

Flow chart of cotton fabric dyeing process:



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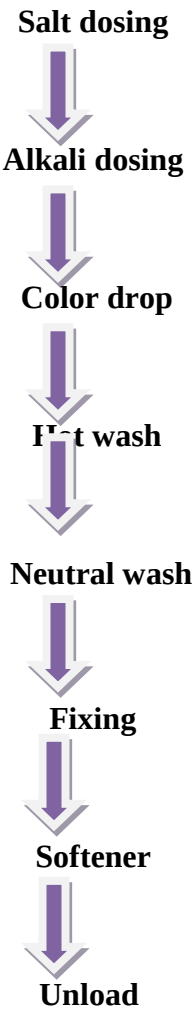
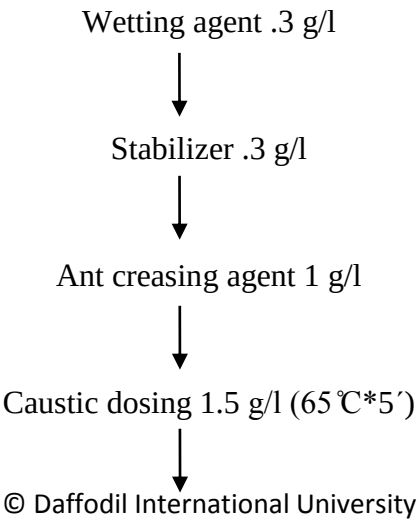


Dyeing process for dark shade & light shade in any fabric but (Except white colour)



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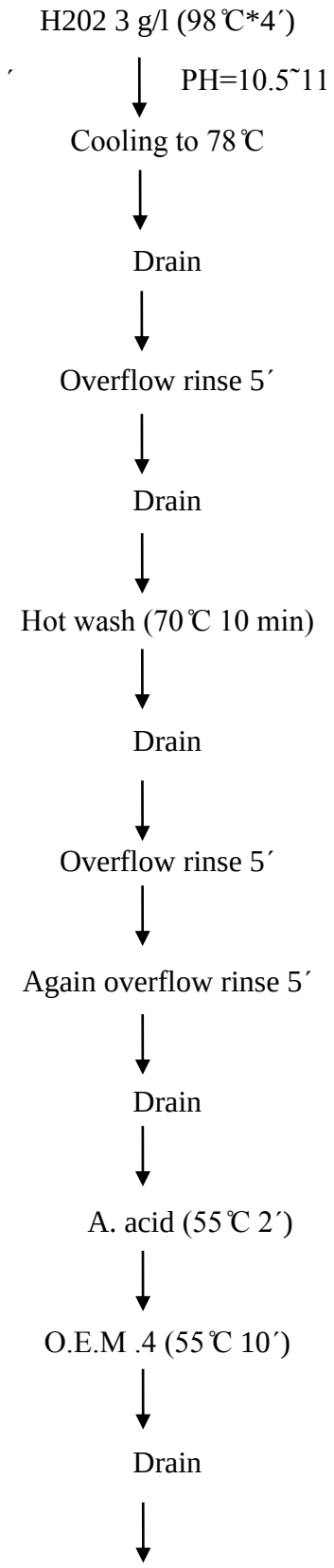

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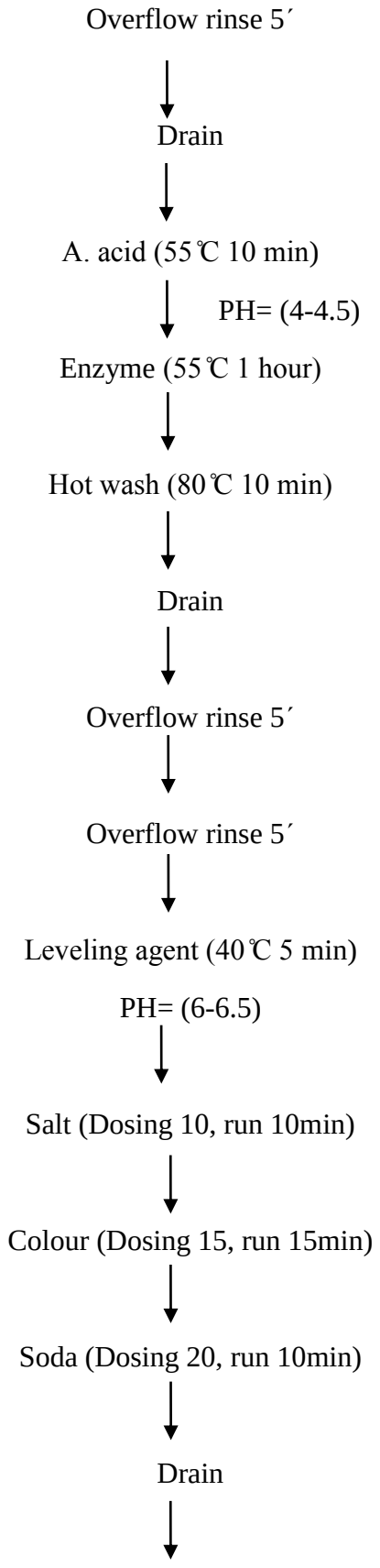

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Overflow rinse 5´

↓

Overflow rinse 5´

↓

A. acid (40℃ 20 min)

↓

Drain

↓

Overflow rinse 5´

↓

Overflow rinse 5´

↓

Colour hot wash

Nap: NC .3g/l (90℃ 20 min)

↓

Drain

↓

Overflow rinse 5´

↓

Overflow rinse 5´

↓

Drain

↓

Fixing agent (40℃ 20 min)

↓

Drain

↓

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Softener

Dyeing procedure for any color (Except white color)

Wetting agent (Map: CRC) = 0.3g/l
Map: LC=.3
Stabilizer **(H_2O_2)** = 3g/l
Ant creasing agent (ACN) = 1 g/l

↓ 60°C x 5'

Caustic → 1.5 g/l

↓ 60°C x 5'

Hydrogen peroxide → 3 g/l

↓ (60°C - 80°c)

Temperature rise up to 98°C 30'

↓

Hot wash (70℃ 10 min)

↓

Acetic acid →1.0 g/l

↓

H_2O_2 killer (O.E.M) → 0.4 g/l

↓ 50°C x 10'

Acetic acid → 0.5 g/l (p^H = 4.5)

↓

Enzyme → .15 g/l

↓ 55°C x 60'

Ant creasing agent (ACN) →1 g/l (90°C x 5')

↓

Leveling agent (Map: EXC) → 0.3 g/l

↓ 60°C x 5'

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Gluber Salt → (According to Shade %)

↓ 60oC x 10'

Dye stuff → (According to Shade %)

↓ 60°C x 15' (Runtime 15')

Soda ash → (According to Shade %)

↓ 60°C x 20' (Runtime 10')

Bath drop after shade matching

↓

Hot rinse

↓ 60°C x 10'

Soaping

↓ 80° - 95°C x 10'

Cold rinse

↓ 45°C x 10'

Neutralize (Acetic acid = **1** g/l)

↓ 45°C x 10'

Cold rinse (2times 5')

↓

Colour hot wash
Nap: NC .3g/l (90℃ 20 min)

↓

Fixing

↓ 40°C x 15'

Softener 0.5

↓ 40°C x 30'

Unload

Dyeing Curve of 100% Cotton fabric:

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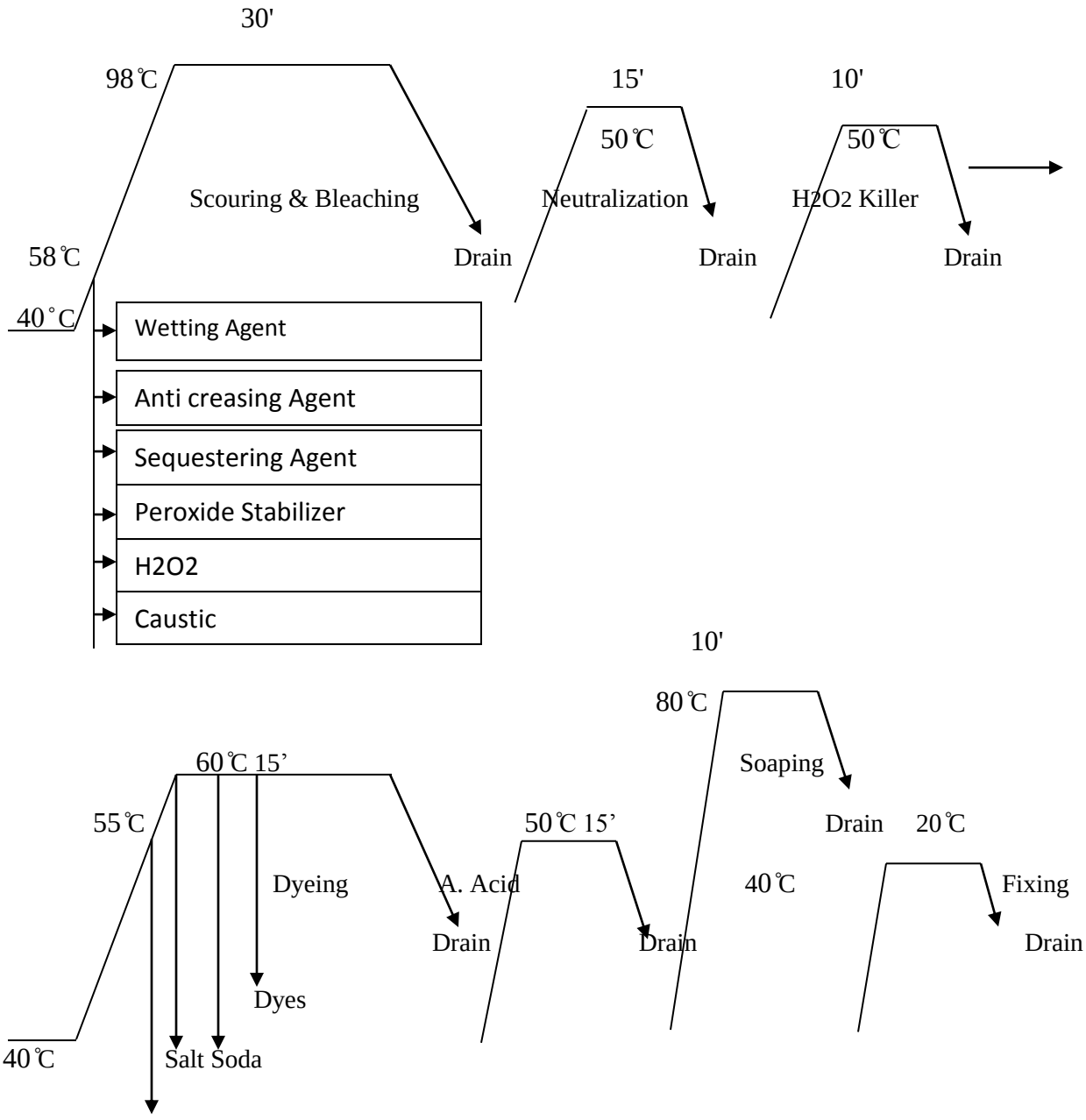

NOTE: Light shade color (Colour→ Salt→ soda)
Deep shade color (Salt → Colour → soda)

Production Chart for White Color Flow

Wetting agent (Map: CRC) = 0.3g/l
Map: LC=.3

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Stabilizer **(H_2O_2)** = 3g/l
Ant creasing agent (ACN) = 1 g/l

↓ 60°C x 5'

Caustic → 1.5 g/l

↓ 6 0°C x 5'

Hydrogen peroxide → 3 g/l

(60°C - 80°c)
Temperature rise up to 98°C 30

↓

Hot wash (95℃ 10 min)

↓

Acetic acid → 1.0 g/l

H_2O_2 killer (O.E.M) → 0.4 g/l

↓ 50°C x 10'

Acetic acid → 0.5 g/l (To control p^H = 4.5)

Enzyme → .15 g/l

↓ 55°C x 60'

Sequestering agent→1 g/l 80°C x 5'

↓

RBK COLOR (Dosing 80°C x 30')
Runtime 95°C x 20'

↓

Hot rinse 5'

↓

Hot rinse 5'

↓

Fixing

↓ 40°C x 15'

Softener 0.5

↓ 35°C x 30'

Unload

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PRODUCTION FLOW CHART FOR CVC:

For CVC fabric dyeing, at first polyester part is dyed at 130^0C according to dyeing procedure of 100% polyester dyeing.

Then cotton part is first scoured & bleached. Then cotton part is dyed according to dyeing procedure of 100% cotton.

Wetting agent (Map: CRC) = 0.3g/l
Map: LC=.3
Stabilizer **(H_2O_2)** = 3g/l
Ant creasing agent (ACN) = 1 g/l

↓ 60°C x 5'

Caustic → 1.5 g/l

↓ 6 0°C x 5'

Hydrogen peroxide → 3 g/l

(60°C - 80°c)
Temperature rise up to 98°C 30

↓

Hot wash (95℃ 10 min)

↓

Acetic acid → 1.0 g/l

H_2O_2 killer (O.E.M) → 0.4 g/l

↓ 50°C x 10'

Acetic acid → 0.5 g/l (To control p^H = 4.5)

Ant creasing agent (ACN) = 1 g/l

Lycol powder=1 g/l

↓

Water Level – As Required

↓

Dye dosing for 10 min

↓

Raise temp. to 130^0C & run for 45 min

↓

Drain

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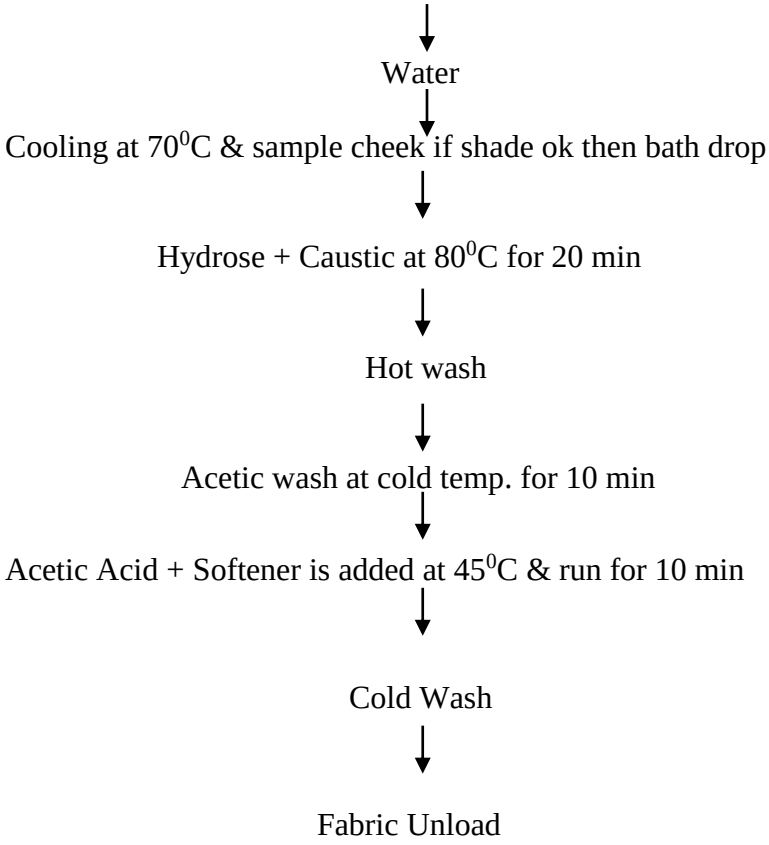

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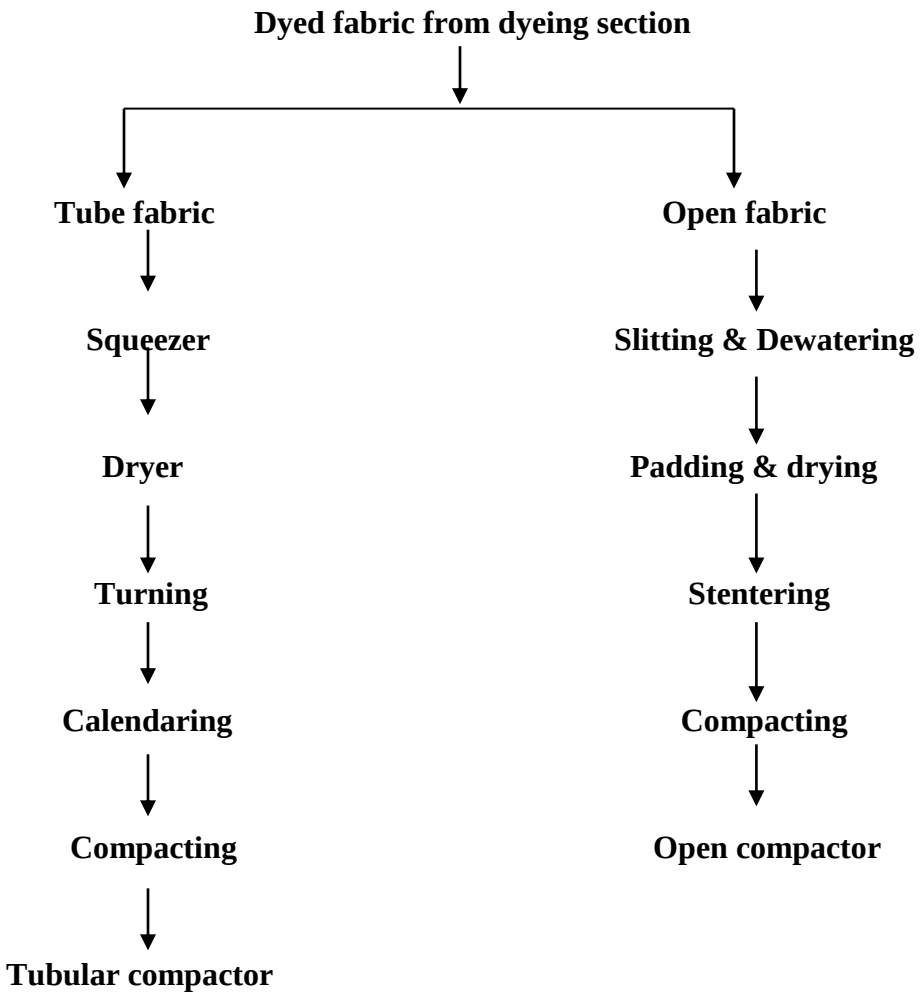
Sequence of operation in finishing section:



Machine used in finishing:

Dryer (Gas & Steam):

- Brand name: Dong Num
- Origin: Korea

Controlling parameters:

GSM: 15-35%
Shrinkage: 12-15 %

Functions of Dryer:

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- To dry dying fabric

Stenter m/c:

- Brand name: Shangai montex
- Country: China
- Brand name:ACC
- Country: Turkey

Functions of Stenter:

- Heat Setting
- Increase dimensional Stability of the Fabric
- Width control
- Spirality control
- Increase soft feel property of the fabric
- Fabric GSM control
- Softener Application
- Drying
- Moisture control
- Loop control

Compactor m/c:

- Brand name: Tube Tex
- Country: USA

Function of Compactor:

- Shrinkage Control
- Width control
- GSM control
- Smooth fabric

Hydro extractor:

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- Brand name: Dong Num
- Country: Korea

Function of Hydro extractor:

GSM	COLOUR	STITCH LENGTH
200	Black	2.50-2.55
220	White	2.60
180-190	Dirty off White	2.65
160	Blue navy	2.70

- To remove Excess water from fabric.

RELATION BETWEEN GSM, COLOUR AND STITCH LENGTH

For Single jersey fabric

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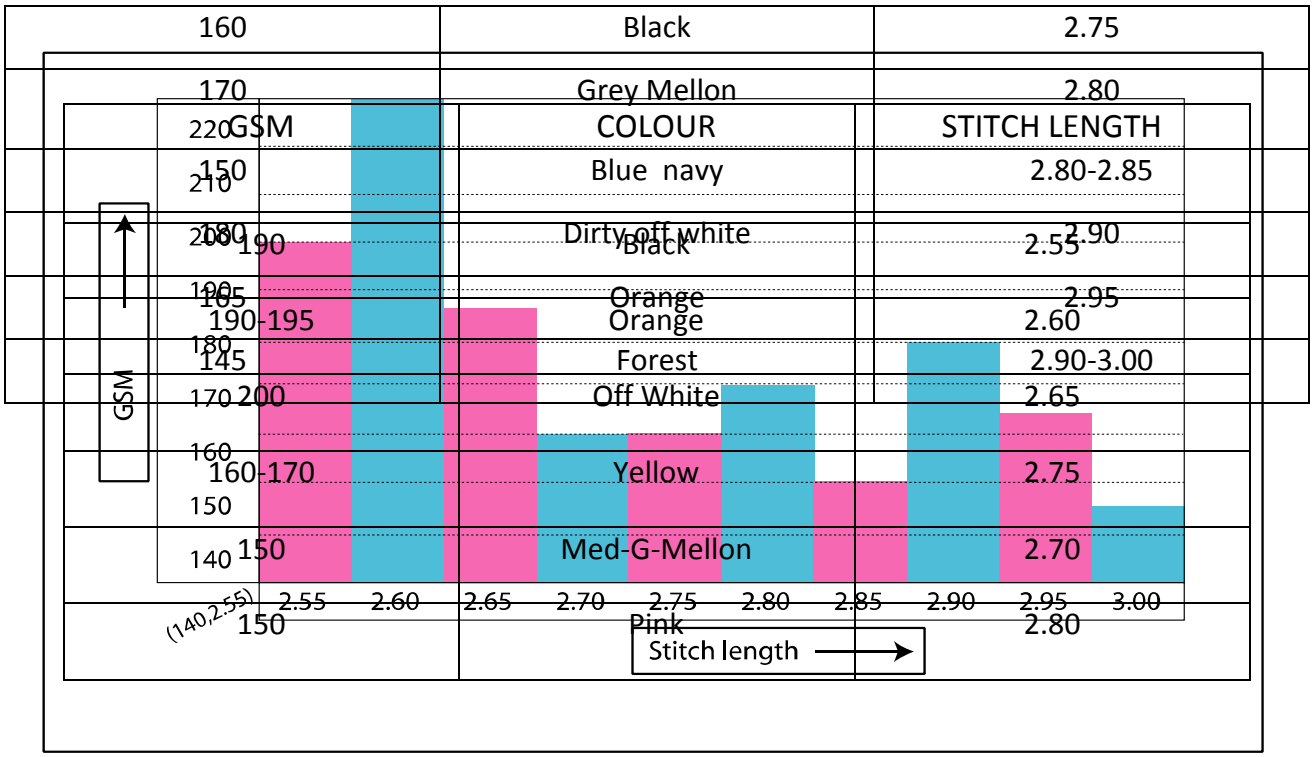
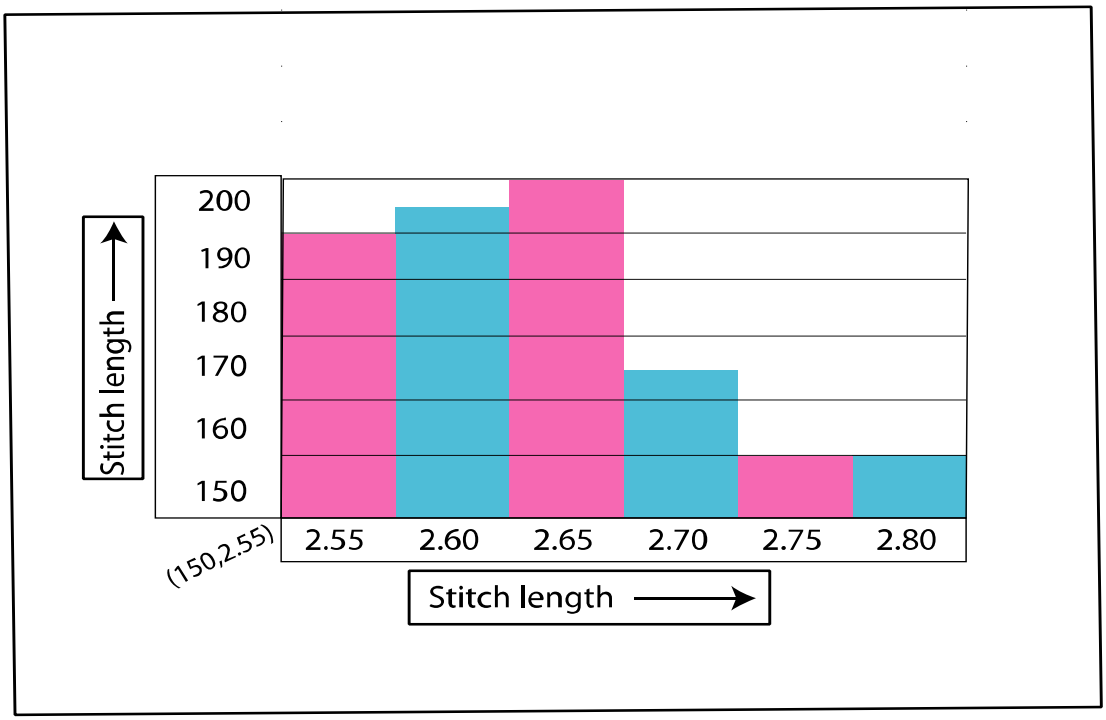


For Rib (1*1) fabric



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Relation between Fabric GSM, Shade percentage, Shrinkage & Spirality

FOR SINGLE JERSY FABRIC

SL NO	FABRIC TYPE	GSM (REQUIRED)	GSM (AFTER knitting)	GSM (AFTER Finishing)	COLOR	RECIPE%	SHRINKAGE (LENGH, WDITH)	SPIRALITY	STICH LENGTH
1	S/J	160	150	155	Grey-Mellon	*Remazol –Yellow-RR: 1.518* *Remazol –Red-RR: 0.589* *Remazol –Blue-B: 1.480* Salt-40 g/l ,Soda-12 g/l	-1,0	1	2.75
2	S/J	160	138	150	Blue-Navy	*Remazol –Yellow-RR: 1.672* *Remazol –Red-RR: 1.4214* *Remazol –Black-B: 5.415* Salt-30 g/l ,Soda-10 g/l	-1,-2	1	2.80
3	S/J	160	148	158	Blue	*Remazol –Yellow-RR: 0.86* *Remazol –Red-RR: 0.43* *Remazol –Blue- RSPL-RR: 6.3* Salt-80 g/l ,Soda-5 g/l	-1,-2	3	2.75
4	S/J	160	134	158	BLUE-Navy	*R/N –Yellow-3RX: 0.96* *R/N –Red-3BX: 0.23* *R/N–Black-B: 6.1* Salt-80 g/l ,Soda-5 g/l	-1,-1	1	2.78
5	S/J	160	145	148	Road	*Remazol –Yellow-RR: 0.686* *Remazol –Red-RR: 0.43* *Remazol –Blue-RSPL: 6.93* Salt-80 g/l ,Soda-5 g/l	-1,-2	1	2.78
6	S/J	160	150	153	Grey-Mellon	*Remazol –Yellow-RR: 1.96* *Remazol –Red-RR: 0.693* *Remazol –Blue- RR-RR: 1.588* Salt-80 g/l ,Soda-5 g/l	-3,-5	5	2.75

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7	S/J	160	148	158	Red	*Remazol –Yellow-RR: 0.58* *Remazol –Red-RR: 0.59* *Remazol –Blue-RSPL: 7.01* Salt-80 g/l ,Soda-5 g/	-2,-6	3	2.75
8	S/J	160	148	158	Royal	*Remazol –Yellow-RR: 0.79* *Remazol –Red-RR: 0.54* *Remazol –Blue-RSPL: 6.21* Salt-80 g/l ,Soda-5 g/	1,-2	1	2.78
9	S/J	160	145	155	Orange	*Remazol –Yellow-RR: 1.20* *Beza -Red -S2B:1.14* *Remazol -Blue- RR:0.0005* Salt-50 g/l ,Soda-5g/l	2,4	2	2.75
10	S/J	160	145	156	Yellow	Remazol –yellow- RR-1.54 Remazol -Red -RR-0.007 Remazol- Blue- RR-0.02 Salt-50 g/l ,Soda-5g/l	1,-2	1	2.70
11	S/J	160	150	160	White	Larhy–Yellow-RRX: 0.054 Lea to –Red-RR : 0.072 Lea to –Blue-RR: 0.0265 Salt-50 g/l ,Soda-5g/l	1,0	1	2.70

SL NO	**FABRIC TYPE**	**GSM (REQUIRED)**	**GSM (AFTER knitting)**	**GSM (AFTER Finishing)**	**COLOR**	**RECIPE%**	**SHRINKAGE (LENGTH, WDITH)**	**SPIRALITY**	**STICH LENGTH**
1	S/J	180	163-170	180	Black	Reactive –Yellow-3RX:1.672 Reactive –Red-3BX:1.42 Reactive –Black-B : 5.415 Salt-80 g/l ,Soda-5g/l	0,-3	2	2.70
2	S/J	180	180	192	Blue Navy	Reactive –Yellow-3RX:1.748 Reactive –Red-3BX:2.36 Reactive –Black-B :0.116 Salt-80 g/l ,Soda-5g/l	-3,-2	1	2.70
3	S/J	180	160	182	Navy	Reactive –Yellow-3RX:1.045 Reactive –Red-3BX :1.001 Reactive –Black-B : 2.26 Salt-70 g/l ,Soda-5g/l	-6,-2	1	2.72
4	S/J	180	160	175	Gray Mellon	*Remazol –Yellow-RR: 1.96* *Remazol –Red-RR: 0.693* *Remazol –Blue- RR-RR: 1.588* Salt-70 g/l ,Soda-5g/l	0,1	1	2.75 - 2.80
5	S/J	180	160	175	Black	Reactive –Yellow-3RX:.92 Reactive –Red-3BX:.43 Reactive –Blue SGR: .28 Salt-90 g/l ,Soda-5g/l	-7,0	3	2.75

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6	S/J	180	170	175	Light Yellow	Remazol –yellow- RR-1.54 Remazol -Red -RR-0.007 Remazol -Blue -RR-0.02 Salt-50 g/l ,Soda-5g/l	-8,2	4	2.75

FOR RIB (1/1) & (2/2) FABRIC

SL NO	FABRIC TYPE	GSM (REQUIRED)	GSM (AFTER knitting)	GSM (AFTER Finishing)	COLOR	RECIPE%	SHRINKAGE (LENGTH, WDITH)	SPIRALITY	STICH LENGTH
1	Rib (1/1)	180	166	185	Off-White	SYNO-4BK:567 Salt-30 g/l ,Soda-10g/l	-4,-6	1	2.65
2	Rib (1/1)	180	167	175	Off-White	SYNO-4BK:.15 BDW-.5 Salt-.5 g/l ,Soda-4g/l	-3,-6	2	2.65
3	Rib (1/1)	180	167	179	White (Appale)	*Remazol –Yellow-RR: 0.069* *Remazol –Red-RR: 0.556* *Remazol –Blue-RR: 0.004* Salt-30 g/l ,Soda-10g/l	1,2	1	2.75
4	Rib (1/1)	180	165	180	Med-G-Mellon	Remazol –Yellow-RR: 0.4 Remazol –Yellow-3GL-RR: 0.33 Di fix–T.BLUE G-RR: 2.20 Salt-60 g/l ,Soda15g/l	2,1	1	2.75
5	Rib (1/1)	180	160	182	Black	Remazol –Yellow-RR: 0.4 Remazol –Yellow-3GL-RR: 0.33 Di fix–T.BLUE G-RR: 2.20 Salt-60 g/l ,Soda-15g/l	3,-2	3	2.65

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6	Rib (1/1) - LYCRA	180	180	178	*Lipstick*	*Remazol –Yellow-RR: 0.069* *Remazol –Red-RR: 0.556* *Remazol –Blue-RR: 0.004* Salt-30 g/l ,Soda-10g/l	-4,-4	1	2.90

SL NO	**FABRIC TYPE**	**GSM (REQUIRED)**	**GSM (AFTER knitting)**	**GSM (AFTER Finishing)**	**COLOR**	**RECIPE%**	**SHRINKAGE (LENGTH, WDITH)**	**SPIRALITY**	**STICH LENGTH**
1	Rib (1/1)	200	180	197	Lagoon	*Remazol –Yellow-RR: 0.002* *Remazol –Red-RR: 0.5* *Remazol –Blue-RSPL: 3.8* Salt-70 g/l ,Soda-20g/l	0,-6	1	2.60
2	Rib (1/1)	200	180	198	Orange	*Remazol –Yellow-RR: 1.20* *Beza -Red -S2B:1.14* *Remazol -Blue -RR:0.0005* Salt-50 g/l ,Soda-5g/l	0,-6	1	2.60
3	Rib (1/1)	200	180	198	Appale	*Remazol –Yellow-RR:.4* *Remazol –YELLOW 3 GL–:.33* *Difix-T-Blue- G:2.20* Salt-50 g/l ,Soda-5g/l	-4,-6	2	2.60
4	Rib (1/1)	200	185-190	200	Blue	*Remazol –Yellow-RR:.02* *Remazol T/Blue G –:1.70* *Remazol- Blue- RR:.10* Salt-50 g/l ,Soda-5g/l	-2,-6	1	2.60

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5	Rib (1/1)	200	185-190	200	G-MELLON	*Remazol –Yellow-RR:.002* *Remazol –Yellow-3GL:1.04* *Remazol -Blue -RR:0.812* Salt-50 g/l ,Soda-5g/l	1,2	1	2.60
6	Rib (1/1)	200	175-180	198	Lipstic	*Remazol –Yellow-RR: 0.079* *Remazol –Red-RR: 0.689* *Remazol –Blue-RR: 0.054* Salt-50 g/l ,Soda-5g/l	1,2	1	2.60

Relation between Fabric GSM, Shade percentage, Shrinkage & Spirality:

FABRIC TYPE	GSM	Color	RECIPE	SHRINKAGE LENGTH, WIDTH	SPIRALITY	SAMPLE
S/J	180	Blue Navy	Reactive –Yellow-3RX:1.672 Reactive –Red-3BX:1.42 Reactive –Black-B : 5.415 Salt-80 g/l ,Soda-5g/l	0,-3	2	
S/J	192	Blue Navy	Reactive –Yellow-3RX:1.748 Reactive –Red-3BX:2.36 Reactive –Black-B :0.116 Salt-80 g/l ,Soda-5g/l	-3,-2	1	
S/J	182	Navy	Reactive –Yellow-3RX:1.045 Reactive –Red-3BX :1.001 Reactive –Black-B : 2.26 Salt-70 g/l ,Soda-5g/l	-6,-2	1	

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S/J	158	BLUE-Navy	*R/N –Yellow-3RX: 0.86* *R/N –Red-3BX: 0.43* *R/N–Black-B: 6.3* Salt-80 g/l ,Soda-5 g/l	-1,-1	1	
Rib (1/1)	180	BLUE-Navy	Reactive –Yellow-3RX:1.045 Reactive –Red-3BX :1.001 Reactive –Black-B : 2.26 Salt-80 g/l ,Soda-5 g/l	1,-1	1	
Rib (1/1)	158	BLUE-Navy	*R/N –Yellow-3RX: 0.96* *R/N –Red-3BX: 0.23* *R/N–Black-B: 6.1* Salt-80 g/l ,Soda-5 g/l	-1,-1	1	
S/J	158	Green	*Remazol –Yellow-RR: 0.86* *Remazol –Red-RR: 0.43* *Remazol –Blue- RSPL-RR: 6.3* Salt-80 g/l ,Soda-5 g/l	-1,-2	3	
Rib (1/1)	200	Appale	*Remazol –Yellow-RR:.3.79* *Remazol –YELLOW 3 GL:.23* *Difix-T-Blue- G:2.39* Salt-80 g/l ,Soda-5g/l	2,-3	1.5	
S/J	160	G-Mellan	Remazol –Yellow-RR: 0.35 Remazol –Yellow-RR: 0.50 Di fix–T.BLUE G-RR: 3.01 Salt-70 g/l ,Soda15g/l	-4,-2	1	1
S/J	200	G-Mellan	*Remazol –Yellow-RR: 1.96* *Remazol –Red-RR: 0.693* *Remazol –Blue- RR-RR: 1.588* Salt-70 g/l ,Soda5g/l	-3,-2	1	37
Rib (1/1)	180	Med-G-Mellon	Remazol –Yellow-RR: 0.4 Remazol –Yellow-3GL-RR: 0.33 Di fix–T.BLUE G-RR: 2.20 Salt-60 g/l ,Soda15g/l	2,1	1	42

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Rib (1/1)	197	Lagoon	*Remazol –Yellow-RR: 0.002* *Remazol –Red-RR: 0.5* *Remazol –Blue-RSPL: 3.8* Salt-70 g/l ,Soda-20g/l	0,-6	1	12
S/J	158	Royal	*Remazol –Yellow-RR: 0.79* *Remazol –Red-RR: 0.54* *Remazol –Blue-RSPL: 6.21* Salt-80 g/l ,Soda-5 g/	1,-2	1	67
S/J	158	Royal	*Remazol –Yellow-RR: 0.57* *Remazol –Red-RR: 0.63* *Remazol –Blue-RSPL: 5.19* Salt-80 g/l ,Soda-5 g/	1,1	1	12
S/J	175	Gray Mellon	*Remazol –Yellow-RR: 1.96* *Remazol –Red-RR: 0.693* *Remazol –Blue- RR-RR: 1.588* Salt-70 g/l ,Soda-5g/l	0,1	1	38
S/J	155	Grey-Mellon	*Remazol –Yellow-RR: 1.518* *Remazol –Red-RR: 0.589* *Remazol –Blue-B: 1.480* Salt-40 g/l ,Soda-12 g/l	-1,0	1	10
Rib (1/1)	198	Lipstic	*Remazol –Yellow-RR: 0.099* *Remazol –Red-RR: .389* *Remazol –Blue-RR: 1.054* Salt-70 g/l ,Soda-5g/l	1,2	1	80
S/J	155	Orange	*Remazol –Yellow-RR: 1.20* *Beza -Red -S2B:1.14* *Remazol -Blue- RR:0.0005* Salt-50 g/l ,Soda-5g/l	2,4	2	72
Rib (1/1)	198	Orange	*Remazol –Yellow-RR: 1.20* *Beza -Red -S2B:1.14* *Remazol -Blue -RR:0.0005* Salt-50 g/l ,Soda-5g/l	0,-6	1	5

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Viscose	175	Light Yellow	Remazol –yellow- RR-1.54 Remazol -Red -RR-0.007 Remazol -Blue -RR-0.02 Salt-50 g/l ,Soda-5g/l	-8,2	4	41
S/J	156	Yellow	Remazol –yellow- RR-1.54 Remazol -Red -RR-0.007 Remazol- Blue- RR-0.02 Salt-50 g/l ,Soda-5g/l	1,-2	1	71
	156	Yellow	Remazol –yellow- RR-3.54 Remazol -Red -RR-0.27 Remazol- Blue- RR-1.2 Salt-80 g/l ,Soda-5g/l	1,-2	1	96
S/J	160	White	Larhy–Yellow-RRX: 0.054 Lea to –Red-RR : 0.072 Lea to –Blue-RR: 0.0265 Salt-50 g/l ,Soda-5g/l	1,0	1	73
Rib (1/1)	185	Off-White	SYNO-4BK:567 Salt-30 g/l ,Soda-10g/l	-4,-6	1	14
(1/1)	179	White (Appale)	*Remazol –Yellow-RR: 0.069* *Remazol –Red-RR: 0.556* *Remazol –Blue-RR: 0.004* Salt-30 g/l ,Soda-10g/l	1,2	1	34

FABRIC TYPE	GSM	COLOUR	RECIPE	SHRINKAGE LENGTH , WIDTH	SPIRALITY	SAMPLE

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Rib (1/1)	175	Off-White	SYNO-4BK:.15 BDW-.5 Salt-.5 g/l ,Soda-4g/l	-3,-6	2	35
S/J	158	Red	*Remazol –Yellow-RR: 0.58* *Remazol –Red-RR: 0.59* *Remazol –Blue-RSPL: 7.01* Salt-80 g/l ,Soda-5 g/	-2,-6	3	66
RIB (2/2)	198	Orange	*Remazol –Yellow-RR: 1.20* *Beza -Red -S2B:1.14* *Remazol -Blue -RR:0.0005* Salt-50 g/l ,Soda-5g/l	0,-6	1	100
Rib (1/1)	198	Lipstic	*Remazol –Yellow-RR: 0.079* *Remazol –Red-RR: 0.689* *Remazol –Blue-RR: 0.054* Salt-50 g/l ,Soda-5g/l	1,2	1	101
RIB (2/2)	200	Blue	*Remazol –Yellow-RR:.02* *Remazol T/Blue G –:1.70* *Remazol- Blue- RR:.10* Salt-50 g/l ,Soda-5g/l	-2,-6	1	103
S/J	158	Royal	*Remazol –Yellow-RR: 0.45* *Remazol –Red-RR: 0.51* *Remazol –Blue-RSPL: 6.98* Salt-80 g/l ,Soda-5 g/	1,-2	1	19
	158	Lilac	Dri-yekk-cl-2R:.005 Dri-Red-cl-5B:.05 Dri-BLUE- Hfrl:.05 Salt-80 g/l ,Soda-5	2,1	1	n
	158	Lilac	Dri-yekk-cl-2R:2.21 Dri-Red-cl-5B:.1.53 Dri-BLUE-Hfrl:2.55 Salt-80 g/l ,Soda-5	6,2	2.3	28

Relation between Colour and knit GSM

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COLOUR	FINISHED FABRIC GSM - KNIT FABRIC GSM
BLACK	20-25
DARK	15-20
MEDIUN DARK	15
LIGHT	10-15
GREY MELLAN	15
WHITE	10-15

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CONCLUSION:

The project has come to a termination finally after lots of thinking, discussion and we uninterrupted trying. We really have worked hard to complete this project well ahead. We wished to make it as a replica of production so that it provides a complete knowledge about DYING. Though there were some limitations like shortage of time that compelled us to complete the thesis as soon as possible, even then we have tried to give our best.

In this project we have studied **Study on effect of dyeing in GSM variation according to the depth of shade**. Here it has been shown different types of GSM of single jersey and rib fabric. The reason of GSM variation is because of dyeing fault and because of dyeing fault it is increased fabric shrinkage and spirality. Because of this fault sometime buyer returns the fabric and company faces huge losses.

In addition, we wanted to discuss some more topics, such as - the problems and prospects of production job in respect of Bangladesh, how a Textile Engineer can contribute more in production job as many of the non - technical persons are doing this and why they are so efficient also merchandising. Because of the limitation of time as well as due to deficiency of enough sources of information, we could not meet these. Further research can be conducted on those topics.

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