Faculty of Engineering

Department of Textile Engineering

Thesis Report On

STUDIES ON THE PROPERTIES OF KNIT FABRICS AFTER DYEING WITH REACTIVE DYE

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Advance in Wet Processing Technology

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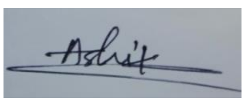
DECLARATION

We hereby declare that, this project report has been done by us under the supervision of **Tanvir Ahmed Chowdhury, Assistant professor,** Department of Textile Engineering, Faculty of Engineering, Daffodil International University. We also declare that, neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.



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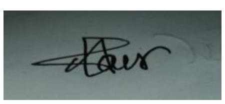

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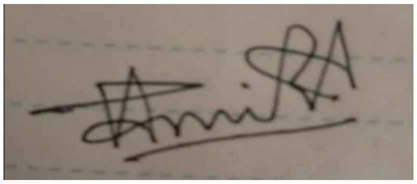
LETTER OF APPROVAL

This project report prepared by **MD: Ashikur Rahman (ID: 171-23-4889) & Ataur Rahman (ID: 171-23-4953)** is approved in Partial Fulfillment of the Requirement for the Degree of **BACHELOR OF SCIENCE IN TEXTILE ENGINEERING**. These said students has completed their project work under my supervision. During the research period I found them sincere, hardworking and enthusiastic.



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DEDICATION

We dedicate this project report to our beloved teacher and our parents.

ABSTRACT

This study has been sorted on effect of dyeing in physical characteristics of different type of cotton knitted fabric. For complete this study we have used pre-treated sample fabric and dyed in lab dyeing machine. We took multiple samples of four type of fabric. And these are Lycra single jersey, Single jersey, Single jersey slub, 2×2 Lycra rib. We dyed these fabric sample with same recipe, same atmospheric condition in light and deep shade. We have measured this samples GSM, WPI, CPI, Stitch length, Shrinkage, Abrasion resistance before dyeing and after dyeing. This measuring data we have compared with before dyeing and after dyeing. We saw sometimes this data increase and sometimes decrease. In the case of GSM, WPI, CPI data is increased after dyeing process. On the other hand, stitch length is decrease after dyeing. That was happened for after dyeing fabric makes more compacter because of absorption of dyes and chemicals. In case of shrinkage, we saw some fabric got expansion and some fabric got contraction. For Abrasion resistance, we utilized that better construction has better abrasion resistance. Here we investigated thus characteristics of cotton knitted fabric after dyeing process. This paper tries to find out the major changes characteristics of cotton knit fabric from before dyeing and after dyeing. Hope this paper will help those people who are in textile dyeing industry.

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Chapter-1

Introduction

1.1 Introduction

A dyeing process is the connection between a dye and a fiber, just as the development of color into the inner piece of the fiber. A dyeing or printing measure is convoluted, since it includes fiber sorts, yarn or texture structures, dyes and synthetic assistants, just as coloring innovation. Dyeing process gives a fabric new look. Dyeing is a technique which imparts beauty to the textile material by applying different colors and their shades on to a texture. Dyeing should be possible at any phase of the manufacturing of textile- fiber, yarn, fabric or a finished textile product including garments and apparels.

There are a lot of advantages of dyeing process including being cost effective and easy way to make your fabric to look new. By dyeing process, you can renew your current fabric and use each one year after year. There are a wide range colors which gives people opportunities to create incredible design patterns by mixing different color.

Dyeing process changes the fabric characteristic such as GSM, Air Permeability, Pilling, Spirality, Loop length, WPI, CPI, Stitch density, Bursting Strength & Shrinkage. Different types of fabric show different characteristic after dyeing process. Some fabric improves these characteristics and some fabric losses. Among all these physical characteristics of knit fabric we are going to work with GSM, WPI, CPI, stitch length, shrinkage and abrasion resistance.

1.2 Objectives:

1. To know how different knit fabric shows different physical characteristics after dyeing with same recipe.
2. To observe the WPI, CPI, GSM changes of different types of knit fabric after dyeing process.
3. To observe the changes of different fabric dimension such as shrinkage after dyeing process.
4. To know the abrasion resistance of different knit fabric after dyeing with same recipe.

Chapter-2

Literature Review

2.1 Introduction

It's a given that, use of cotton knitted fabric has been expanding in around the world. Individuals around each side of the world, every custom, projects feel good wearing cotton sewed texture because of legitimate fitting properties, gentler handle properties and high expansion at low strain contrasted with woven made texture. Cotton lately has become most broadly utilized material fiber on the planet. Cotton filaments are treated with different chemical processes to get properties appropriate for coloring and further handling. For scouring, different non-cellulose parts like (wax, gelatin, proteins, hemi-celluloses) that encompass the fiber cellulose center are eliminated, and accordingly, fibers become hydrophilic. For as far back as couple of years, reactive dyes have become most generally utilized colors, as in light of the fact that the reactive dyes are the best for cotton for its wide scope of utilization and better fastness properties. There are over half of cellulosic filaments are colored with reactive dyes. Because of their strong bonding with numerous surfaces of manufactured and natural fabrics, reactive dyes are utilized for coloring cotton, fleece, nylon, silk, and modified acrylics. In Bangladeshi textile dyeing and finishing industries, reactive dyes are tremendously used. As indicated by the chemical structures of reactive dyes, the reactive site of the dye responds with functional group of fiber under impact of alkali and heat. In this exploration we use cotton knitted fabric and dyeing chemicals.

For uniform dyeing a well-treated base fabric is needed. It is well known that when cotton fabric is subjected to wet finishing it shrinks due to the swelling of fiber. Thus because of dimensional changes, the physical properties of fabric changes.

Adams emphasized the importance of effective scouring for all cotton and cotton/polyester blended fabrics for subsequent dyeing and finishing. A thoroughly prepared cotton fabric should have total Non-cotton content less than 1.5% and absorbency of less than 2 seconds.

The major interesting thing of dyeing is, if we dyed different type of cotton knitted with same recipe, same liquor ratio, same atmospheric condition and same time shade of these fabric will be different because different cotton knit fabric have different structure & properties.

In this exploration we are going to observe that what type of physical changes are shown in different type of cotton knitted fabric after dyeing process. For that we are selected four type of cotton knit fabric (Single jersey, Lycra single jersey, Slub single jersey and (2x2) Lycra Rib) and will dyed with dark & light shade. After dyeing process try to find out the changes of physical characteristics of following fabrics. A cotton knitted gray fabric will loss it's weight and it will make more whiter after scouring and bleaching process. Because at the time of scouring and bleaching process any kind of dust, dirt or grease, natural impurities (oil, fat, wax) and natural color is removed. After passing these processes fabric will be more hydrophilic and that time dyeing process will be done perfectly and uniformly. After dyeing process fabric GSM, WPI, CPI will be increase because fabric absorb dyes and other chemicals. Dyed fabric will more compacter than gray fabric. That's why weight the fabric will increase. This weight also varied for light and dark shade. Shade percentage has various impacts on cotton knitted fabric. Besides these physical characteristics may change i.e. Air permeability, Pilling, Spirality, Loop length, Stitch density, Bursting Strength and Shrinkage.

2.2 Sample preparation for dyeing:

Fabric (1,2,3) are knitted by open form single jersey knitting machine and Fabric 4 is knitted by double jersey knitting machine.

2.3 Specification of Knitting machine:

Specification of Single jersey knitting Machine:

- Brand Name: JIUNN LONG Machine CO. LTD.
- Origin: Taiwan
- Model: JLS-C
- M/C No: 160515
- Día: 36”
- Set of Needle: 1
- No. of Needle: 2712
- Feeder: 108
- Gauge: 28
- RPM: 22.8 - 24

- Production: 300 kg/day.

Figure no. 2.1: Single jersey knitting machine.

Specification of double jersey knitting machine:

- Brand Name: JIUNN LONG Machine CO. LTD.
- Origin: Taiwan
- Model: JLD-2×4
- M/C No: 090528
- Día: 42”
- Set of Needle: 2
- No. of Needle: 2376
- Feeder: 84
- Gauge: 18
- RPM: 13
- Production: 250 kg/day.

Figure no. 2.2: Double jersey knitting machine.

At first, we are collected following these grey fabrics from knitting section. After that pre-treatment process is done in bulk production. For scouring and bleaching we used DILMENLER dyeing machine.

2.4 Specification of scouring and bleaching machine:

Specification of DILMENLER dyeing machine

DILMENLER dyeing machine:

- Origin: Turkey.
- Brand Name: DILMENLER
- Model: DMS
- Capacity: 1250Kg
- Machine type: Automatic
- Shape: Horizontal
- Liquor ratio: 1:5
- Productivity: Depends on fabric.

Figure no. 2.3: DILMENLER dyeing machine for pre-treatment.

Before pre-treatment process Fabric 1 & 4 gave heat set in Stenter machine. Because these fabrics consist of Lycra. Heat set is done for perfect dimensional stability of knitted fabric. Unless heat set isn't done, Lycra tends to compact the fabric length and width during pre-treatment, dyeing and after treatment. For fabric 1 heat set is done at 195℃ temperature. And for fabric 4 heat set is done at 200℃ temperature. In these two fabrics we gave heat set to control the dimensional stability and uniform arrangement of Lycra all over the fabric.

After heat-set we done pre-treatment process in DILMENLER dyeing machine with bulk production. For pre-treatment process using chemicals are sequestering agent, stabilizer, detergent, anti-creasing agent, soda ash, caustic soda, hydrogen peroxide, peroxide killer, acetic acid, enzyme etc.

2.5 Recipe of pretreatment:

- Detergent: 2.346kg
- Sequestering agent: 1.560kg
- Anti-creasing agent: 7.806kg
- Hydrogen peroxide: 15.600kg

- Caustic soda: 11.700kg
- Stabilizer: 0.780kg
- Peroxide killer: 0.780kg
- Acetic acid: 2.340kg
- Enzyme: 2.300kg

After completing pre-treatment process, we collected pre-treated sample and gone for dyeing in lab dyeing machine. All process has done in exhaust method in lab dyeing machine. All fabrics are dyed with the same recipe for light shade and again all fabrics are dyed with same recipe for dark shade.

For this exploration dyeing is done in dyeing lab with Ahiba IR dyeing machine. After dyeing process has been completed, samples are kept in rapid dryer for drying.

2.6 Specification of dyeing machine:

Ahiba IR Lab Dyeing machine:

- Brand Name: Ahiba IR
- Company: Datacolor.
- Origin: New jersey USA.
- Fiber Types: All
- Minimum liquor ratio: 1:5 Natural – 1:4 Synthetic
- Temperature Range: 20℃-140℃
- Infrared lamp: 3KW
- Cooling system: Air

Figure no. 2.4: Lab dyeing machine.

Rapid Dryer Machine:

- Brand Name: Rapid Dryer.
- Company: XIAMIN RAPID Co. LTD.
- Origin: TAIWAN
- Model No: R-1
- Volt: 3KW
- Frequency: 50-60 Hz.

Figure no. 2.5: Rapid dryer machine.

Chapter -3

Methodology

3.1 Materials

In this experiment we used four types grey fabrics from knitting section. Following fabrics are,

I. Fabric 1: Lycra single jersey.
II. Fabric 2: Single jersey.
III. Fabric 3: Slub Single jersey.
IV. Fabric 4: (2×2) Lycra Rib.

3.2 Dyeing mechanism:

When the fabric is submerged into the dye liquor, an electrolyte is needed to neutralize the negative charge formed on the fiber surface and to put some extra energy to improve the dye absorption rate. In this project we used NaCl as a electrolyte which assisted the exhaustion of dye. After completing the exhaustion process fixation of dye occurred. This fixation of dye occurred by the formation of covalent bond between the reactive group of dye and the hydroxyl(-OH) group of cotton fiber. This reaction take place when we maintaining proper pH by adding alkali.

$$D\text{-}SO_2\text{-}CH_2\text{-}CH_2\text{-}OSO_3Na + HO\text{-}Cell \longrightarrow D\text{-}SO_2\text{-}CH_2\text{-}CH_2\text{-}O\text{-}Cell + NaHSO_3$$

3.3 Dyeing Recipe:

Dyeing recipe for light shade,

- D/C Yellow MERP: 0.4% stock solution (2%)
- D/C Red ME4BP: 0.6% stock solution (1%)
- D/C Black H/C: 1.2% stock solution (1%)
- Soda: 50 gm/L
- Salt: 12 gm/L
- Sample weight: 4gm
- Liquor ratio: 1:8.

Dyeing recipe for dark shade

- D/C Yellow MERP: 1.0% stock solution

- D/C Red ME4BP: 1.2% stock solution
- D/C Black H/C: 2.6% stock solution
- Soda: 70 gm/L
- Salt: 18 gm/L
- Sample weight: 4gm
- Liquor ratio: 1:8.

3.4 Recipe Calculation:

Total Liquor = 4×8 = 32ml.

For dyes = (Color% × Sample weight)/ Stock solution%

D/C Yellow MERP = (1% × 4)/ 2%.

= 2ml.

All dyes calculations are done this way.

Salt = (Amount of Salt in gm/L × total liquor × 100) / (1000 × amount of stock solution).

= (50gm/L × 32 × 100) / (1000 × 20)

= 8gm/L

Soda = (Amount of Soda in gm/L × total liquor × 100) / (1000 × amount of stock solution).

= (12gm/L × 32 × 100) / (1000 × 10)

= 3.84 gm/L.

For deep and light shade all soda and salt calculations are done in this way.

Process: At first, we cut these fabric sample into four grams by the help of electric balance. Fabric sample selected same amount of weight for both light and deep shade. Then pipetting was started. We took same amount of dye and chemicals and liquor ratio for every fabric. For light shade we took 0.8 ml D/C Yellow MERP, 2.4 ml D/C Red ME4BP, 4.8 ml D/C Black H/C, 8 ml NaCl, 3.84 ml Na_2CO_3 from stock solution and 12.16 ml water. And for deep shade we took 2 ml D/C Yellow MERP, 4.8 ml D/C Red ME4BP, 10.4 ml D/C Black H/C, 5.76 ml Na_2CO_3 from stock solution, 11.2 gm NaCl and 9.04 ml water. Then all fabric samples were slightly wetted by normal water and put on the pot. After that closed all pot and little shaken by hand. Then placed pots on the dyeing machine and set the temperature 60℃ for 1hr. And started the machine. Dyeing process was done automatically by the machine. After 1hr machine took 40 min for cooling. Then we dropped the bath and firstly gave normal wash and after that gave hot wash and again gave normal wash. Then all fabric sample are dried by rapid dryer machine.

3.5 GSM Measurement:

Fabric GSM represents grams per square meter. Fabric GSM implies the heaviness of one square meter fabric in grams. GSM can also be denoted as gm/m^2. Measurement of GSM is very important for fabric production. By following method, we can measure GSM of both woven and knitted fabric.

- By means of instruments: In this method we need GSM cutter (round), GSM pad, electric balance. For to calculate fabric GSM first of all we have to cut five sample by GSM cutter and then weight these sample by electric balance. And then take the average weight value of these sample and multiply this average value of samples with 100. Now this founded value is our required GSM value. We multiply this value with 100 because the area of GSM cutter is 1/100 square meters. In this exploration we used this method for the calculation of GSM.
- By the use of formula: By following formula we can calculate fabric GSM. For this first of all we have to take sample weight in gram and multiply with 10000 and then divided by the value of area in cm^2 of the sample.

Weight per square meter = (weight of the sample in gram × 10000) / area of sample in cm^2.

Figure 3.1: GSM cutter and electric balance.

3.6 Measurement of Shrinkage:

The textile fabric has a typical shape that it shrinks in wet processing. Shrinkage expose the length of the fabric gets abbreviate after wash. So before cutting the fabric for bulk production, we should check its shrinkage rate in washing. The shrinkage rate needed to add to the production model. Else, we should not get the right fitted garment and measurement should not match with buyer requirement.

Now we are going to discuss how we calculated the shrinkage percentage of our projected fabrics.

Firstly,

We prepared the wash test sample. For that we cut the fabric sample from roll. And cutting sample size was 110 cm X 110 cm (length X width).

Secondly,

We measured the sample length and width before washing. That time we marked a square of 100 cm X 100 cm into ‘‘+” sign at the corner of the square by fabric marker.

Thirdly,

We washed the fabric sample by Rota Wash machine.

Fourthly,

We dried the fabric sample after washing by tumble dryer machine.

Fifthly,

We measured the sample length and width after washing with following marking points and noted it. Before taking value after washing, sample set on flat table and remove creases by hand ironing machine.

Formula of Shrinkage% Calculation:

Shrinkage %= {(Length before washing - length after washing) × 100}/Length before washing

Formula of Fabric Growth% Calculation

Fabric growth% = {(Length after washing - length before washing) × 100}/Length before washing

Figure 3.2: Rota wash machine.

3.7 Stitch length Measurement:

The length of yarn needed to create a complete knitted loop is known as stitch length or loop length. Stitch length is a length of yarn which incorporates the needle loop and a large portion of the sinker loop on one or the other side of it. Loop exists in course length and it is what impact fabric dimension and different properties including weight. So, we need to know fabric stitch length. We measure the stitch length by following method.

At first take 10cm×10cm size fabric from the sample and counted the number of wales in 10cm samples. Then five yarns of full length were taken and to remove curliness of yarns they were stretched. Avoiding yarns which didn't have full length. Then by using scale we measure those 5 yarns length and then calculate the average length of the sample yarns. Then this average length of yarns was divided by the no. of loops on fabric sample. And this value is our required loop length.

3.8 Abrasion resistance:

In general, abrasion is difficult to define, but usually it means the loss of fabric surface by rubbing or scrapping. Sometimes it is called "erosion". The ability of a fabric surface to resist being worn away by rubbing or friction is called abrasion resistant. It is an important parameter of fabric. Abrasion resistant mainly depends on fiber types and properties, fabric structure and twist. Here we use Martindale abrasion tester for the measurement of abrasion resistance. By following method, we measure abrasion resistance of our samples.

- At first, we cut four samples of each fabric by using GSM cutter which diameter is 3.8cm.
- Then weight the samples in electric balance.
- Then the samples are placed in sample holder with a standard foam backing behind the sample (samples are placed flat against the mounting block)
- Spindles are attached to the samples and placed it on the abradant.
- Then cover this through the top plate and 9kpa weight is placed on the top of spindles.
- Then run the machine for 600 cycles.
- After that samples are taken out and weight with electric balance.
- Then by weight loss formula we can measure our required abrasion resistance result in percentage.

Formula: Abrasion resistance = {(weight before abrasion – weight after abrasion) × 100} / weight before abrasion.

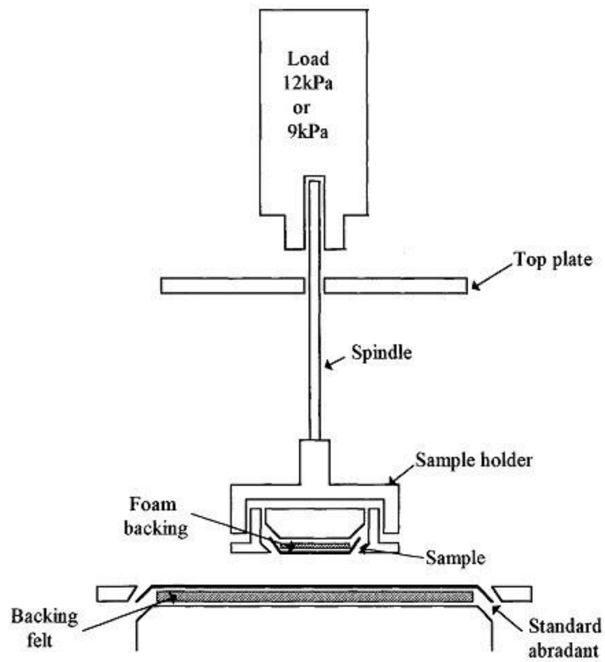

Fig 3.3: Schematic diagram of a Martindale abrasion tester

Figure 3.4: Martindale abrasion tester.

3.9 Measurement of WPI, CPI:

It is very important to know how much yarn is in length wise and widthwise in a fabric. A measurement is done to know the number of yarns in a specific area of fabric. For this yarn in one inch is measured by magnifying glass. In knit fabric this measurement is done in course and wales direction. CPI means the total number of courses in one inch of fabric and WPI means total number of wales in one inch of fabric. For the measurement of these we need magnifying glass setting multiplier and ball pen for marking. By following method, we measure WPI and CPI of our sample fabric.

- At first, we take sample and mark one inch with ball pen according to the course and wales wise of the sample.
- Then we set the magnifying glass setting multiplier to the marking point and count the WPI and CPI of our knit sample.

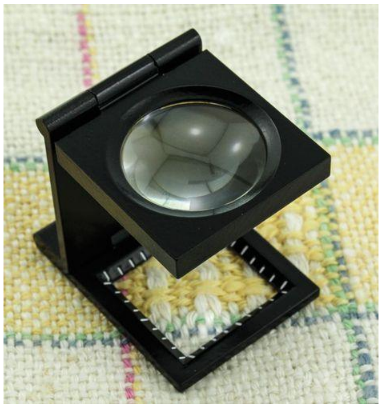

Figure 3.5: Pick glass.

Chapter 4

Discussion of Results

4.1 Introduction:

We measure our samples before dyeing and after dyeing. We dyed our samples in light shade and deep shade with same recipe for each fabric type. Following changes for both light and deep shade are shown below.

4.2 Analysis of GSM:

Table no 4.1: Impact of dyeing on GSM of knit fabric.

Sl. No	Fabric type	GSM (Before dyeing)	GSM (After dyeing)		Change of GSM%	
			Light shade	Deep shade	Light shade	Dark shade
01	Lycra single jersey	176.3	179	182	-1.53	-3.23
02	Single jersey	167.5	174.5	185.2	-4.18	-10.57
03	Single jersey slub	132.3	141.9	149.9	-7.26	-13.30
04	2×2 Lycra rib	343.9	352.7	358	-2.6	-4.1

Note: We calculate GSM% by following formula,

GSM% = {(Before dyeing – After dyeing) / Before dyeing} × 100.

We see that GSM is increased after dyeing and dyeing with deep shade GSM is more than light shade GSM. This happened because in deep shade dyeing samples absorbed more dye than light shade dyeing. Though we dyed our all four samples with same (recipe, temperature, atmospheric condition), we see that, there are difference on their GSM. This happened because their fabric construction is different so the dye consumption is different for different fabric sample. Thus, we see the changes of GSM.

4.3 Analysis of shrinkage%:

Table no 4.2: Impact of dyeing on shrinkage% of knit fabric.

Sl. No	Fabric type	Lengthwise shrinkage%		Widthwise shrinkage%	
		Light shade	Deep shade	Light shade	Deep shade
01	Lycra single jersey	-4.1	-5.2	-6.9	-13.8
02	Single jersey	-3.2	-7.7	-1.9	3.5
03	Single jersey slub	3.5	-7.0	-8.7	2.1
04	2×2 Lycra rib	-13.1	-15.9	-3.3	-3.6

We calculated our samples changes lengthwise and widthwise after washing them. For ready-made garments fabric shrinkage is one of the major concerning point because after washing it affect the size of the garments. In competitive markets buyers always want low shrinkage from their providers. Basically, two types shrinkage occurs in fabric. One is called expansion and another is called contraction. But in both type fabric dimension is changes. Generally, shrinkage occurs due to the use of unstable and low quality of material in fabric as well as depend on the chemical composition, properties and absorption capacity of fabric. We see that our four samples which are different in their construction material and dyed with same recipe results different shrinkage rate.

4.4 Analysis of stitch length, WPI, CPI:

4.4.1 Analysis of stitch length:

Table no 4.3: Impact of dyeing on stitch length of knit fabric.

Sl. No	Fabric type	Stitch length (Before dyeing)	Stitch length (After dyeing)		Change of Stitch length%	
			Light shade	Deep shade	Light shade	Deep shade
01	Lycra single jersey	2.94mm	2.83mm	2.86mm	3.74	2.72
02	Single jersey	2.62mm	2.50mm	2.54mm	4.6	3.05
03	Single jersey slub	2.74mm	2.62mm	2.60mm	4.4	5.11
04	2×2 Lycra rib	3.02mm	2.87mm	2.85mm	4.95	5.63

Note: We calculate Stitch length% by following formula,

Stitch length% = {(Before dyeing – After dyeing) / Before dyeing} × 100

Stitch length is a major point for cotton knitted fabric. Here we see that, after dyeing process following samples stitch length are decreasing. Stitch lengths are decreased because as the reduction of loop length fabric makes more compact.

4.4.2 Analysis of WPI

Table no 4.4: Impact of dyeing on WPI of knit fabric.

Sl. No	Fabric type	WPI (Before dyeing)	WPI (After dyeing)		Change of WPI%	
			Light shade	Deep shade	Light shade	Deep shade
01	Lycra single jersey	34	36	36	-5.85	-5.85
02	Single jersey	37	39	38	-5.41	-2.70
03	Single jersey slub	35	36	35	-2.86	0.00
04	2×2 Lycra rib	68	73	73	-7.35	-7.35

Note: We calculate WPI% by following formula,

WPI% = {(Before dyeing – After dyeing) / Before dyeing} × 100

WPI (Wales per inch) is a major point for cotton knitted fabric. Here we see that, after dyeing process following samples WPI are increasing. WPI is increased because at the time of dyeing we use various chemicals and color. Fabric absorb these and make more compacter than before dyeing process.

4.4.3 Analysis of CPI:

Table no 4.5: Impact of dyeing on CPI of knit fabric.

Sl. No	Fabric type	CPI (Before dyeing)	CPI (After dyeing)		Change of CPI%	
			Light shade	Deep shade	Light shade	Deep shade
01	Lycra single jersey	64	60	60	6.25	6.25
02	Single jersey	56	53	53	5.35	5.35
03	Single jersey slub	48	44	43	8.33	10.41
04	2×2 Lycra rib	52	56	48	-7.69	7.69

Note: We calculate CPI% by following formula,

CPI% = {(Before dyeing – After dyeing) / Before dyeing} × 100

CPI (Course per inch) is a major point for cotton knitted fabric. Here we see that, after dyeing process following samples WPI are increasing. CPI is increased because at the time of dyeing we use various chemicals and color. Fabric absorb these and make more compacter than before dyeing process.

4.5 Analysis of Abrasion resistance (%):

Table no 4.6: Impact of dyeing on abrasion resistance% of knit fabric.

Sl. No	Fabric type	Abrasion resistance (%) (Before dyeing)	Abrasion resistance (%) (After dyeing)		Change of Abrasion resistance %	
			Light shade	Deep shade	Light shade	Deep shade
01	Lycra single jersey	2.53	2.13	1.56	0.4	0.97
02	Single jersey	5.21	3.82	3.13	1.39	2.08
03	Single jersey slub	6.75	5.21	4.35	1.54	2.4
04	2×2 Lycra rib	1.33	1.27	1.2	0.06	0.13

4.6 SAMPLE ATTATCHMENT

Sl. No	Fiber type	Before dyeing	Light shade (After dyeing)	Deep shade (After dyeing)
1	Lycra single jersey			
2	Single jersey			
3	Single jersey slub			
4	2×2 Lycra rib			

Table no 4.7: Sample attachment

Chapter-5

Conclusion

5.1 Conclusion:

In this study, it was overserved that, after completing the dyeing process, the physical characteristics of fabric's are changed. Our exploration was about on 100% cotton knit fabric. For that we tested four (Lycra single jersey, single jersey, Single jersey slub, 2x2 Lycra Rib) types of cotton knit fabric with light and deep shade. And we noticed that after passing the dyeing process, they change in GSM, WPI, CPI, Stitch length, Shrinkage, Abrasion resistance. We dyed our sample in same recipe, same atmospheric condition but the changes of mentioned characteristics are not same because of variation of fabric's construction and structural properties.

We conclude that,

For every sample changes of GSM % is increased.

- Lycra single jersey (Light shade: -1.53, Deep shade: -3.23)
- Single jersey (Light shade: -4.18, Deep shade: -10.57)
- Single jersey slub (Light shade: -7.26, Deep shade: -13.30)
- 2×2 Lycra rib (Light shade: -2.6, Deep shade: -4.1)

For every sample changes of WPI% is increased.

- Lycra single jersey (Light shade: -5.85, Deep shade: -5.85)
- Single jersey (Light shade: -5.41, Deep shade: -2.07)
- Single jersey slub (Light shade: -2.86, Deep shade: 0.00)
- 2×2 Lycra rib (Light shade: -7.35, Deep shade: -7.35)

For every sample changes of CPI% is given below,

- Lycra single jersey (Light shade: 6.25, Deep shade: 6.25)
- Single jersey (Light shade: 5.35, Deep shade: 5.35)
- Single jersey slub (Light shade: 8.33, Deep shade: 10.41)
- 2×2 Lycra rib (Light shade: -7.69, Deep shade: 7.69)

For every sample changes of Stitch length% is decreased,

- Lycra single jersey (Light shade: 3.74, Deep shade: 2.72)
- Single jersey (Light shade: 4.6, Deep shade: 3.05)
- Single jersey slub (Light shade: 4.4, Deep shade: 5.11)
- 2×2 Lycra rib (Light shade: 4.95, Deep shade: 5.63)

In case of shrinkage some fabric got expansion and some fabric got contraction. Changes of Shrinkage% is given below,

- Lycra single jersey (Light shade: -6.9, Deep shade: -13.8)
- Single jersey (Light shade: -1.9, Deep shade: 3.5)
- Single jersey slub (Light shade: -8.7, Deep shade: 2.1)
- 2×2 Lycra rib (Light shade: -3.33, Deep shade: -3.6)

Abrasion resistance of following fabrics depends on their fabric construction. Here we utilize that better construction fabric has better abrasion resistance. Changes of Abrasion resistance % is given below,

- Lycra single jersey (Light shade: 0.4, Deep shade: 0.97)
- Single jersey (Light shade: 1.39, Deep shade: 2.08)
- Single jersey slub (Light shade: 1.54, Deep shade: 2.4)
- 2×2 Lycra rib (Light shade: 0.06, Deep shade: 0.13)

Reference:

1. https://www.researchgate.net/publication/293699491_Effect_of_scouring_and_dyeing_on_physical_properties_of_the_fabric
2. http://article.sciencepublishinggroup.com/html/10.11648.j.sr.20160401.12.html
3. https://www.onlineclothingstudy.com/2015/10/how-to-calculate-fabric-shrinkage.html
4. http://textilefasionstudy.com
5. http://textilelearner.blogspot.com
6. http://fibre2fashion.com
7. http://www.slideshare.net
8. http://textilecourse.blogspot.com/2018/10/calculate-gsm-knitted-fabric.html
9. http://textilestudycenter.com
10. http://textileleaner.blogspot.com
11. http://library.daffodilvarsity.edu.bd
12. www.textiletoday.com
13. www.scribd.com
14. Textile Testing and quality control J.E. Booth

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