Faculty of Engineering

Department of Textile Engineering

STUDY ON THE EFFECTS OF SANFORIZING MACHINE ON THE PROPERTIES OF WOVEN FABRIC

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Submitted by:

Morshed

152-23-4411

Md. Johirul Islam

152-23-4412

Supervised by:

Sumon Mozumder

Assistant Professor

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Bachelor of Science in Textile Engineering

Advance in Wet Processing Technology

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Sumon Mozumder, 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.

Morshed
ID: 152-23-4411
Department of Textile Engineering
Daffodil International University

Md. Johirul Islam
ID: 152-23-4412
Department of Textile Engineering
Daffodil International University

LETTER OF APPROVAL

This project report prepared by Morshed (ID: 152-23-4411) and Md. Johirul Islam (ID: 152-23-4412), is approved in Partial Fulfillment of the Requirement for the Degree of BACHELOR OF SCIENCE IN TEXTILE ENGINEERING. The said students have completed their project work under my supervision. During the research period I found them sincere, hardworking and enthusiastic.

SUMON MOZUMDER
ASSISTANT PROFESSOR
DEPARTMENT OF TEXTILE ENGINEERING
FACULTY OF ENGINEERING
DAFFODIL INTERNATIONAL UNIVERSITY

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This projects report is dedicated to our beloved Parents & Teachers

ABSTRACT

Sanforizing machine is a very imperative machine in textile finishing process. Sanforizing machine is generally used in textile finishing sector because of having many advantages such as controlling of the fabric GSM, width, shrinkage. Sanforizing process is a mechanical process which is done by the sanforizing machine. It was very significant to observe the effects of sanforizing on woven fabric properties. The project title was here by designed as "Effect of Sanforizing Machine on the woven fabric properties". We have selected 9 (nine) different woven fabric samples including twill, poplin & canvas those were used in this research work. The objective of our work was to assess the effects of sanforizing machine on woven fabric properties. GSM and EPI, PPI, Shrinkage, Width of those woven fabrics were calculated before and after sanforizing and the effects have been observed. By this work it has been seen that after sanforizing the fabric width is decreased because the fabric yearns comes closer for sanforization by sanforizing machine. But few of the fabric EPI, PPI & GSM are increased after Sanforizing. The process of changing this parameters is related with the machine speed, temperature and overfeed (%) and that were studied very carefully.

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INTRODUCTION

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INTRODUCTION

1.1 Introduction

Sanforizing is a mechanical finishing process controlled compressive shrinkage, which is applied on woven fabric to achieve shrinkage before making the garments goods it is also called anti-shrinkage finishing process. Textile woven fabrics treating to prevent the normal dimensional change of warp and weft. After the sanforizing process the residual shrinkage of woven fabric may be zero. Sanforizing is a process of treatment used for cotton woven fabrics mainly and most textiles made from natural or chemical fibres, patented by Sanford Lockwood Cluett in 1930.

It is a technique of stretching, shrinking and fixing the woven cloth in both length and width, before cutting and producing to reduce the shrinkage which would otherwise occur after washing. In sanforizing process shrinkage is achieve by passing the cotton fabric onto a movable elastic felt blanket is released it assumes a shortened conditional. Thus the cotton fabric is forced to conform this compression. Sanforizing process is based on the principle that when an elastic felt blanket is passed around a metal roller in contact with it, its outer surface is process extended and the inner surface contracted. So the process is called controlled compressive shrinkage process.

The **broad objective** of this work is to study the effects of Sanforizing Machine on the woven fabric properties.

The **specific objectives** of this work are:

- To know about sanforizing machine & how the sanforizing machine processing the fabric.
- To know how to control GSM, how to control width and how to control shrinkage (%) that depends on the temperature, overfeed (%) & machine speed.
- To know the change of GSM percentage (%), the change of EPI percentage (%), the change of PPI percentage (%), the change of width percentage (%) & to know the change of shrinkage percentage (%).
- To know the relation between overfeed % with GSM, EPI, PPI, width & shrinkage.

CHAPTER-2

LITERATURE REVIEW

CHAPTER-2

LITERATURE REVIEW

2.1 Stenter Machine

Stentering is the one of a series of textile finishing processes, where the selvedges of an open-width fabric are held at a predetermined width with maintaining proper tension. The term “stentering” is used for passing a fabric through a stenter or tenter. The attachment to the selvedges can be by pins (pin stenter) or clips (clip stenter). Traditionally the process was done on simple frames, but now it is done in a stentering machine which usually contains a dryer. A machine for stretching or stentering fabrics. The purpose of the stenter machine is to bringing the length and width to pre determine dimensions and also for heat setting and it is used for applying finishing chemicals and also shade variation is adjusted. The main function of the stenter is to stretch the fabric widthwise and to recover the uniform width.

2.1.1 Objectives of Stenter Machine

- To stretch the fabric so that any unwanted creases can be removed.
- To remove the wrinkles of fabric.
- To control the length and width of fabric.
- To dry the fabric
- To perform heat-setting on the thermoplastic materials.
- To control the GSM and shrinkage of fabric.
- To perform the curing operation on pigment printed fabric.
- For the fixation of various chemical finishes.

2.1.2 Flow Chart of Stentering

Fabric Feeding

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Aligning the fabric in Center

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Padding the Fabric

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Fabric Weft Straightening

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Lower Overfeeding the Fabric

↓

Expending

↓

Upper Overfeeding the Fabric

↓

Uncurling

↓

Fabric Pinning or Clipping on

↓

Heat Setting of the Fabric

↓

Air Cooling

↓

Fabric Pinning or Clipping off

↓

Unload Fabric by Plating

2.1.3 Stenter machine specification

Machine Name	: Stenter Machine
Brand Name	: Mi Kwang Machine Industries Co. Ltd
Origin	: Korea
Manpower	: 8
Production range	: 25000-38000 m/day
Machine Speed	: 40 to 80 m/min
Temperature	: 150 to 190^{o}C
No. of Chamber	: 6
No. of Burner	: 6
No. of Blower	: 12
Used utilities	: Gas, Electricity

2.1.4 Pictorial View of Stenter Machine

Figure: 2.1 Stenter Machine

2.1.4 Different parts of Stentering Machine

Following elements are available in the stentering machine:

- Overfeeding roller
- Brush roll
- Perforated Steam and Air tunnel
- Sensing band
- Slower moving pin chain
- Sensing monitor
- Heated chamber
- Gluing device
- Delivery rollers
- Selvedge cutting device
- Conveyor belt
- Anti-static bar or rod
- Bowing and Skewness correction device
- A pair of Padders
- Hot air flowing nozzle
- Gas tunnel
- Air suction hood
- Motor
- Control panel & so on

2.1.5 Different sections of Stenter Machine

Following sections are available in the stentering machine:

- Padder Section
- Weft Straightener
- Width Setting Chamber
- Heating Chamber
- Cooling Chamber
- Exhaust Motor
- Delivery Zone

2.2 Sanforizing Machine

After stentering process is coming that sanforizing the fabric, is known as sanforization. This process is done by a machine that name is sanforizing machine. Sanforizng machine (sanforization process) is including the finishing section. In textile finishing, sanforization process are very important because sanforization process is used for control shrinkage of the textile materials (fabric). In finishing section of wet processing industry sanforizing machine is used after stentering of fabric. In textile finishing unit sanforizing machine is used for control shrinkage of the woven fabrics. We can be defined sanforization is a process where it is a mechanical finishing process controlled compressive shrinkage, which is applied on woven fabric to achieve shrinkage before making the garments goods it is also called anti-shrinkage finishing process. The control shrinkage in a textile material by stretching, shrinking and fixing the woven cloth in both length and width, before cutting and producing to control the shrinkage which would otherwise occur after washing. Sanforization process is used to control the shrinkage and zero zero the fabric with the help of steam, high temperature & stretching. Besides sanforization is controlled the shrinkage%, GSM, width, length etc. and prepared the fabric for the next process. One more word, a sanforizing is a machine which is used to control shrinkage before produce garment goods and it is one of the valuable machines in finishing section. In finishing section its important is more. Woven fabrics is sanforize by sanforizing machine. All form of wove fabric like open width form is sanforize by sanforizing machine. But the process of sanforizing and sanforizing mechanism of woven fabric is different for different fabric. To control the shrinkage from the fabric, sanforization process is necessary. Not only control shrinkage but also control GSM, width, length by this machine. So it can be said that the main function of a sanforizing machine to control shrinkage, GSM, width, length of the textile materials.

Pictorial View of the Sanforizing Machine

Figure: 2.2 Sanforizing Machine

2.2.1 Features of Sanforizing Process

- To control shrinkage of the fabric.
- To maintain proper temperature and speed that depend on fabric construction.
- To control GSM of the fabric.
- To maintain proper overfeed.
- Basically, it is used for open width woven fabric.
- To improve the finishing requirement.
- To maintain the fabric color shade.

2.2.2 Flow diagram of Sanforizing Machine

Inlet for Fabric

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Guide Roller

↓

Steam Box

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Damping Cylinder

↓

Water Spray

↓

Rubber Belt

↓

Steam Cylinder

↓

Blanket Steam Drum

↓

Cooling cylinder

↓

Batching

2.2.3 Important Feature of Sanforizing Machine

- Sanforizing machine has 3 units.
- Steam Box.
- Rubber Belt.
- Blanket Steam Drum.
- Air pressure controller.
- Steam controller.
- Maximum temperature up to 160°C
- Water sprayer present
- It has also 5 cylinders.

2.2.4 Specification of Sanforizing Machine

Machine Name	: Sanforizing Machine
Brand Name	: Hyundai
Origin	: Korea
Manpower	: 6
Production range	: 35000-45000 m/day
Machine Speed	: 10 to 30 m/min
Over Feed	: 5-8%
Belt Roller Temp.	: 160 to 180^{o}C
Felt Roller Temp.	: 180 to 190^{o}C
Steam Box Temp.	: 60-65 ^{o}C
Used utilities	: Gas, Electricity

2.2.5 Different Parts Name of Sanforizing Machine

- Inverter
- Motor
- Temperature Meter
- Operating Monitor
- Emergency Sensor
- Emergency Stop Switch
- Stop Switch
- Guide Roller
- Tension Roller
- Fabric Guider
- Gear Box
- Alarm Switch
- Screw
- Adjust Fan
- Thermometer
- Nozzle
- Steam Pipe
- Steam Meter
- Pressure Meter

- Steam Cylinder
- Chain
- Bearing
- Rubber Belt
- Electric Wear
- Cooling cylinder
- Batch Winder
- Steam Valve

2.2.6 Main Parts of a Sanforizing Machine

- Unit : 3
- Water Sprayer : 1 pieces
- Rubber Belt : 1 pieces
- Blanket : 1 pieces
- Motor : 8 pieces
- Cylinder : 5 pieces
- Total Roller : 20 pieces

2.2.7. Function of Different Parts of a Sanforizing Machine

- Inverter: It is an electric device. The input voltage, output voltage and frequency and overall power handling to adjust the motor that motor works freely.
- Temperature Meter: By this meter we control the temperature. And also if need we increase or decrease the temperature by this meter.
- Operating Monitor: To show the all information of sanforizing machine, that's why we get all information very easily like – temperature, overfeed, speed, compaction % etc.
- Emergency Sensor: If any problem occurs in sanforizing machine then emergency sensor gives a signal automatically.
- Emergency Stop Switch: This switch used when problem occurs in machine very badly for stop machine to avoid any accident.
- Stop Switch: By this part of sanforizing machine is used for stopped machine.
- Guide Roller: Guide roller guide the fabric for pass from the machine.
- Tension Roller: This roller used for give tension in fabric for avoid wrinkle.
- Fabric Guider: This guider used for guide the fabric.

- Gear Box: In these box gear is present and these gear give energy to run the machine.
- Alarm Switch: If any problem occurs such as fire or accident, then this switch press to gives signal.
- Thermometer: By thermometer temperature is measured.
- Nozzle: By this part air and gas is passed.
- Steam Pipe: Steam is passed by this pipe that's why cylinder gets required amount of heat.
- Steam Meter: By this meter we measure the amount of steam is passed by the steam pipe and high amount of steam is required for heating the cylinder.
- Pressure Meter: This meter to can see pressure of the roller.
- Steam Cylinder: It helps to heat the textile materials by steam.
- Chain: Chain give energy that's why rollers are running by motor power and fabric is passing in front.
- Bearing: To give the reciprocating motion of roller, cylinder, motor and that's why roller, cylinder, motors are running easily.
- Rubber Belt: It is the heart of the machine, main function of this belt is to give warp-wise shrinkage to the fabric.
- Electric wear: By the electric wear; electricity is present. That's why machine gets energy and for this reason machine runs.
- Batching Roller: By batching roller to batch the fabric and that's why fabric carries easily for next process.

2.2.8 Details of sanforizing finishing machine

Inlet: This part is utilized to store the fabric amid the batch change and this Inlet unit contains different parts like tension gadget, draw roll, pressure roll and break roll. The critical elements of the above rollers are to encourage the fabric equally all through the machine.

Damping Cylinder: The damping cylinder gives concentrated, uniform and controlled steaming of the fabric. The damping cylinder has a steam-warmed internal shell. This internal shell is encompassed by a steam penetrable wire work, around which a damage fabric is wrapped in a few layers. The chamber is warmed from within with soaked steam.

Rubber unit: It is the core of the machine, primary function of this unit is to give warp wise shrinkage to the fabric. It comprises of rubber warming cylinder, perpetual rubber, tension roll and pressure roll. A stainless steel cylinder, which has smaller polished surface that guarantees least contact among fabric and cylinder with the goal that the fabric is allowed to take after the development of the rubber.

Figure: 2.3 Rubber Unit

Fabric is passed between hot cylinder and interminable rubber, warming of the cylinder happens by steaming courses of action. Pressure is applied on the fabric between the rubber and cylinder by pressure roll. Amid this above activity shrinkage happens on the fabric.

Squeeze rolls: Squeeze rolls presses away additional water from rubber after water shower.

Felt unit: During processing of fabric in the felt unit, the dampness is consistently retained from the fabric by the felt blanket. Also, the shrinkage of the fabric is set. This unit is likewise having felt drying cylinder, which dries the perpetual felt cover.

Figure: 2.4 Felt Unit

Cooling cylinder: This cylinder is utilized to additionally cool the fabric to ordinary temperature.

Batching unit: This unit winds the fabric on a casing or plaits the completed fabric in a suitable box/trolley.

Figure: 2.5 Batching

2.2.9 Working Principle of Sanforizing Machine

After stentering process then the fabric is passing through the sanforizing machine. The main function of the sanforizing machine is given below:

- To control shrinkage of the fabric
- To control the overfeed system
- To control width of the fabric
- To control GSM of the fabric

1. Sanforizing procedure depends on the rule that when a versatile felt blanket is passed around a metal roller in contact with it, its external surface is process expanded and the inward surface contracted. So the procedure is called controlled compressive shrinkage process.

2. The procedure of sanforizing incorporates the extending and control of the fabric before it is washed.

3. During the sanforization procedure, the fabric is encouraged into a sanforizing machine where it is treated with water or steam to advance shrinkage, at that point squeezed against a warmed rubber band to unwind and re-get the filaments.

4. The measure of potential wash shrinkage must be resolved before shrinking. A full width sample is wash-tried by the test technique. After the length wise and width wise shrinkage has been resolved, the compressive shrinkage machine can be balanced in like manner.

5. The material is constantly fed into the sanforizing machine and in that saturated with either water or steam. A pivoting cylinder presses a rubber sleeve against another, warmed, rotating cylinder. Subsequently the sleeve quickly gets compacted and along the side extended, a while later unwinding to its ordinary thickness. The material to be dealt with is transported between elastic sleeve and warmed cylinder and is compelled to take after this short pressure and horizontal development, and unwinding. It hence gets shrunk.

6. The more noteworthy the pressure applied to the elastic sleeve, the greater the shrinking a short time later. The procedure might be rehashed.

2.2.10 Parameter Used for Different Types of Fabric in Sanforizing Machine

Table: 2.1 The parameter for different fabrics that depend on fabric composition that is given below:

Sl. No.	Fabric	GSM	Rubber Blanket Temp.	Felt Temp.
01	Light (Cotton/TC/CVC)	100-135	150°C	135°C
02	Medium (Cotton)	150-230	145°C	130°C
03	Heavy (Cotton)	240-320	135°C	120°C

2.2.11 Operating Parameters of Sanforizing Machine

- Temperature: To set the temperature between 120°C to 150°C for base on different composition fabric.
- Overfeed: To set the over feed up to 5 to 10% or as required.
- Speed: To set the speed as much as possible (10 to 30 m/min).

2.2.13 Checking Parameter of Sanforizing Machine

During sanforzation of fabric, various types of quality test are done for getting good quality fabric and meet the buyer requirement. Sanforized woven sample is stored for future proof. Following parameters should be checked. They are:

Shrinkage Check: After Sanforizing of the fabric, sanforzied fabric sample is checked shrinkage% with the buyer requirement that is approved by buyer. If any problem or faults are found, then the operator informs the supervisor who takes some necessary steps to overcome the identification problem. In sanforizing shrinkage of the fabric is adjusted by changing the machine parameter that is depending on the fabric composition. Experienced person is required for identification this problem and take some necessary steps and to overcome this problem.

Width Check: Width check of the fabric adjust in sanforizing process. Operator measure fabric width by using measuring tape and compare with required width.

Weight (GSM) Check: Weight of the fabric is checked by cutting a sample by GSM cutter. And then it measures by electrical balance and at last compares this sample with buyer requirement sample.

Fabric Fault: Various types of weaving and dyeing faults or problem are checked after the sanforizing process. If any problems are found, then take some necessary steps to overcome this problem.

2.2.14 Controlling points or Control system

- Overfeed control : As per required. Higher the GSM higher the over feed.
- Speed control : As much as possible 10 to 30 m/min.
- Width control : Fabric width is adjusted as per required width.

2.2.15 Standard Operating Procedure

- Machine should be cleaned.
- Machine speed should be maintaining as requirement.
- Setting of machine as per process requirement.
- Roller should be cleaned.
- Any problem should be checked.
- Rubber belt should be cleaned.

- Air, water and steam supply should be regularly.
- Parameter set up as per requirement.

2.2.16 Manpower Required

Worker: 06

- Senior Operator : 02
- Operator : 02
- Helper : 02

2.2.17 Utility

1. Water
2. Compressed air
3. Electricity
4. Gas

CHAPTER-3

METHODOLOGY

CHAPTER-3

METHODOLOGY

3.1 Materials

In this project, we used different types of woven fabric. We collected this sample from sanforizing machine. When a fabric trolley sets on the input side of sanforizing machine, in this time we collected before sanforization fabric samples from the trolley.

3.1.1. Sample Specification

We have taken the following samples for our study:

Table: 3.1 Fabric Sample specification

Sample No.	Types of Fabric with Composition	EPI	PPI	GSM
01	30X10 (Twill)	152	72	266
02	40X40 (Poplin)	133	100	215
03	20X20 (Canvas)	100	50	254
04	32X21 (Twill)	144	70	235
05	40X30 (Canvas)	135	90	222
06	30X20 (Twill)	140	72	230
07	30X16 (Twill)	169	77	255
08	50X40 (Canvas)	170	100	218
09	30X30 (Twill)	140	80	249

3.2. Method

3.2.1 Method of data collection

At first stentering fabric is feed on the sanforizing machine. Then the fabric is treated by sanforizing machine including overfeed, temperature. After sanforizing the output fabric comes out with change in width and GSM.

We noticed that for the different over feeding and temperature the GSM of fabrics are different. The width of the fabric also can be increased or decreased by the process of sanforizing machine. After sanforizing, the yarn count of the fabric remains same.

We have additionally watched the temperature and machine speed for the processing fabrics. We have taken nine woven fabric tests for our investigation. We have estimated the GSM and EPI, PPI, Width, Shrinkage before sanforizing and after sanforizing of the fabric.

Before sanforizing sample

↓

Machine parameter collection from the machine

↓

Sanforizing process

↓

Collection sample after sanforizing

↓

Calculate GSM, EPI, PPI and Shrinkage of all samples

↓

Listed all data in different tables

↓

Analysis the data of fabric with the help of suitable bar diagram and scatter chart

3.2.2 Method of testing

Calculation of grams per square meter (GSM):

To calculate the Fabric's GSM before sanforizing first, we collected the sample from the loading side of sanforizing machine. Then we cut the sample by GSM cutter. Then we weighted the cut sample by electronic digital balance and then we multiply the value by 100 and got desired GSM of the fabric. This process is required for both initial fabric (Fabric before sanforizing process) and for final fabric (Fabric after sanforizing process). Here we get two GSM of the fabric. By follow the formula of Percentage (%) of variation in GSM we find the change of percentage of variation in GSM.

Percentage (%) of change in GSM:

$$\frac{\text{GSM after sanforizing - GSM before sanforizing}}{\text{GSM before sanforizing}} \text{ X } 100$$

Calculation of ends per inch (EPI):

Ends per inch (EPI) indicates the total numbers of warp in one inch of linear fabric. EPI is one of the important parameters to determine GSM of woven fabric and other fabric properties. To calculate EPI, we took 1 inch of sample and then count the warp widthwise. Then we calculate percentage of change in EPI after sanforizing. Following formula was used to calculate the percentage (%) of variation of EPI.

Percentage of variation in EPI:

$$\frac{\text{EPI after sanforizing - EPI before sanforizing}}{\text{EPI before sanforizing}} \text{ X } 100$$

Calculation of ends per inch (PPI):

Picks per inch (PPI) indicates the total numbers of weft in one inch of linear fabric. In the same manner PPI is one of the important parameters to determine GSM of woven fabric and other fabric properties. To calculate PPI, we took 1 inch of sample and then count the weft lengthwise. Then we calculate percentage of change in PPI after sanforizing. Following formula was used to calculate the percentage (%) of variation of PPI.

Percentage of variation in PPI:

$$\frac{\text{PPI after sanforizing - PPI before sanforizing}}{\text{PPI before sanforizing}} \text{ X } 100$$

Calculation of Shrinkage:

Shrinkage on fabric is mainly due to yarn swelling and the result crimp increase during washing in the case of cotton fabrics. To calculate cut a square of fabric from a roll and Draw a square 18"x18" on the fabric. Make sure you are using a template and that your square template is at least 2" away from selvedge. Measure square before wash and after wash.

Percentage (%) of variation in Shrinkage:

$$\frac{\text{Width of square template before wash - Width of template square after wash}}{\text{Width of square template before wash}} \text{ X } 100$$

3.3. Instrument

1. Counting Glass: By the use of counting glass we can measured the ends per inch (EPI) and picks per inch (PPI) for woven fabric very easily.

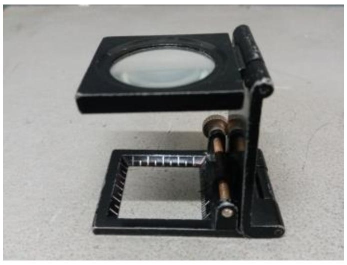


Figure: 3.1 Counting Glass

2. Needle: By the use of needle we can count the fabric EPI and PPI easily.

Figure: 3.2 Needle

3. GSM Cutter: By the use of GSM cutter we can cut the GSM of a fabric. It is widely used in any section where GSM is cut and measured.

Figure: 3.3 GSM Cutter

4. Electrical Balance: It is widely used for measuring weight. By electrical balance we can be measured light weight easily.

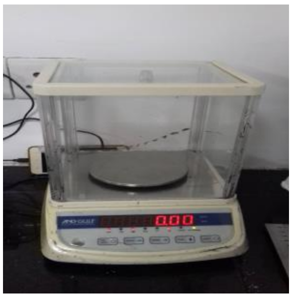


Figure: 3.4 Electrical Balance

5. Measuring Scale: By measuring scale we measure the length of yarn.

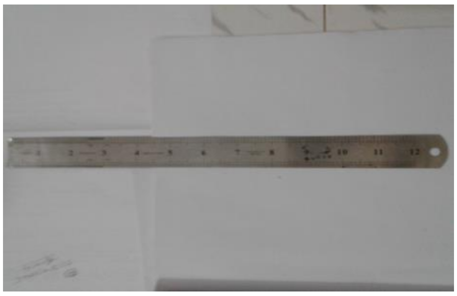


Figure: 3.5 Measuring Scale

6. Measuring Tape: We measure the length of fabric by using measuring Tape.

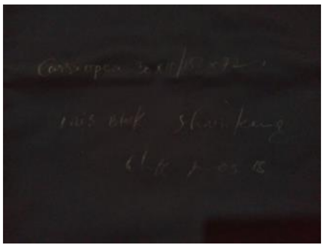
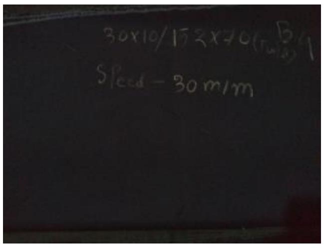
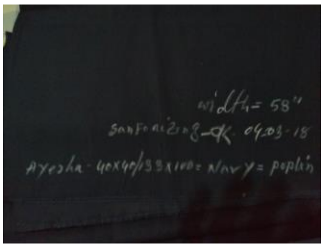
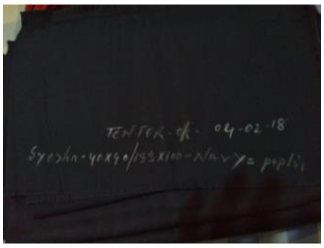
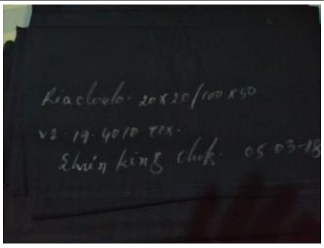
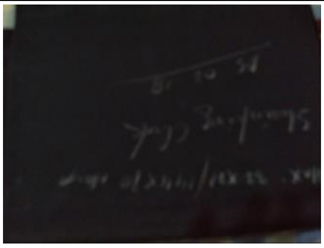
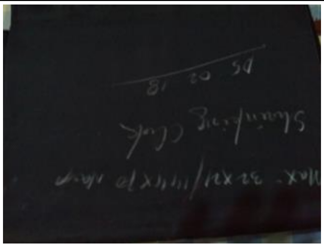
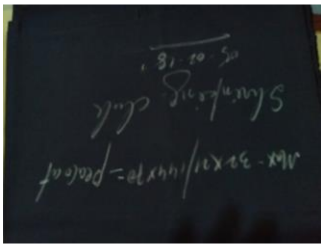
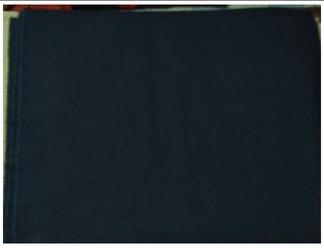
Figure: 3.6 Measuring Tape

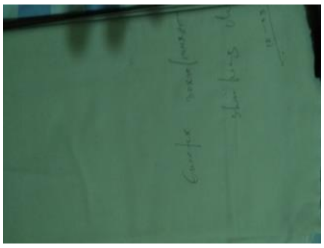
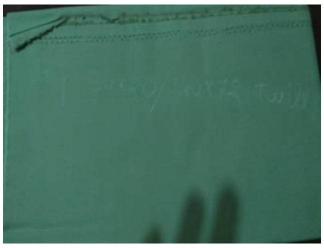
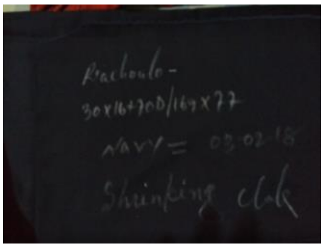
7. Scissor: It is widely used for cutting. When we count EPI, PPI, width of fabric, then we need scissor for cutting fabric.

Figure: 3.7 Scissor

3.4 Attached Sample Before and After Sanforizing

Table: 3.2 Fabric Sample Attachment

Sample No.	Type of Fabric With Composition	Before Sanforization	After Sanforiation
01	30X10 (Twill)		
02	40X40 (Poplin)		
03	20X20 (Canvas)		
04	32X21 (Twill)		
05	40X30 (Canvas)		
06	30X20 (Twill)		

07	30X16 (Twill)		
08	50X40 (Canvas)		
09	30X30 (Twill)		

CHAPTER-4

DISCUSSION OF RESULTS

CHAPTER-4

DISCUSSION OF RESULTS

4.1. Variation in GSM of the fabric samples after Sanforization

In this work, we have selected some samples and before sanforization GSM of the samples are taken. Then the samples are passed in the sanforizing machine for further processing. And after sanforization by the GSM cutter we are cut GSM samples in the same fabric and measured by electrical balance. And then we can see that some variation or change in here before and after sanforization. According to the formula of GSM change percentage (%) we can get the variation in GSM of the fabric samples after sanforization. And this results are input are table (A.1).

From the table (A.1), we can see that the woven fabric GSM increasing or decreasing is depending on machine speed, temperature and overfeed (%). Changing this parameter of sanforizing machine, we can change in GSM after sanforizing. From this table, we can see maximum percentage (%) of change in GSM after sanforizing is 8.00% for sample no.8. Initially the GSM of this sample was 100. After sanforizing GSM increase to 108. For this sample, the machine speed was 25 m/min, rubber unit temperature was 150°C and felt unit temperature was 135°C and overfeed was 12% of this sanforizing machine. Here we also see that the minimum percentage (%) of change in GSM after sanforizing is 3.33% for sample no.1. Initially the GSM of the sample was 240. After sanforizing GSM increase to 248. For this sample the machine speed was 25 m/min, rubber unit temperature was 135°C and felt unit temperature was 120°C and overfeed 5%. Here we can see that for sample no.8 and sample no.1 the machine speed is same but the temperature of sample no.8 is higher than sample no.1 and also the overfeed (%) of sample no.1 is lower than the sample no.8.

4.1.1 Change of GSM after the Sanforization

After sanforization the change of GSM of different fabrics were recorded in the Table (A.1). The change of GSM has been used here to drawn the following chart.

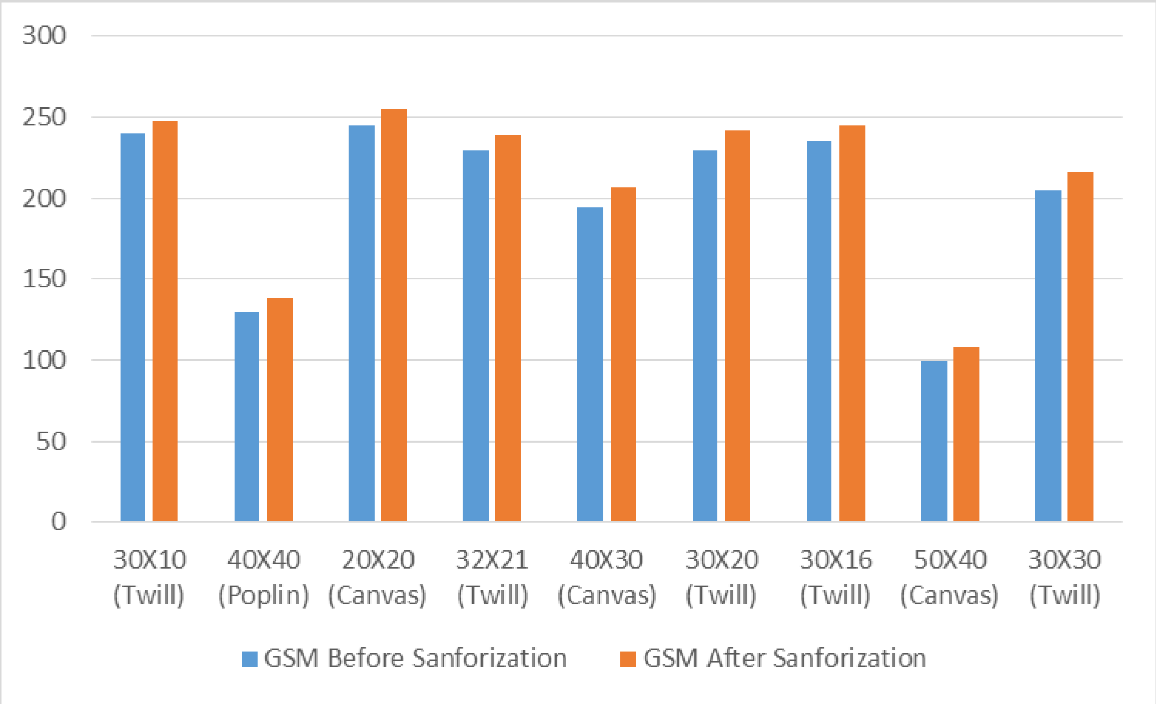


Figure: 4.1 Bar diagram represents the change of GSM of Woven fabrics after the Sanforizing

In this bar diagram "X" axis represents the Sample type and "Y" axis represents the Fabric GSM. The blue bars represent the GSM before sanforization and the orange bars represents the GSM after sanforization of the fabric. We see that for every sample GSM raises after sanforization process. Because the fabrics yearn comes closer for this reason the GSM after sanforizing is more. Here we see, sample 5 & 6 40X30 canvas & 30X20 Twill fabric the GSM after sanforizing raises higher than any other sample. For samples 1, 2, 3, 4, 7, 8 & 9 the GSM after sanforization raise less than from other 2 samples.

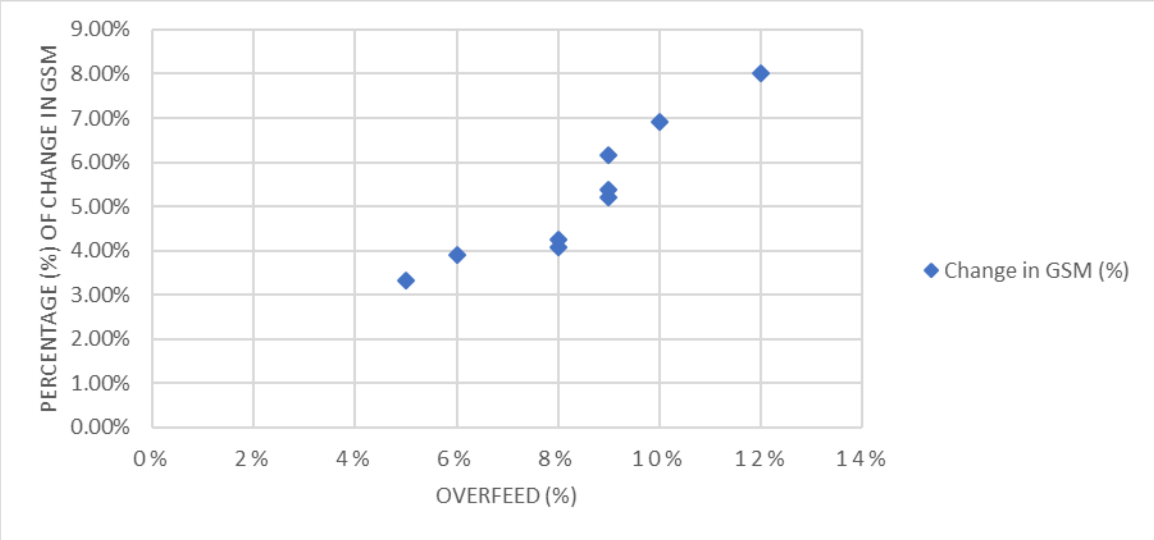


Figure: 4.2 Correlation between overfeed (%) and change of GSM

In this chart "X" axis represents "Overfeed (%)" and "Y" axis represents "Percentage of Change in GSM". We used different types of fabric and those fabrics had different GSM. Form the chart we can see that the percentage of variation of change in GSM. Here, for highest 12% overfeed (%) the change of GSM is 8.00% and this fabric are 50X40 (Canvas). We can also see that the change in GSM is 3.33% and this fabric name is 30X10 (Twill) & where lowest overfeed (%) is 5%. Here we see that increased of overfeed (%) then increased GSM also the decreased of overfeed (%) then decreased GSM.

4.2 Variation in Width of the fabric samples after Sanforization

In this work, we have selected some samples and before sanforization Width of the samples are taken. Then the samples are passed in the sanforizing machine for further processing. And after sanforization samples width measured by measuring tape. And then we can see that some variation or change in here before and after sanforization. We can get the variation in width of the fabric samples after sanforization. And this results are input are table (A.2).

From the table (A.2), we can see that the woven fabric width decreasing is depending on machine speed, temperature and overfeed (%). Changing this parameter of sanforizing machine, we can change in width after sanforizing. From this table, we can see maximum percentage (%) of change in width after sanforizing is 9.43% for sample no.9 Initially the width of this sample was 58. After sanforizing width decrease to 53. For this sample, the machine speed was 28 m/min, rubber unit temperature was 145°C and felt unit temperature was 130°C and overfeed was 9% of this sanforizing machine. Here we also see that the minimum percentage (%) of change in width after sanforizing is 4.35% for sample no.7. Initially the width of the sample was 60. After sanforizing width decrease to 57.5. For this sample the machine speed was 30 m/min, rubber unit temperature was 135°C and felt unit temperature was 120°C and overfeed 8%. Here we can see that for sample no.9 and sample no.7 the machine speed is different and also the temperature of sample no.9 is higher than sample no.7 and also the overfeed (%) of sample no.7 is lower than the sample no.9.

4.2.1 Change of Width after the Sanforization:

After sanforization the change of width of different fabrics were recorded in the Table (A.2). The change of width has been used here to drawn the following chart.

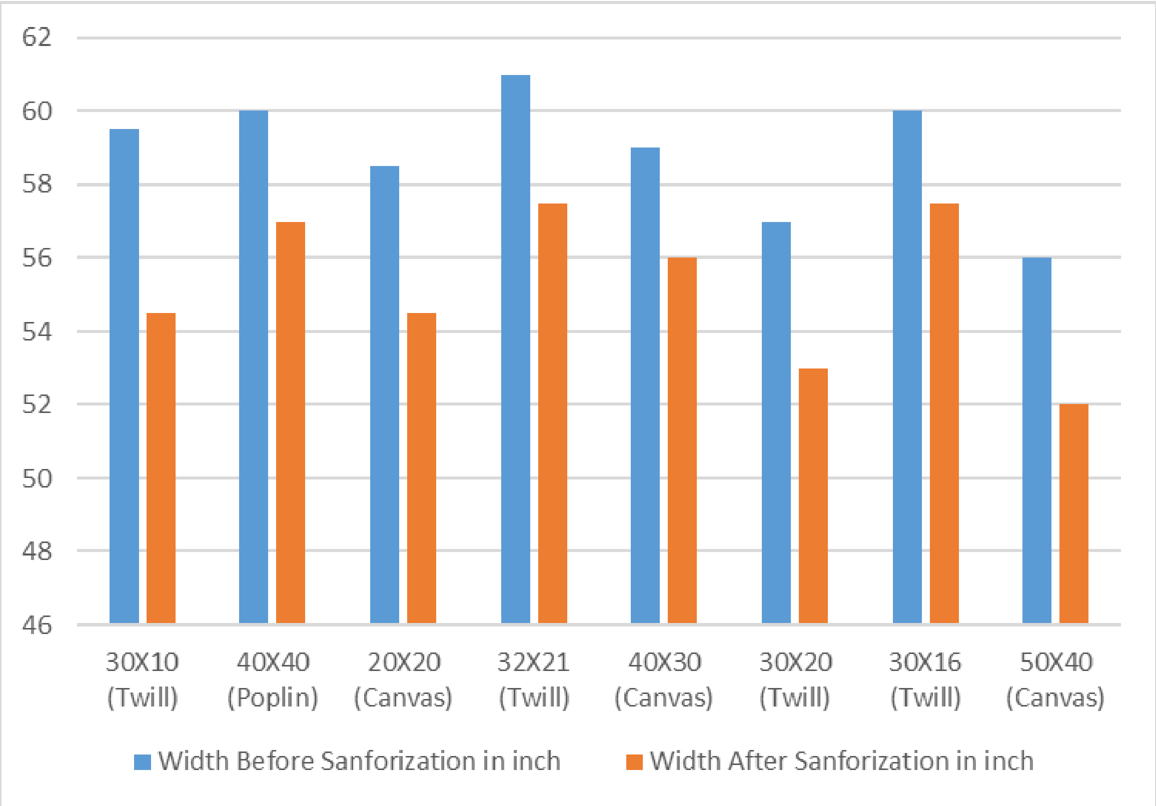


Figure: 4.3 Bar diagram represents the change of width of Woven fabrics after the Sanforizing

In this bar diagram "X" axis represents the Sample type and "Y" axis represents the fabric width. The blue bars represent the width before sanforization and the orange bars represents the width after sanforization of the fabric. We see that for every sample width loss after sanforization process. Because the fabrics yearn comes closer for this reason the width after sanforizing is less. Here we see sample 1 (30X10 Twill) & 9 (30X30 Twill) width change is higher than other sample. Also we see sample 7 (30X16 Twill) width change is less than other sample. In this process width control as buyer requirement.

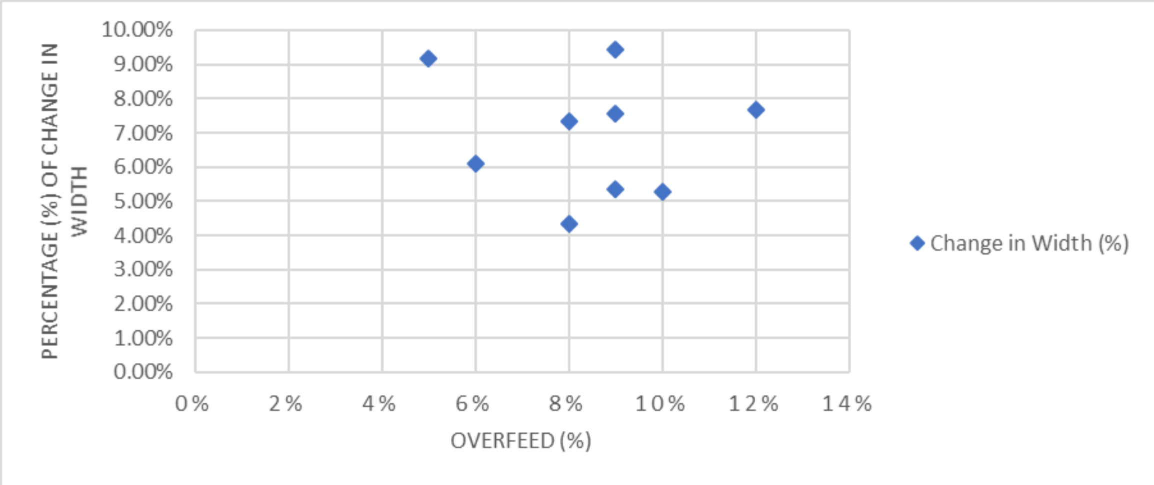


Figure: 4.4 Correlation between overfeed (%) and change of width

In this chart "X" axis represents "Overfeed (%)" and "Y" axis represents "Percentage of Change in Width". We used different types of fabric and those fabrics had different width. Form the chart we can see that the percentage of variation of change in width. Here, for highest 12% overfeed (%) the change of width is 7.69% and this fabric are 50X40 (Canvas). We can also see that the change in width is 9.17% and this fabric name is 30X10 (Twill) & where lowest overfeed (%) is 5%. Also Here, highest the change of width is 9.43% for 9% overfeed (%) and this fabric are 30X30 (Twill). We can also see that lowest the change in width is 4.35% and this fabric name is 30X16 (Twill) & where overfeed (%) is 8%.

4.3 Variation in EPI of the fabric samples after Sanforizing

To calculate EPI, we took 1 inch of sample and then count the warp widthwise. By this way, we got initial and after sanforizing EPI for each sample. Then we compared the after sanforizing EPI with the initial EPI of the sample.

From the table (A.3), we can see that the woven fabric EPI Increasing is depending on machine speed, temperature and overfeed (%). Changing this parameter of sanforizing machine, we can change in EPI after sanforizing. From this table, we can see maximum percentage (%) of change in EPI after sanforizing is 4.71% for sample no.8 Initially the EPI of this sample was 170. After sanforizing EPI Increase to 178. For this sample, the machine speed was 25 m/min, rubber unit temperature was 150°C and felt unit temperature was 135°C and overfeed was 12% of this sanforizing machine. Here we also see that the minimum percentage (%) of change in EPI after sanforizing is 0.74% for sample no.5. Initially the EPI of the sample was 135. After sanforizing EPI Increase to 136. For this sample the machine speed was 34 m/min, rubber unit temperature was 145°C and felt unit temperature was 130°C and overfeed 9%. Here we can see that for sample no.8 and sample no.5 the machine speed is different and also the temperature of sample no.8 is higher than sample no.5 and also the overfeed (%) of sample no.8 is higher than the sample no.5.

4.3.1 Change of EPI after the Sanforizing

After sanforizing the change of EPI of different fabrics were recorded in the Table A.3. The change of EPI has been used here to drawn the following figure.

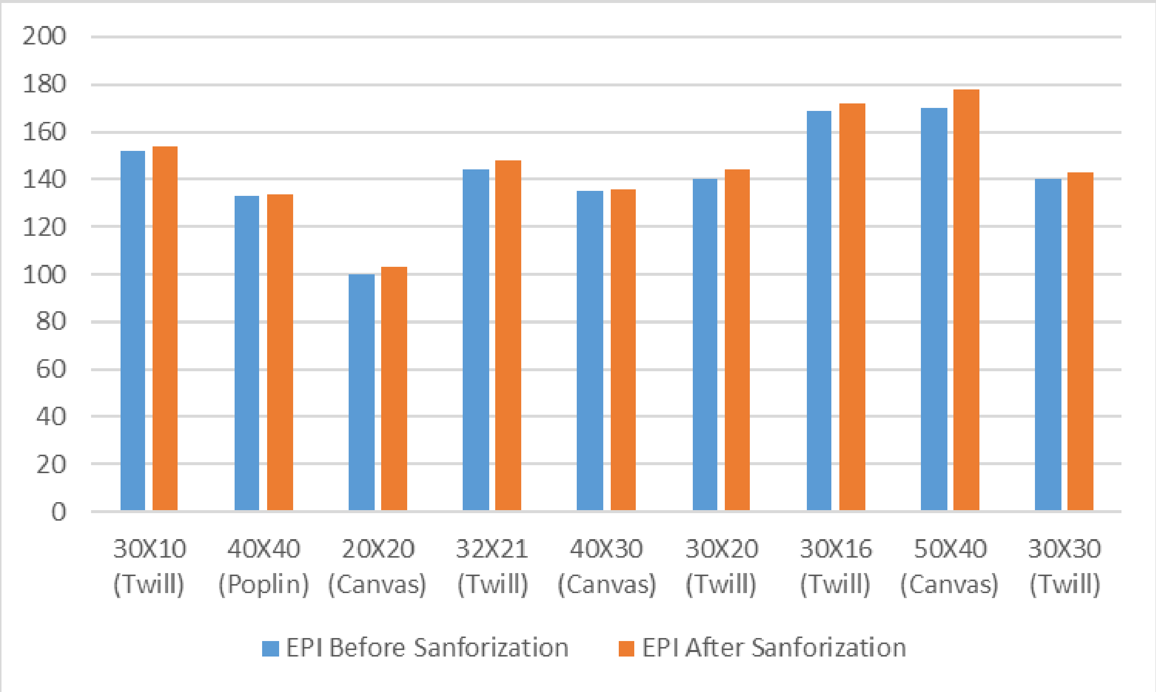


Figure 4.5: Bar diagram represents the change of EPI of woven fabrics after the sanforizing

In this bar diagram "X" axis represents the Sample type and "Y" axis represents the Fabric EPI. The blue bars represent the EPI before sanforizing and the orange bars represent the EPI after sanforizing of the fabric. Here we can see that the EPI before sanforizing is more than EPI after sanforizing of the sample.

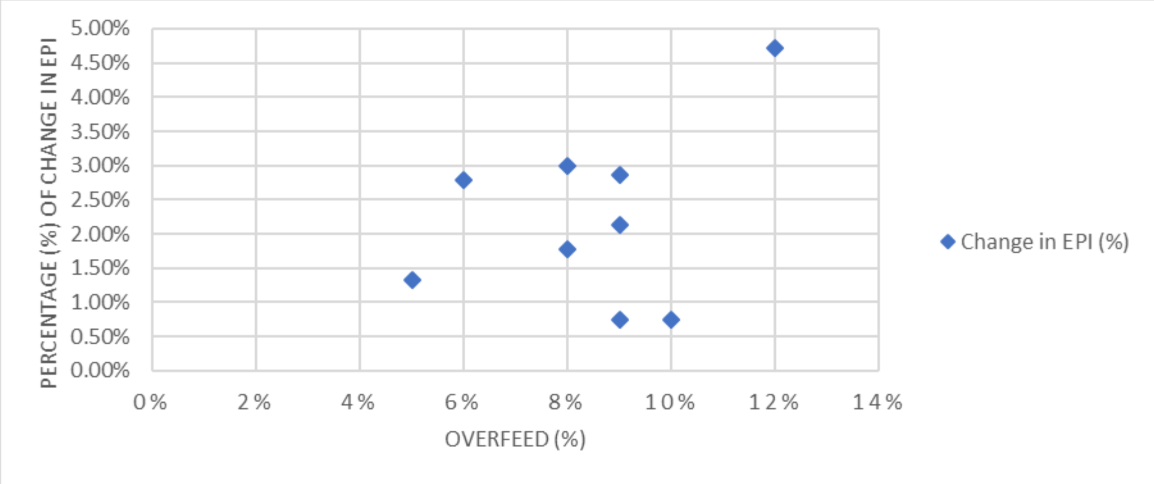


Figure: 4.6 Correlation between overfeed (%) and change of EPI percentage (%)

In this chart "X" axis represents "Overfeed (%)" and "Y" axis represents "Percentage of Change in EPI". We used different types of fabric and those fabrics had different EPI. Form the chart we can see that the percentage of variation of change in EPI. Here, for highest 12% overfeed (%) the change of EPI is 4.71% and this fabric are 50X40 (Canvas). We can also see that the change in EPI is 1.32% and this fabric name is 30X10 (Twill) & where lowest overfeed (%) is 5%. Also Here, highest the change of EPI is 4.71% for 12% overfeed (%) and this fabric are 50X40 (Canvas). We can also see that lowest the change in EPI is 0.75% and this fabric name is 40X40 (Poplin) & where overfeed (%) is 10%.

4.4 Variation in PPI of the fabric samples after Sanforizing

To calculate PPI, we took 1 inch of sample and then count the weft length wise. By this way, we got initial and after sanforizing PPI for each sample. Then we compared the after sanforizing PPI with the initial PPI of the sample.

From the table (A.4), we can see that the woven fabric PPI Increasing is depending on machine speed, temperature and overfeed (%). Changing this parameter of sanforizing machine, we can change in PPI after sanforizing. From this table, we can see maximum percentage (%) of change in PPI after sanforizing is 4.71% for sample no.8 Initially the PPI of this sample was 170. After sanforizing PPI Increase to 178. For this sample, the machine speed was 25 m/min, rubber unit temperature was 150°C and felt unit temperature was 135°C and overfeed was 12% of this sanforizing machine. Here we also see that the minimum percentage (%) of change in PPI after sanforizing is 0.74% for sample no.5. Initially the PPI of the sample was 135. After sanforizing PPI Increase to 136. For this sample the machine speed was 34 m/min, rubber unit temperature was 145°C and felt unit temperature was 130°C and overfeed 9%. Here we can see that for sample no.8 and sample no.5 the machine speed is different and also the temperature of sample no.8 is higher than sample no.5 and also the overfeed (%) of sample no.8 is higher than the sample no.5.

4.4.1 Change of PPI after the Sanforizing

After sanforizing the change of PPI of different fabrics were recorded in the Table A.4. The change of PPI has been used here to drawn the following figure.

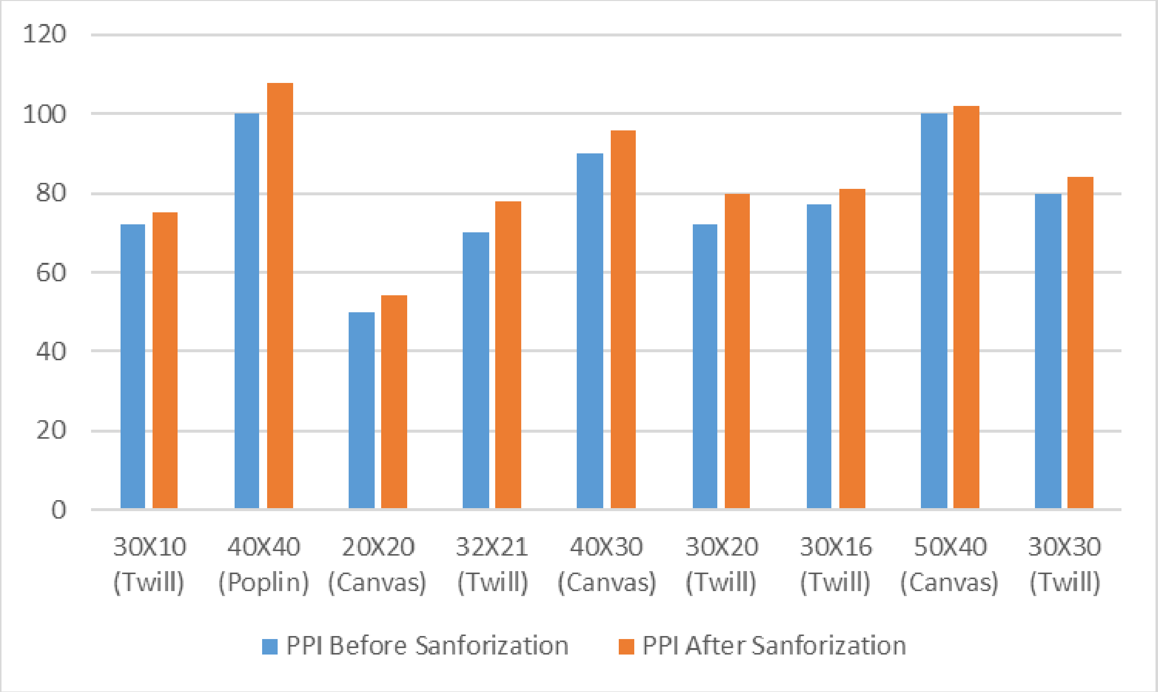


Figure: 4.7 Bar diagram represents the change of PPI of woven fabrics after the sanforizing

In this bar diagram "X" axis represents the Sample type and "Y" axis represents the Fabric PPI. The blue bars represent the PPI before sanforizing and the orange bars represent the PPI after sanforizing of the fabric. Here we can see that the PPI before sanforizing is more than PPI after sanforizing of the sample.

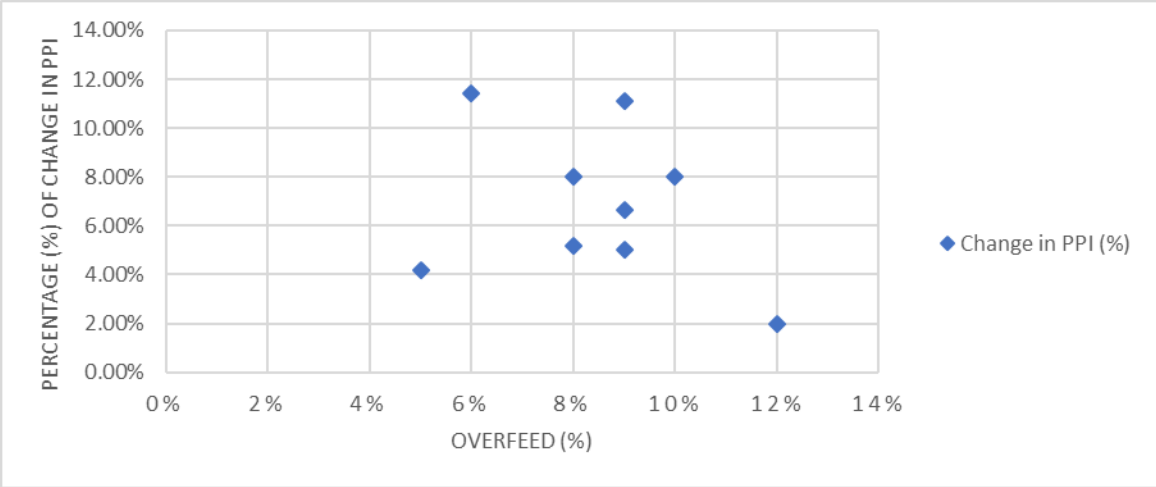


Figure: 4.8 Correlation between overfeed (%) and change of PPI percentage (%)

In this chart "X" axis represents "Overfeed (%)" and "Y" axis represents "Percentage of Change in PPI". We used different types of fabric and those fabrics had different PPI. Form the chart we can see that the percentage of variation of change in PPI. Here, for highest 12% overfeed (%) the change of PPI is 2% and this fabric are 50X40 (Canvas). We can also see that the change in PPI is 4.17% and this fabric name is 30X10 (Twill) & where lowest overfeed (%) is 5%. Also Here, highest the change of PPI is 11.43% for 6% overfeed (%) and this fabric are 32X21 (Twill). We can also see that lowest the change in PPI is 2% and this fabric name is 50X40 (Canvas) & where overfeed (%) is 12%.

4.5 Variation in Warp Shrinkage of the fabric samples after Sanforization

To calculate we cut a square of fabric from a roll and Draw a square 18"x18" on the fabric. Make sure you are using a template and that your square template is at least 2" away from selvedge. Measure square before wash and after wash.

From the table (A.6), we can see that the woven fabric warp shrinkage is depending on machine speed, temperature and overfeed (%). Changing this parameter of sanforizing machine, we can change in warp shrinkage (%) after sanforizing. From this table, we can see maximum percentage (%) of change in warp shrinkage after sanforizing is 7.78% for sample no.6. For this sample, the machine speed was 35 m/min, rubber unit temperature was 145°C and felt unit temperature was 130°C and overfeed was 9% of this sanforizing machine. Initially the minimum warp shrinkage of this sample was 1.11% for sample no.2. For this sample, the machine speed was 30 m/min, rubber unit temperature was

150°C and felt unit temperature was 135°C and overfeed was 10% of this sanforizing machine.

4.5.1 Change of warp Shrinkage after the Sanforization

After sanforizing the change of warp shrinkage of different fabrics were recorded in the Table A.6. The change of shrinkage for warp has been used here to drawn the following figure.

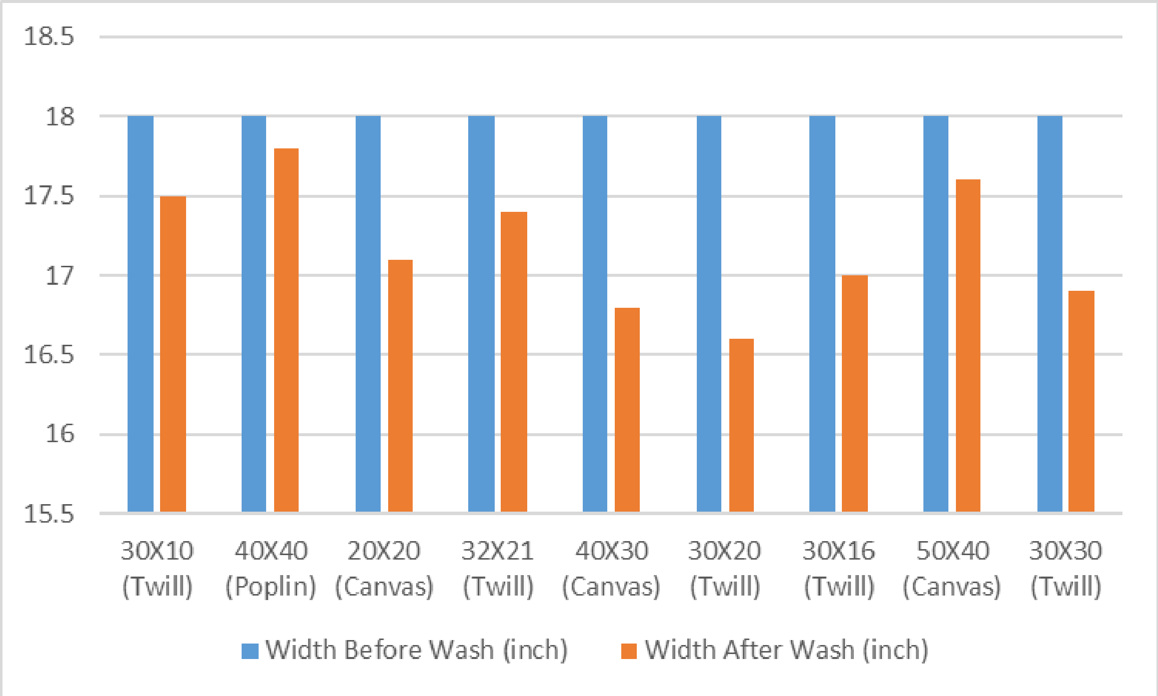


Figure: 4.9 Bar diagram represents the change of warp shrinkage of woven fabrics after the sanforizing

In this bar diagram "X" axis represents the Sample type and "Y" axis represents the width of fabric warp wise after & before wash. The blue bars represent the width before wash (inch) and the orange bars represent the width after wash of the fabric. Here we can see that the warp shrinkage after wash increased of the sample.

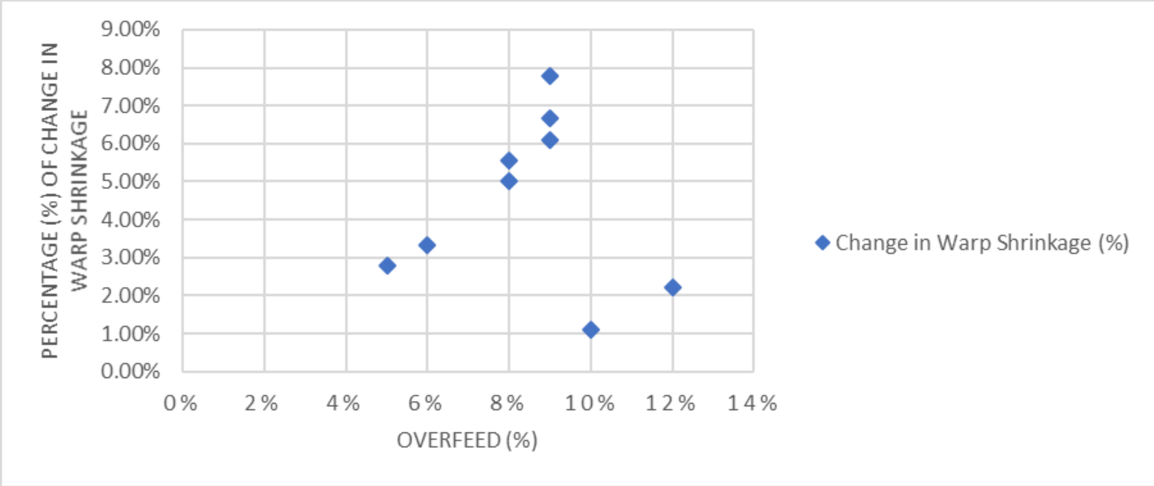


Figure: 4.10 Correlation between warp shrinkage (%) and overfeed (%)

In this chart “X” axis represents “Overfeed (%)” and “Y” axis represents “Percentage of Change in Warp Shrinkage”. We used different types of fabric and those fabrics had different Shrinkage. Form the chart we can see that the percentage of variation of change in warp shrinkage. Here, for highest 12% overfeed (%) the change of Shrinkage is 2.22% and this fabric are 50X40 (Canvas). We can also see that the change in warp shrinkage is 2.78% and this fabric name is 30X10 (Twill) & where lowest overfeed (%) is 5%. Also Here, highest the change of warp shrinkage is 7.78% for 9% overfeed (%) and this fabric are 30X20 (Twill). We can also see that lowest the change in weft shrinkage is 1.11% and this fabric name is 40X40 (Poplin) & where overfeed (%) is 10%.

4.6 Variation in Weft Shrinkage of the fabric samples after Sanforization

To calculate we cut a square of fabric from a roll and Draw a square 18"x18" on the fabric. Make sure you are using a template and that your square template is at least 2" away from selvedge. Measure square before wash and after wash.

From the table (A.7), we can see that the woven fabric weft shrinkage is depending on machine speed, temperature and overfeed (%). Changing this parameter of sanforizing machine, we can change in weft shrinkage (%) after sanforizing. From this table, we can see maximum percentage (%) of change in weft shrinkage after sanforizing is 15.56% for sample no.7. For this sample, the machine speed was 30 m/min, rubber unit temperature was 135°C and felt unit temperature was 120°C and overfeed was 8% of this sanforizing machine. Initially the minimum weft shrinkage of this sample was 8.33% for sample no.1.

For this sample, the machine speed was 25 m/min, rubber unit temperature was 135°C and felt unit temperature was 120°C and overfeed was 5% of this sanforizing machine.

4.6.1 Change of weft Shrinkage after the Sanforization

After sanforizing the change of weft shrinkage of different fabrics were recorded in the Table A.7. The change of shrinkage for weft has been used here to drawn the following figure.

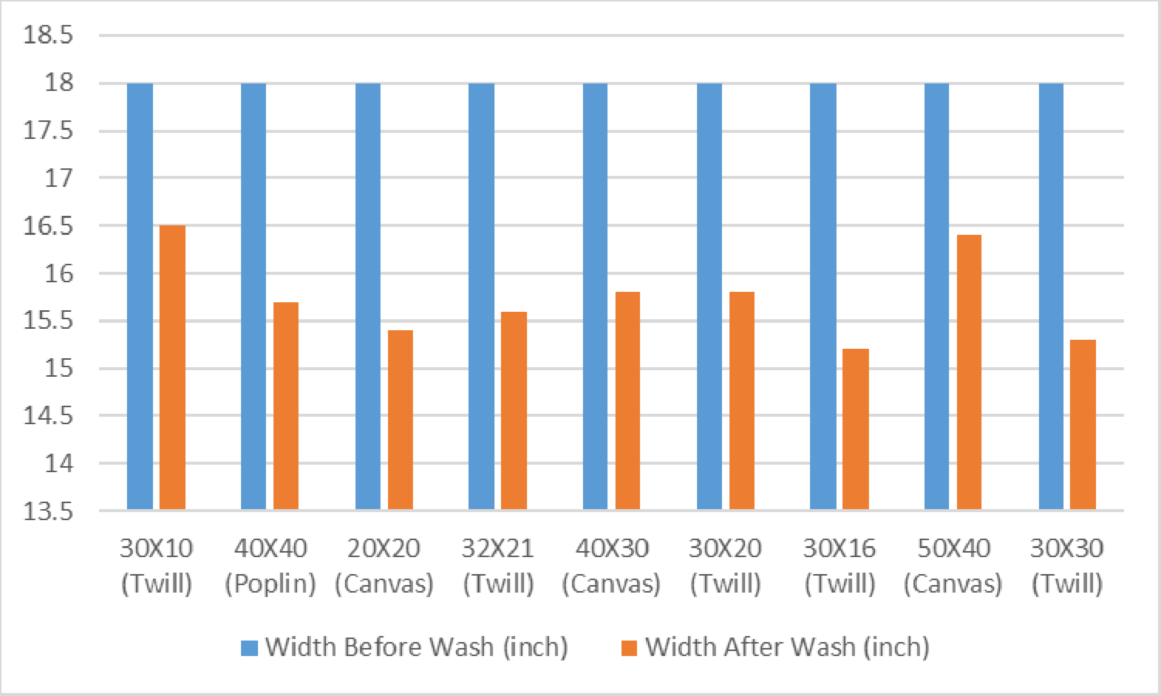


Figure: 4.11 Bar diagram represents the change of weft shrinkage of woven fabrics after the sanforizing

In this bar diagram "X" axis represents the Sample type and "Y" axis represents the width of fabric warp wise after & before wash. The blue bars represent the width before wash (inch) and the orange bars represent the width after wash of the fabric. Here we can see that the weft shrinkage after wash increased of the sample.

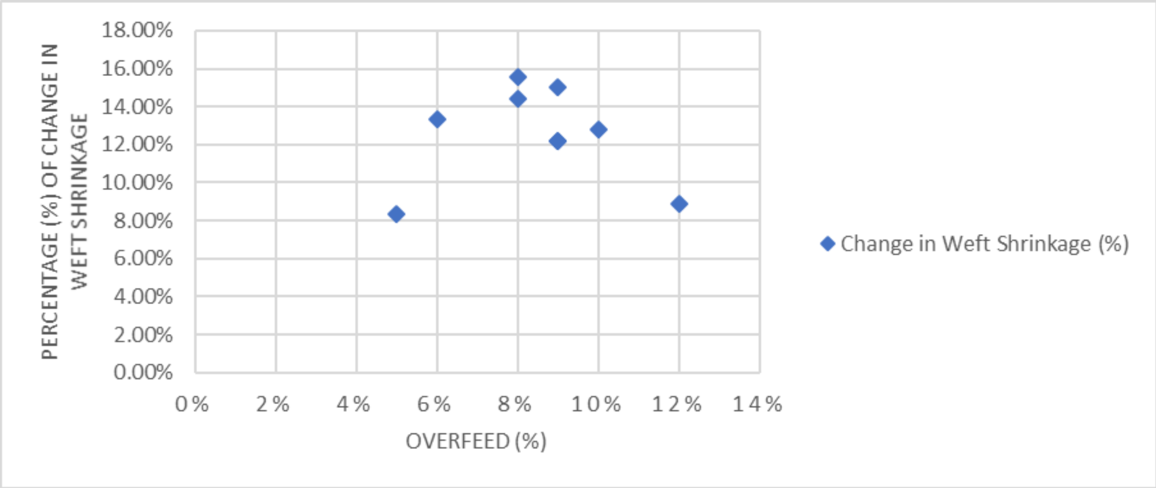


Figure: 4.12 Correlation between weft shrinkage (%) and overfeed (%)

In this chart "X" axis represents "Overfeed (%)" and "Y" axis represents "Percentage of Change in Weft Shrinkage". We used different types of fabric and those fabrics had different Shrinkage. Form the chart we can see that the percentage of variation of change in weft shrinkage. Here, for highest 12% overfeed (%) the change of Shrinkage is 8.89% and this fabric are 50X40 (Canvas). We can also see that the change in weft shrinkage is 8.33% and this fabric name is 30X10 (Twill) & where lowest overfeed (%) is 5%. Also Here, highest the change of weft shrinkage is 15.56% for 8% overfeed (%) and this fabric are 30X16 (Twill). We can also see that lowest the change in weft shrinkage is 8.33% and this fabric name is 30X10 (Twill) & where overfeed (%) is 5%.

CHAPTER-5

CONCLUSION

CHAPTER-5

CONCLUSION

After completing this project report work we fully understood the working process of a sanforizing machine. Besides, the sanforizing machine we learnt about stenter machine those are related with sanforizing machine. This project work basically helps us to meet the knowledge about sanforizing machine. We learnt about different parts and parameters of the machine (like temperature, machine speed and overfeed %). By this study, we get the result of variation in the change of GSM (%), EPI (%), PPI (%), Width and Shrinkage (%). That's are given below:

- ❖ Highest 12% overfeed (%) the change of GSM is 8.00%. The change in GSM is 3.33% where lowest overfeed (%) is 5%. Increased of overfeed (%) increased GSM also the decreased of overfeed (%) decreased GSM.
- ❖ Highest 12% overfeed (%) the change of width is 7.69%. The change in width is 9.17% where lowest overfeed (%) is 5%. Highest the change of width is 9.43% for 9% overfeed (%). Lowest the change in width is 4.35% where overfeed (%) is 8%.
- ❖ Highest 12% overfeed (%) the change of highest EPI is 4.71%. The change in EPI is 1.32% where lowest overfeed (%) is 5%. Lowest the change in EPI is 0.75% where overfeed (%) is 10%.
- ❖ Highest 12% overfeed (%) the change of PPI is 2%. The change in PPI is 4.17% where lowest overfeed (%) is 5%. Highest the change of PPI is 11.43% for 6% overfeed (%). Lowest the change in PPI is 2% where overfeed (%) is 12%.
- ❖ Highest 12% overfeed (%) the change of Shrinkage is 2.22%. The change in warp shrinkage is 2.78% where lowest overfeed (%) is 5%. Highest the change of warp shrinkage is 7.78% for 9% overfeed (%). Lowest the change in weft shrinkage is 1.11% where overfeed (%) is 10%.
- ❖ Highest 12% overfeed (%) the change of Shrinkage is 8.89%. The change in weft shrinkage is 8.33% where lowest overfeed (%) is 5%. highest the change of weft shrinkage is 15.56% for 8% overfeed. Lowest the change in weft shrinkage is 8.33% where overfeed (%) is 5%.

It is an important study in the field of wet processing technology. The study confirmed that sanforizing machine for fabrics and always so obvious for finished fabric. Finally, we can say that this study will help us in our future life.

REFERENCE

[1] http://textileinsight.blogspot.com/2014/09/sanforizing-machine-and-process.html (Retrieved Date: 25/03/18; Retrieved Time: 11:30 am).

[2] http://textilelearner.blogspot.com/2012/02/sanforizinganti-shrinkage-finishing.html (Retrieved Date: 27/03/18; Retrieved Time: 12 pm).

[3] http://textilescommittee.nic.in/writereaddata/files/publication/Pro10.pdf (Retrieved Date: 30/03/18; Retrieved Time: 02:30 am).

[4] http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/20.500.11948/1381/P04799.pdf?sequence=1&isAllowed=y (Retrieved Date: 01/04/18; Retrieved Time: 04:30 am).

[5] https://www.smartpatternmaking.com/blogs/pattern-making-news-articles-and-tips/how-to-calculate-fabric-shrinkage-in-3-easy-steps (Retrieved Date: 05/04/18; Retrieved Time: 05:00 am).

APPENDIX

(Information that We Get about GSM, EPI, PPI, Width & Shrinkage)

Table: A.1 Percentage of change in GSM after Sanforization

Sample No.	Sample Name with Composition	Required GSM	GSM Before Sanforization	GSM After Sanforization	Change in GSM After Sanforization	Percentage (%) of change in GSM after Sanforization	Machine speed (rpm)	Rubber Temp. (°C)	Felt Temp. (°C)	Overfeed (%)
01	30X10 (Twill)	250	240	248	8	3.33	25	135	120	5
02	40X40 (Poplin)	140	130	139	9	6.92	30	150	135	10
03	20X20 (Canvas)	260	245	255	10	4.08	32	135	120	8
04	32X21 (Twill)	240	230	239	9	3.91	30	145	130	6
05	40X30 (Canvas)	210	195	207	12	6.15	34	145	130	9
06	30X20 (Twill)	245	230	242	12	5.22	35	145	130	9
07	30X16 (Twill)	250	235	245	10	4.26	30	135	120	8
08	50X40 (Canvas)	110	100	108	8	8.00	25	150	135	12
09	30X30 (Twill)	220	205	216	11	5.37	28	145	130	9

Table: A.2 Percentage of change in Width after Sanforization

Sample No.	Sample Name with Composition	Required Width (inch)	Width Before Sanforization (inch)	Width After Sanforization (inch)	Change in Width After Sanforization	Percentage (%) of change in Width after Sanforization	Machine speed (rpm)	Rubber Temp. (°C)	Felt Temp. (°C)	Overfeed (%)

01	30X10 (Twill)	55	59.5	54.5	5	9.17	25	135	120	5
02	40X40 (Poplin)	57	60	57	3	5.26	30	150	135	10
03	20X20 (Canvas)	55	58.5	54.5	4	7.34	32	135	120	8
04	32X21 (Twill)	58	61	57.5	3.5	6.09	30	145	130	6
05	40X30 (Canvas)	56	59	56	3	5.36	34	145	130	9
06	30X20 (Twill)	54	57	53	4	7.55	35	145	130	9
07	30X16 (Twill)	58	60	57.5	2.5	4.35	30	135	120	8
08	50X40 (Canvas)	52	56	52	4	7.69	25	150	135	12
09	30X30 (Twill)	54	58	53	5	9.43	28	145	130	9

Table: A.3 Percentage of change in EPI after Sanforization

Sample No.	Sample Name with Composition	Required GSM	EPI Before Sanforization	EPI After Sanforization	Change in EPI After Sanforization	Percentage (%) of change in EPI after Sanforization	Machine speed (rpm)	Rubber Temp. (°C)	Felt Temp. (°C)	Overfeed (%)
01	30X10 (Twill)	250	152	154	2	1.32	25	135	120	5
02	40X40 (Poplin)	140	133	134	1	0.75	30	150	135	10
03	20X20 (Canvas)	260	100	103	3	3	32	135	120	8
04	32X21 (Twill)	240	144	148	4	2.78	30	145	130	6
05	40X30 (Canvas)	210	135	136	1	0.74	34	145	130	9
06	30X20 (Twill)	245	140	144	4	2.86	35	145	130	9
07	30X16 (Twill)	250	169	172	3	1.78	30	135	120	8

08	50X40 (Canvas)	110	170	178	8	4.71	25	150	135	12
09	30X30 (Twill)	220	140	143	3	2.14	28	145	130	9

Table: A.4 Percentage of change in PPI after Sanforization

Sample No.	Sample Name with Composition	Required GSM	PPI Before Sanforization	PPI After Sanforization	Change in PPI After Sanforization	Percentage (%) of change in PPI after Sanforization	Machine speed (rpm)	Rubber Temp. (°C)	Felt Temp. (°C)	Overfeed (%)
01	30X10 (Twill)	250	72	75	3	4.17	25	135	120	5
02	40X40 (Poplin)	140	100	108	8	8	30	150	135	10
03	20X20 (Canvas)	260	50	54	4	8	32	135	120	8
04	32X21 (Twill)	240	70	78	8	11.43	30	145	130	6
05	40X30 (Canvas)	210	90	96	6	6.67	34	145	130	9
06	30X20 (Twill)	245	72	80	8	11.11	35	145	130	9
07	30X16 (Twill)	250	77	81	4	5.19	30	135	120	8
08	50X40 (Canvas)	110	100	102	2	2	25	150	135	12
09	30X30 (Twill)	220	80	84	4	5	28	145	130	9

Table: A.6 Percentage of change in Warp Shrinkage after Sanforization

Sample No.	Sample Name with Composition	Required GSM	Width Before Wash (inch)	Width After Wash (inch)	Change in Shrinkage After Sanforization	Percentage (%) of change in Shrinkage after Sanforization	Machine speed (rpm)	Rubber Temp. (°C)	Felt Temp. (°C)	Overfeed (%)

01	30X10 (Twill)	250	18	17.5	0.5	2.78	25	135	120	5
02	40X40 (Poplin)	140	18	17.8	0.2	1.11	30	150	135	10
03	20X20 (Canvas)	260	18	17.1	0.9	5.00	32	135	120	8
04	32X21 (Twill)	240	18	17.4	0.6	3.33	30	145	130	6
05	40X30 (Canvas)	210	18	16.8	1.2	6.67	34	145	130	9
06	30X20 (Twill)	245	18	16.6	1.4	7.78	35	145	130	9
07	30X16 (Twill)	250	18	17.0	1.0	5.56	30	135	120	8
08	50X40 (Canvas)	110	18	17.6	0.4	2.22	25	150	135	12
09	30X30 (Twill)	220	18	16.9	1.1	6.11	28	145	130	9

Table: A.7 Percentage of change in Weft Shrinkage after Sanforization

Sample No.	Sample Name with Composition	Required GSM	Width Before Wash (inch)	Width After Wash (inch)	Change in Shrinkage After Sanforization	Percentage (%) of change in Shrinkage after Sanforization	Machine speed (rpm)	Rubber Temp. (°C)	Felt Temp. (°C)	Overfeed (%)
01	30X10 (Twill)	250	18	16.5	1.5	8.33	25	135	120	5
02	40X40 (Poplin)	140	18	15.7	2.3	12.78	30	150	135	10
03	20X20 (Canvas)	260	18	15.4	2.6	14.44	32	135	120	8
04	32X21 (Twill)	240	18	15.6	2.4	13.33	30	145	130	6
05	40X30 (Canvas)	210	18	15.8	2.2	12.22	34	145	130	9
06	30X20 (Twill)	245	18	15.8	2.2	12.22	35	145	130	9
07	30X16 (Twill)	250	18	15.2	2.8	15.56	30	135	120	8

08	50X40 (Canvas)	110	18	16.4	1.6	8.89	25	150	135	12
09	30X30 (Twill)	220	18	15.3	2.7	15.00	28	145	130	9