Faculty of Engineering

Department of Textile Engineering

Project Report

On

Effect of bio-polishing in cotton fabric

Course code: TE-4214Course title: Project (Thesis)

Submitted by:

Md.Samim Reja

ID: 133-23-3689

Supervised by:

Ms. Nawshin Farzana
Assistant professor
Department of Textile Engineering
Daffodil International University

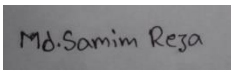
A thesis submitted in partial fulfillment of the requirements for the degree of
Bachelorof Science in Textile Engineering

Advance in Wet ProcessingTechnology

Spring – 2020

DECLARATION

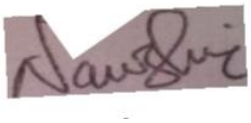
I hereby declare that, this project report has been done by me under the supervision of **Ms.Nawshin Farzana, Assistant professor,**Department of Textile Engineering, Faculty of Engineering, Daffodil International University. I also declare that,neither this project nor any part of this project has been submitted elsewhere for award of anydegree or diploma.



Md. Samim Reja
ID:133-23-3689
Department of Textile Engineering
Daffodil International University

LETTER OF APPROVAL

This project report prepared by**Md. Samim Reja(ID: 133-23-3689),**is approved in Partial Fulfillment of the Requirement for the Degree of **BACHELOR OF SCIENCE IN TEXTILE ENGINEERING**. The said student has completed his project work under my supervision. During the research period I found him sincere, hardworking and enthusiastic.



Ms. Nawshin Farzana
ASSISTANT PROFESSOR
DEPARTMENT OF TEXTILE ENGINEERING
FACULTY OF ENGINEERING
DAFFODIL INTERNATIONAL UNIVERSITY

ACKNOWLEDGEMENT

Firstly, we express our gratefulness to almighty Allah for his divine blessingmakes us possible to complete this project successfully.

Iam grateful tomysupervisor **Ms. Nawshin Farzana,** Assistant Professor,Department of Textile Engineering, Faculty of Engineering, Daffodil international University. Deep knowledge and keen interestsof our supervisor in the field of textile dyeing and finishing influenced us to carry out the project work.Hisendless patience,scholarly guidance, continual encouragement, energeticsupervision, constructive criticism, valuable advice,reading many inferior drafts and correctingthese at all stages have made it possible to complete this project.

We would like to express our thanks to**Mr. Md. Mominur Rahman**,**Assistant Professor & Head (In-Charge)**, Department of Textile Engineering, Faculty of Engineering, Daffodil international University for his kind help to finish our project report. We would like to express our thanks to **Prof. Dr. Md. Zulhash Uddin**, Dean, BUTexand **Prof. Dr. S.M. Mahbub Ul Haque Majumder**for providing us necessary information to complete the report on time.

We would like to deliver thanks to our entire course mates in Daffodil International University, who tookpart in the discussion while completing the course work.

Finally, we would like to express a sense of gratitude to our beloved parents and friends for their mental support, strength and assistance throughout writing the project report.

DEDICATION

I DEDICATE THIS PROJECT REPORT TO MY PARENTS.

ABSTRACT

The most common and widespread process applied to fabrics during wet processing is bio-polishing to reduce Hairiness, and making the surface of the fabric smoother. The bio-polishing of fabrics to remove hairiness It decreases the pilling pattern, but fabrics lose some strength and weight. This subject will be selected as Since this process is of great importance to the textile industry, our project. In the course of bio-polishing, We use a biodegradable, non-toxic enzyme called cellulase. In this project, we are interested in.

TABLE OF CONTENTS

Contents **Page No.**

List of Figures

List of Tables

Chapter-1
Introduction

1.1 Background of the Study: Bio-polishing means cellulosic fabric enzyme washing to strip

Hairiness of the fabrics or fuzziness. In the textile industry, bio-polishing has been one of the most popular wet-processing applications. Bio-polishing is compatible with the ecosystem and is biodegradable. Smoother, more lustrous, less hairiness and handling properties are enhanced after bio-polishing fabric surface is smoother. The hairiness of yarn in the fabric is eliminated due to bio-polishing , so rubbing fastness is very pleasant since the tendency of pilling formation is lower. Like cotton cloth, the bio-polishing effect on cellulose is a permanent effect that is achieved through enzyme application. The consistency of the fabric is improved after bio-polishing. Bio-polishing, primarily before dying, may be performed before or after the dyeing process. If the enzyme concentration is higher during bio-polishing, then the cost of the process would be higher. Again if the temperature and time were not adequately controlled and more time continued, then the loss of fiber would be greater and the quality of the fabric would be lower.

1.2 Objectives:

The bio-polishing effect on 100 percent cotton knitted fabric is the topic of this thesis study.

The tangible objectives are-

A. To know about bio-polishing process and effect of cotton knitted fabric
B. To know about changes of GSM, CPI, WPI and stitch length of fabric
C. To compare changes percentages %.

Chapter-2
Literature Review

2.1 What does bio-polishing mean?

Bio-polishing is a permanent finishing procedure in textile wet-processing with the application of enzyme to develop fabric quality by reducing the pilling tendency and fuzziness of (cellulose) cotton fabric. This is the permanent effect on cotton fabric.

2.2 The Bio-polishing Advantages:

1. To develop fabric handle properties.
2. To make the fabric surface smoother and flexible.
3. To reduce hairiness, fuzziness and pilling tendency.
4. To increase the fabric quality.

2.3 The Bio-polishing Disadvantages:

- Reduce fabric power
- Weight loss

2.4 What is Enzyme?

The term enzyme comes from the Greek word "Enzymos "means from or in the cell. Eduard Buchner named the enzyme that brought about the fermentation of sucrose "zymase".The enzyme is naturally available, capable of catalyzing action, high molecular weight and most of them are proteins made up to more than 250 amino acid groups. An enzyme activity reduced outside its optimum temperature and pH.So we can say that the enzyme is a substance that acts as a catalyst in the living organism. In recent year's application of enzyme in textile industries are increased rapidly but first application of enzyme on fabric in Japan in 1989.

2.5 Enzyme Advantages:

- The enzyme is biodegradable and free of toxicity.
- Enhanced standard of fabric.
- Reduce the cost of water, chemicals, and electricity.
- The enzyme can be easily regulated.

2.6 Enzyme Disadvantages:

- Allergies can affect staff .
- Enzymes may be harmed if the temperature increases slightly.
- It reduces the strength of the fabric and often kills the fabric.

2.7 List of enzymes that are used in the textile industry:

Serial No	Name of Enzyme	Uses and Effect in Textile
1	Celluloses	Bio-polishing, Counter finishing, Smoothness, Denim stonewash
2	Proteases	Better to extract oil or stain protein, mostly used in households, Washing Uses
3	Catalases	Proteases H2O2, known as the per-oxide killer, decomposes.
4	Amylases	Starch De-sizing from Warp Yarn
5	Pectinases	Hydrolysis of pectin decomposes, for example, flax and hemp
6	Lipases	Oils and fats hydrolysis in detergent
7	Peroxidases	After reactive dyeing, it is used as an enzymatic rinse process to give Better-wet power and decolorized waste water, referred to as per-oxide
8	Collagenases	Remove wools skin parts
9	Nitrilases	Provide better coloration
10	Ligninases	Separate wool from other plant components

Table no 01

2.8Enzyme Mechanism:

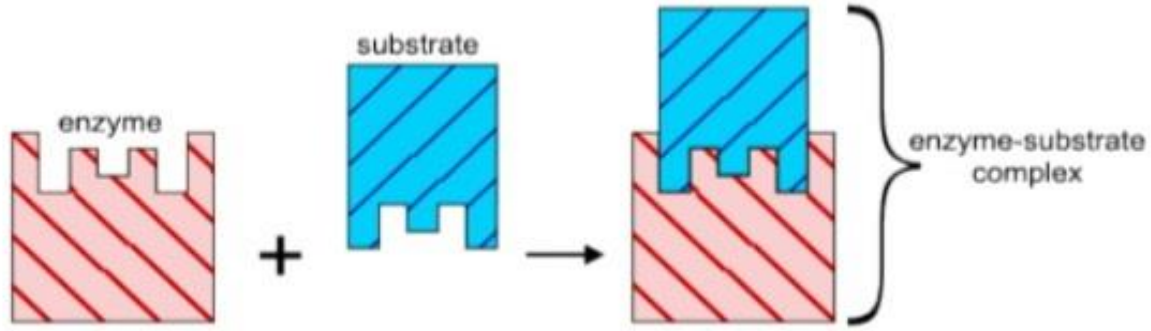


Figure 1: Enzyme Mechanism

There is an active site in the enzyme where substrate molecules bind together. The enzyme molecule changes its shape during the reaction, so that the substrate molecule can get closer to the enzyme molecule. The molecule on which the enzyme acts is called a substrate. An enzyme-substrate compound was then formed. Products leave the active side of the enzyme after a complete reaction and the enzyme is regenerated.

2.9Factors influencing the function of enzymes:

1.Temperature: The optimum temperature of the enzyme is between 37˚-45˚c.In this region enzyme activity is more but after 55˚c activity gradually lowers and at high temperature (80˚c) enzymes are dyed.

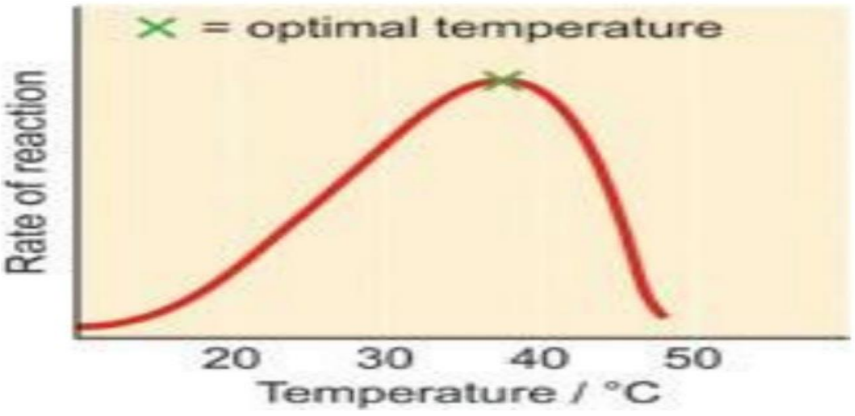


Figure: 2 Effect of temperature

2.pH:

If the pH value of the enzyme is less or more than optimal, then the activity of the enzyme will be decreased. Pepsin, for example works in an acidic state, but trypsin works in an alkaline condition.

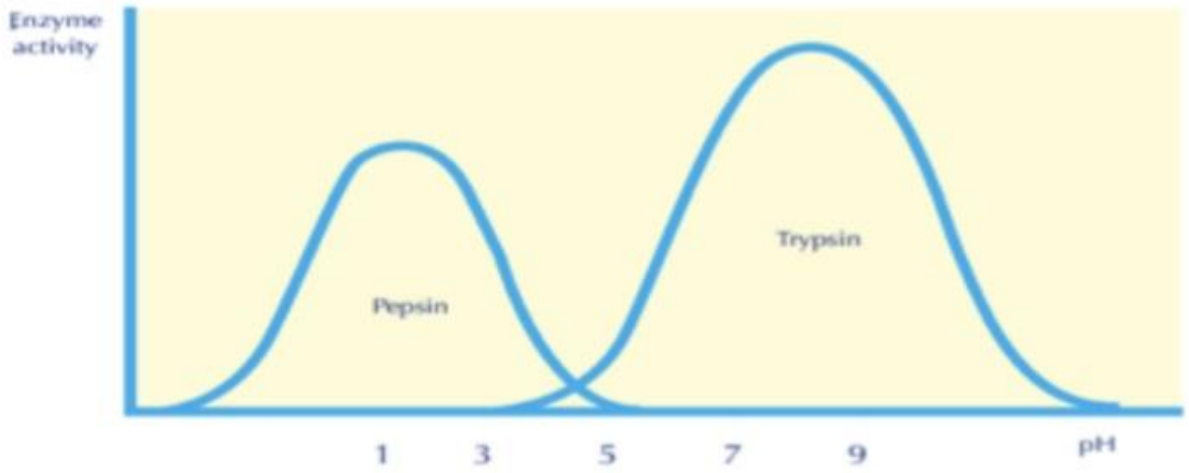


Figure 3: Effect of pH

3. Enzyme concentration:

if the enzyme concentration increases, the reaction speed steadily increases.

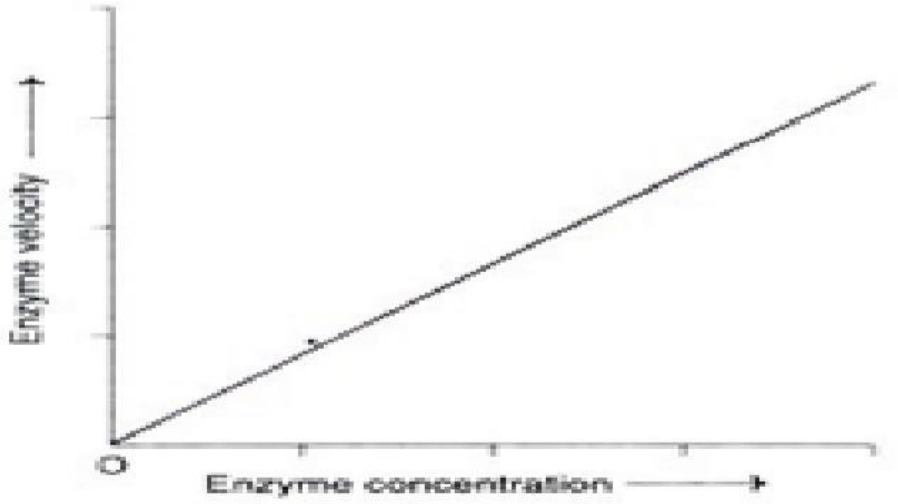


Figure 4: Effect of enzyme concentration

4. Substrate concentration:

The rate of reaction will be increased to a certain substrate limit About focus.

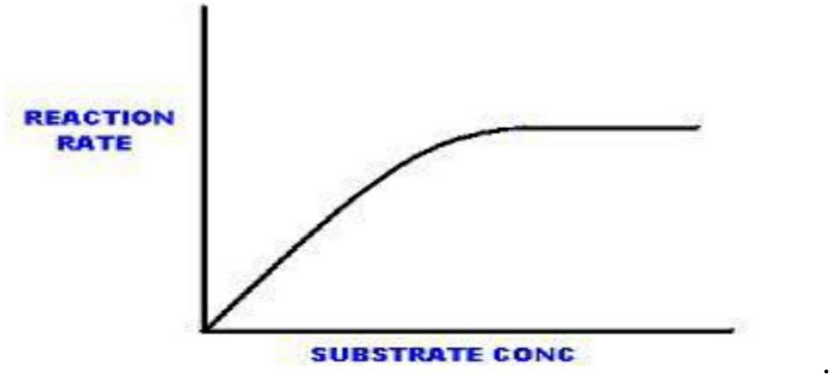


Figure 4: Effect of substrate concentration.

2.10 The advantages of using the enzyme in bio-polishing:

- Remove hairy, cloth surface pills
- Make a flexible and smooth fabric
- Establish the fabric property of the handle
- Developing the consistency of the fabric

2.11 Disadvantages of the enzyme using in bio-polishing:

- Weight loss
- Strength loss

Chapter-3
Information of experiments

3.1 Bio-polishing process:

According to the bio-polishing recipe, we have completed our thesis at "CPM composite Knit Limited" In the markets, preceded.

3.2 Bio-polishing Recipe:

a) Enzyme = 1% (stock solution-1%)
b) Acetic Acid = 0.8 g/l (stock solution-1%)
c) Temperature = 45˚c-55˚c (for 15 minute)
d) Temperature = 80˚c (for 5 minute)
e) pH = 4.5-5.5
f) M:L = 1:30

3.3 Definition of Process:

- We picked up a scoured cotton knitted fabric first,
- Then according to the recipe, we set the dye bath and make the solution
- Then we check the pH and place the sample on the bath of the colorant
- We then increase the temperature for 15 minutes and maintain 45c-55c
- After 15 minutes, the temperature is increased to 80 c and held for 5 minutes.
- Then the bath drained, and the fabric washed off hot
- Ultimately, we get bio-polished knitted cotton fabric.

3.4 Deactivated Enzyme

For deactive enzymes, we increase the temperature by 80 c and proceed for 5 minutes or 5 minutes. Increase the pH above 8 and hold for 5 minutes.

3.5 Data from experiments:

We obtained 6 samples of knitted cotton for our thesis experiment. Of cotton. Before and after bio-polishing, we measure the samples' GSM, Stitch Length, CPI and WPI and calculate the shift percentage. The specimens are—

Before bio-polishing

Fabric Name	GSM	Stitch Length	CPI	WPI
S/ J Combed yarn	173.5	2.78	54	40
S/J Neps	196.4	2.58	54	34
S/J Carded yarn	170.4	2.54	54	39
1×1 Rib	292.4	2.74	33	54
Interlock	216	1.55	54	52
Pique	196.5	2.19	24	27

Table no 2

3.6 Formula Used for Determine Change Percentage:

$$\textbf{Change Percentage}=\frac{\textbf{Measurement before bio}-\textbf{polishing} - \textbf{Measurement after bio}-\textbf{polishing}}{\textbf{Measurement before bio}-\textbf{polishing}} \text{ X } 100$$

CHAPTER 4
DATA ANALYSIS & FINDINGS

4.1 Analyzing Data:

- Sample no -01 (Single Jersey Combed Yarns)

Test names	Before bio-polishing	After bio-polishing	Change percentage%
GSM	173.5	173	0.3%
WPI	40	37	7.5%
CPI	54	51	5.55%
Stitch length	2.78	2.68	3.6%

Table no 3

For Sample-01

- GSM before bio-polishing is 173.5 after bio-polishing is 173 and change is 0.3%
- WPI before bio-polishing is 40 after bio-polishing is 37 and change is 7.5%
- CPI before bio-polishing is 54 after bio-polishing is 51 and change is 5.55%
- Stitch length before bio-polishing is 2.78 after bio-polishing is 2.68 and change is 3.6%

- Sample no 2 neps

Test names	Before bio-polishing	After bio-polishing	Change percentage%
GSM	196.4	191.7	2.34%
WPI	34	36	5.88%
CPI	55	50	5.55%
Stitch length	2.59	2.88	10.85%

Table no 4

For Sample-02

- GSM before bio-polishing is 196.4, after bio-polishing is 191.7and change is 2.34%
- WPI before bio-polishing is 34, after bio-polishing is 36 and change is 5.88%
- CPI before bio-polishing is 55, after bio-polishing is 50 and change is 5.55%
- Stitch length before bio-polishing is 2.59, after bio-polishing is 2.88 and change is 10.85

- Sample no - 03 Single Jersey Carded Yarns

Test names	Before bio-polishing	After bio-polishing	Change percentage%
GSM	170.4	166.7	2.06%
WPI	39	38	2.56%
CPI	54	52	5.56%
Stitch length	2.53	2.62	2.36%

Table no -05

For Sample-03

- ❖ GSM before bio-polishing is 170.4,after bio-polishing is 166.7 and change is 2.06%
- ❖ WPI before bio-polishing is 39, after bio-polishing is 38 and change is 2.56%
- ❖ CPI before bio-polishing is 54,after bio-polishing is 52 and change is 5.56%
- ❖ Stitch length before bio-polishing is 2.53,after bio-polishing is 2.62 and change is 2.38%

- Sample no -04 (1×1 Rib)

Test names	Before bio-polishing	After bio-polishing	Change percentage%
GSM	292.5	291.9	0.205%
WPI	54	56	3.7%
CPI	33	31	6.06%
Stitch length	2.74	2.55	6.93%

Table no - 06

For Sample no-04

- ❖ GSM before bio-polishing is 292.5, after bio-polishing is 291.9 and change is 0.205%
- ❖ WPI before bio-polishing is 54, after bio-polishing is 56 and change is 3.7%
- ❖ CPI before bio-polishing is 33, after bio-polishing is 31 and change is 6.06%
- ❖ Stitch length before bio-polishing is 2.74, after bio-polishing is 2.55 and change is 6.93%

- Sample no -05 Interlock

Test names	Before bio-polishing	After bio-polishing	Change percentage%
GSM	216	215.2	0.370%
WPI	52	52	0.00%
CPI	54	51	5.55%
Stitch length	1.55	1.44	7.09%

Table no - 07

For sample no – 05

- GSM before bio-polishing is 216, after bio-polishing is 215.2 and change is 0.370%
- WPI before bio-polishing is 52,after bio-polishing is 52 and change is 0.00%
- CPI before bio-polishing is 54, after bio-polishing is 51 and change is 5.55%
- Stitch length before bio-polishing is 1.55, after bio-polishing is 1.44and change is 7.09%

- Sample no -06 Pique

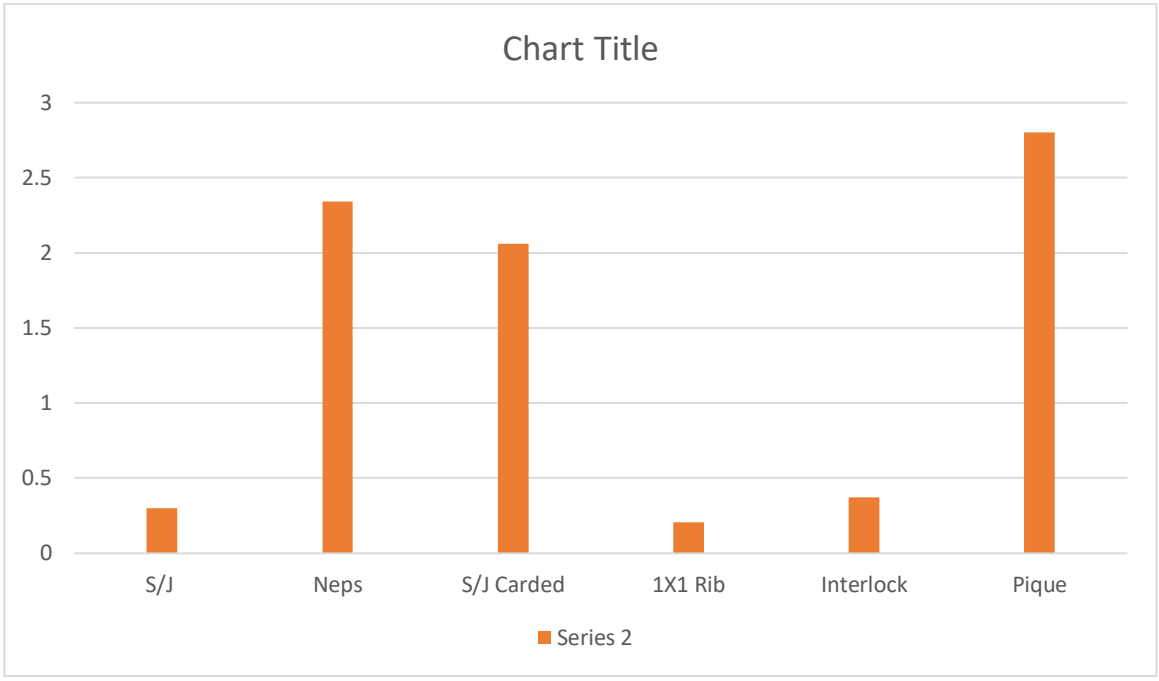
Test names	Before bio-polishing	After bio-polishing	Change percentage%
GSM	196.5	191	2.80%
WPI	27	27	0.00%
CPI	24	25	4.2%
Stitch length	2.18	2.40	10.09%

Table no – 08

For Sample no-06

- GSM before bio-polishing is 196.5, after bio-polishing is 191 and change is 2.80%
- WPI before bio-polishing is 27, after bio-polishing is 27 and change is 0.00%
- CPI before bio-polishing is 24, after bio-polishing is 25 and change is 4.2%
- Stitch length before bio-polishing is 2.18, after bio-polishing is 2.40 and change is 10.09%

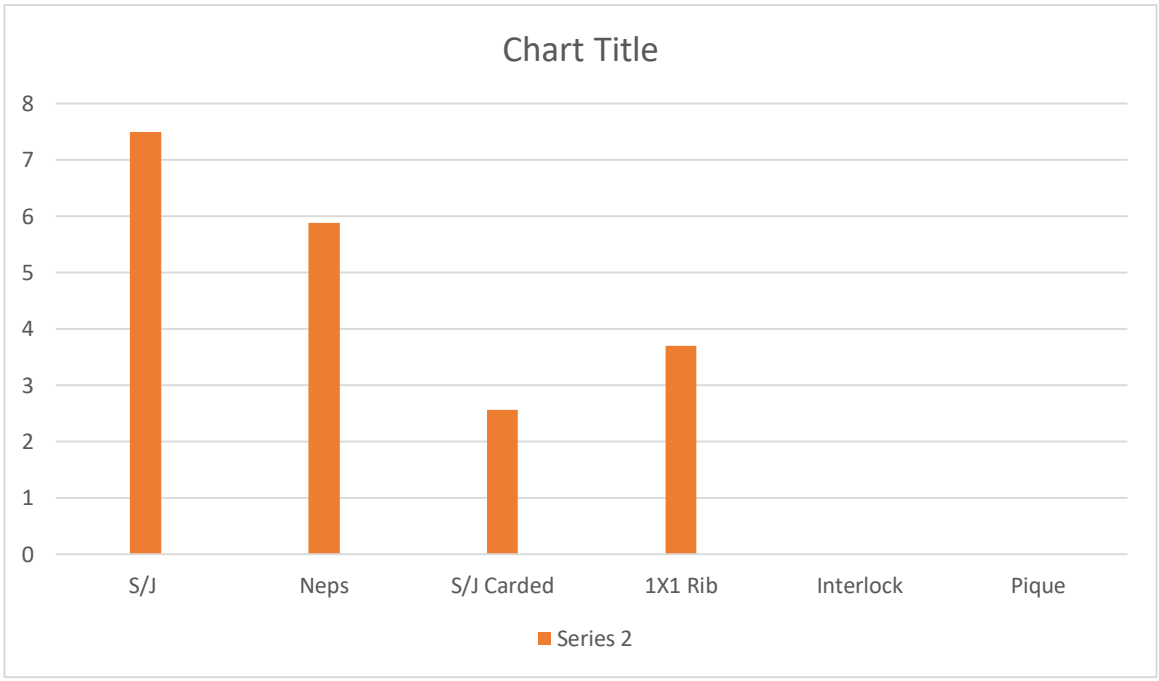
4.2 findings the graph



Graph no – 01:- GSM % change

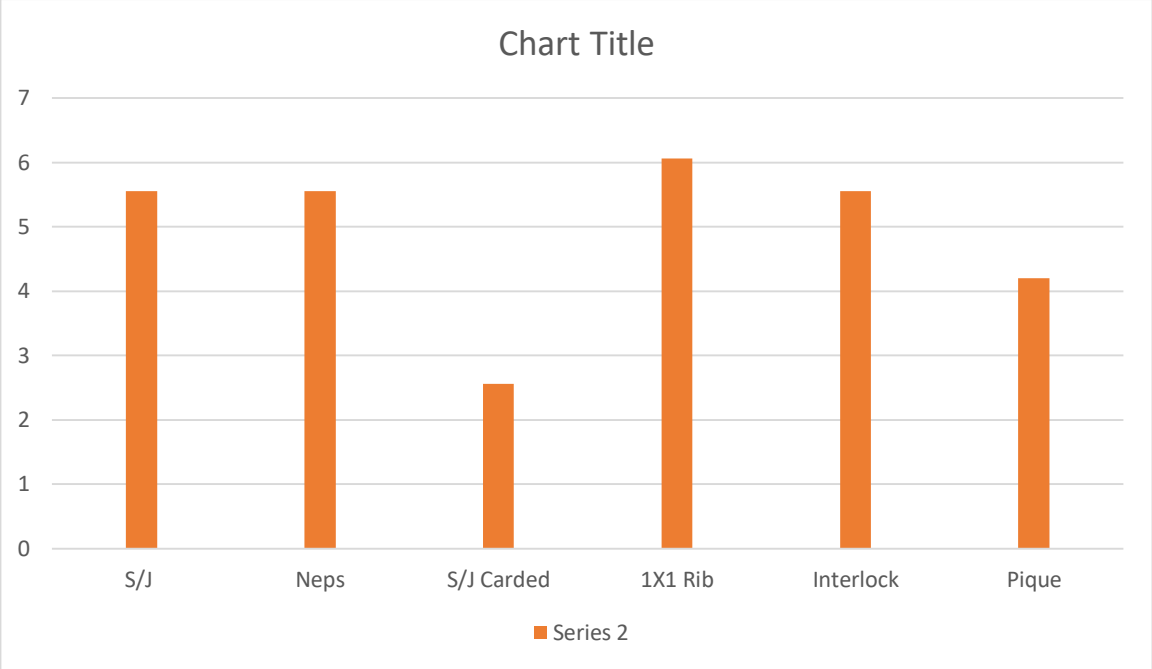
Graph 1 demonstrates variations in the percentage of GSM after bio-polishing. Here, we see that there are more GSM shifts in In rib fabric, piqué fabric and less adjustments are This is the values are S/J combed 0.3%, Neps 2.34%, S/J carded 2.05%, rib 0.205%, interlock 0.370% and pique 2.80%.

Graph no – 02:- WPI % change



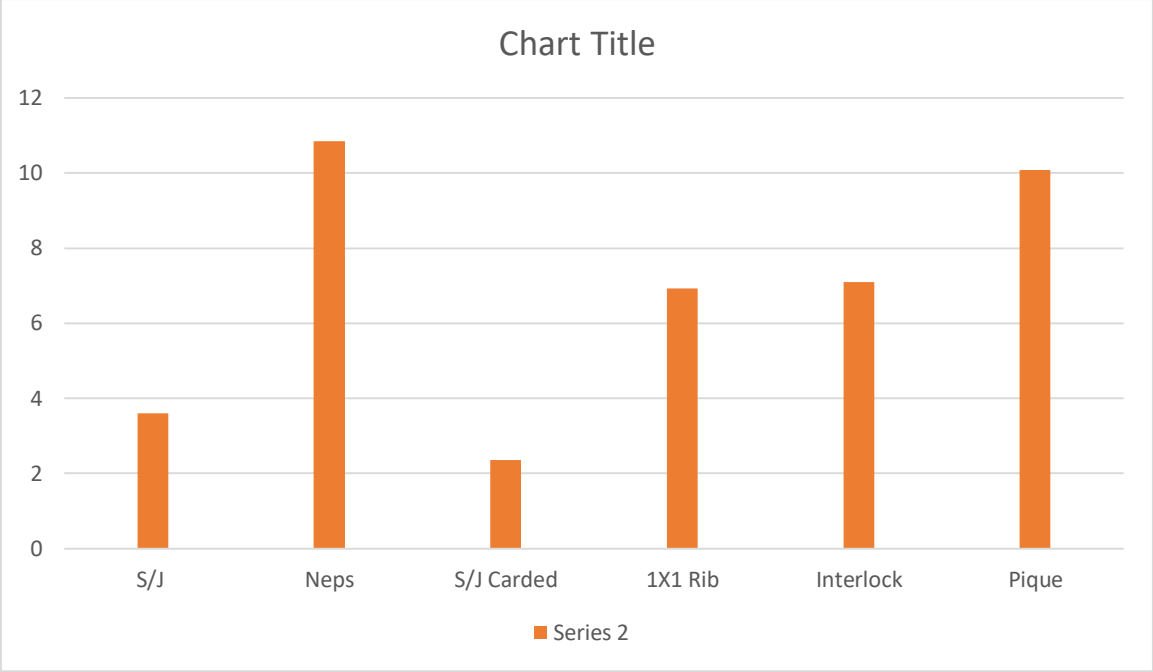
Graph 2 demonstrates improvements in the percentage of WPI after bio-polishing. Here we see that there are more GSM shifts in S/JIn both interlock and pique fabric, combed fabric and no improvements areThis is values are S/J combed 7.5%,Neps 5.88%, S/J carded 2.56%, rib 3.70%, interlock 0.00% and pique 0.00%.

.



Graph no – 03:- CPI % change

Diagram 3 displays improvements in the percentage of CPI after bio-polishing. Here we see that there are more improvements to GSM at Rib In pique cloth, fabric and fewer adjustments are present. Single jersey values are (combed) 5.55%, Neps 5.55%,single jersey 5.55%, rib 6.06%, interlock 5.55% and pique 4.2%.



Graph no – 04:- stitch length % change

graph 4 demonstrates improvements in the stitch length percentage after bio-polishing. We see here that there are more GSM shifts, It is in the fabric of Neps and fewer changes are in single fabric jersey (carded). The ideals aresingle jersey(combed) 3.6%, Neps 10.85%, single jersey(carded) 2.36%, rib 6.93%, interlock 7.09% and pique 10.09%.

Chapter: 5

Conclusion

Conclusion: A long-lasting and commonly used effect on cellulosic textiles by the use of an enzyme is bio-polishing. Bio-polishing in all dying industries nowadays has to be done during the dying process. The surface is cleaner, less hairy and develops the handling properties of the fabrics after bio-polishing fabrics. But the bio-polishing drawback is that fabrics lose their strength.

We acquired basic knowledge about CPI, WPI, Stitch Length, and GSM and their changes due to bio-polishing by doing this thesis. We have basically learned how to calculate CPI, WPI, Stitch Length, and GSM during our work.

Our thoughts about the bio-polishing method or treatment have become more transparent and precise following this thesis. I think this experience will be more useful for us, and this bio-polishing report will be useful for others.

Reference:

- http://www.academia.edu/8446151/bio_poli
- http://en.wikipedia.org/wiki/bio-polishing
- https://www.scribd.com/document/26134278
- http://www.rsc.org/Education/Teachers/Resources/cfb/enzymes.htm
- https://www.dlsu.edu.ph/research/abstrac
- http://textilelearner.blogspot.com/2014/05/what-is-biopolishing-of-textiles.html
- http://nopr.niscair.res.in/bitstream/123
- http://textilelearner.blogspot.com/2013/03/enzyme-and-its-applications-in-textile.html
- https://www.fibre2fashion.com/industry-article/6436/biopolishing

Effect of biopolishing on cotton

ORIGINALITY REPORT

18%	15%	2%	17%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Daffodil International University Student Paper	16%
2	diutestudents.blogspot.com Internet Source	1%
3	Mastromatteo, Marcella, Marianna Mastromatteo, Amalia Conte, and Matteo Alessandro Del Nobile. "Antimicrobial Enzymes and Natural Extracts in Plastics", Antimicrobial Polymers Lagaron/Antimicrobial Polymers, 2011. Publication	<1%
4	dspace.thapar.edu:8080 Internet Source	<1%
5	eprints.utem.edu.my Internet Source	<1%
6	dspace.daffodilvarsity.edu.bd:8080 Internet Source	<1%