



Daffodil International University
Faculty of Textile Engineering

Project on
**Study On The Denim Fabric Properties Changes Due To
Different Washing Process.**

Submitted By:

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“This Project Report Submitted in partial fulfillment of the requirement for the Degree of BSc in Textile Engineering in the Faculty of Textile Engineering of Daffodil International University(DIU).

Department of Textile Engineering

Department of Textile Engineering

Letter of Approval

March 03, 2021

To,

Head (In-Charge)

Department of Textile Engineering

Daffodil International University.

102, Shukrabad, Mirpur Road, Dhaka, 1207

Subject: Approval of Project Report of B.Sc. in TE Program.

Dear sir,

We are just writing to let you know that this project report titled as “**Study on the Denim Fabric Properties changes due to different washing process**” has been prepared by the student bearing IDs 182-23-5382, 182-23-5393, 182-23-5250. are completed for final evaluation. The whole report is prepared based on the proper investigation and interruption. The student were directly involved in their project activities and the report become vital to spark of many valuable information for the readers. Therefore it will highly be appreciated if you kindly accept this project report and consider it for final evaluation.

Yours Sincerely,



Mr. Mohammad Abdul Baset,

Associate Professor, Department of TE.

Daffodil International University

April, 2021

Declaration

We hereby declare that the project entitles “**Study on the Denim Fabric Properties changes due to different washing process**” submission is our own work and that to the best of our knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the University or other Institute of higher learning, except where due acknowledge has been made in the text.

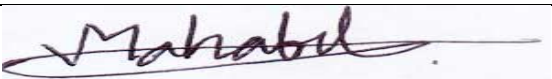
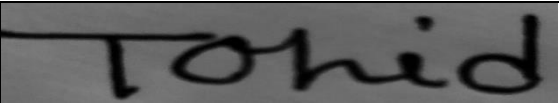
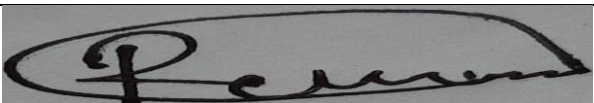
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We would like to extend thanks to all of persons, who contributed to the work presented in this project.

Abstract

For completing the project title as “**Study on the Denim Fabric Properties changes due to different washing process**” we have randomly selected three different types of denim fabric. These are **Stretch Denim Fabric** (82% Cotton, 17%Polyester&1%Elastane), **Non-Stretch Denim Fabric** (59% Cotton& 41% Polyester) & **Tencel Denim Fabric** (100% Lyocell. Determine the changes of fabric parameters we have also selected three types of washing process for our work. These are Dark Blue Stone Wash, Blue Stone Wash, Blue Bleached Wash. Pretreatment was desizing and after treatment is silicon softener. After washing different samples from different washing are going to express different physical properties. Finding out the different physical properties of denim for different wash and compare with each change is the major part of that research.

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Chapter -01

Introduction

1.1 Background of the Study:

Denim is one of the world's oldest fabrics, and it's best known for its use in jeans. It is a fabric that is exceptionally robust, stiff, and long-lasting. Denim is a cotton and twill-weave fabric that is used for jeans and work garments and has a colored warp and white weft yarn. Indigo, vat, and sulfur dyes are commonly used, and the dyes remain on the yarn surface. After stitching, denim clothes are sent to the manufacturer.

1.2 Objectives of the Study

- ❖ To know about 82% Cotton, 17%Polyester& 1% Elastane Denim Fabric, 59% Cotton 41% Polyester Denim Fabric & 100% Lyocell (Tencel) Denim Fabric.
- ❖ To know about dark blue stone wash, blue stone wash & blue bleached wash.
- ❖ To know about the properties changes of denim fabric such as shrinkage percentages, PPI-EPI, Weight and fabric properties after wash the denim fabric.

1.2 Significant

It is critical for a new textile engineer to understand the qualities of fabric before and after washing. This knowledge will assist us in a variety of ways, including planning, production, and meeting the needs of the buyer. On the other side, we now have a fantastic opportunity to work for a denim clothing business. As a result, knowing how to wash denim will be really beneficial to you.

1.4 Limitation

There are some limitations to complete the study. This experiment was taken under a newly established washing plant named **Color Creation**. This wash plant works only for **Jeans & Polo Ltd**. They only receive the garments and wash according to the given recipe. There have no lab facility and no way to do physical properties test. They do it from 3rd party testing company if it needs.

Chapter -02

Literature Review

2.1 Tencel Fabric (100% Lyocell)

Tencel fabric is an amazing eco-friendly fabric that represents a milestone in the development of environmentally sustainable textiles. Lyocell is a natural, man-made fibre. Made with wood pulp from sustainable tree farms, lyocell textiles are created using nanotechnology in an award-winning closed-loop process that recovers or decomposes all solvents and emissions. It is 100% biodegradable; perhaps the greatest benefits are the variety and exceptional comfort you can experience with lyocell clothing [1].

Characteristics of lyocell fabric:

- ❖ Lyocell material has a smooth surface and a beautiful appearance.
- ❖ This fabric has better moisture absorption than cotton
- ❖ Flexible.
- ❖ Perfect for sensitive skins.
- ❖ Environmentally friendly [2].

2.2 Stretch Denim Fabric (82% Cotton, 17%Polyester& 1% Elastane)

Stretch denim could be a comparatively new style of denim cotton (or cotton/polyester blend) that comes with a little quantity of elastane, a stretchable fiber conjointly called fabric, or Lycra, into the material. Stretch jeans generally embody regarding one to a few p.c elastane.

Jeans product of stretch denim material might seem like regular jeans, however offer additional flexibility and “give” with the wearer’s body movements. Stretch jeans also are typically additional form-fitting than jeans created with none stretch within the material [3].

Typically, stretch jeans from the leading denim brands can have from one to a few p.c elastane (stretchy material), tho' some brands, like a whole referred to as NYDJ, currently supply four-dimensional fabric in body contouring kinds of jeans. once combined with a premium quality, medium weight denim material, here’s what you’ll be able to expect from the various stretch denim jeans available:

- ❖ **1% Stretch:** Provides only enough stretch to give you some flexibility and help the jeans hold their shape, without being too body-hugging. Example: Citizens of Humanity Emerson Jeans.
- ❖ **2% Stretch:** Enough stretch to be very comfortable to sit and stand in, while providing some contouring to smooth your curves.
- ❖ **3-4% Stretch:** Very form-fitting jeans that offer good body contouring, and feel soft and stretchy to wear [4].

2.3 Non-Stretch Denim Fabric (59% Cotton 41% Polyester)

Cotton Jeans, for example, that are made of 100% cotton are known for stretching over time especially when worn wet. While a strand of cotton does not have stretch properties that does not mean that the cotton will not expand, now we weave heaps of those strands together and put all those strands under tension in the right conditions and you have some baggy jeans. You can temporarily shrink these with a warm wash or by throwing them in the dryer but since cotton is not elastic, the stretched out size is the size the strands will return to.

Polyester - Being a stronger more rigid polymer material is less likely to change form and will not have the same characteristics or react to conditions the same as cotton.

Blend these two together and it will create a good denim fabric Polyester is a synthetic fabric that doesn't stretch. Polyester, in combination with cotton, generally makes the article of clothing less susceptible to wrinkling as opposed to 100% cotton [5].

The cotton-polyester blend is versatile and is used to make everything from bedding to shirts. Because polyester doesn't shrink or change shape like cotton does, this blend is easier to wash and dry. And thanks to the cotton component in the blend, garments made from cotton-polyester are more breathable compared to pure polyester products [6].

2.4 Denim Wash

In the textile sector garment washing is one among the foremost processes followed in trade. Dust, dirt and infectious materials may be faraway from clothes by industrial clothes laundry. a range of wash techniques may be followed as per fashion demand, for rising special look on clothes [7]. ordinarily once sewing garment laundry is completed. patrons invite garment laundry in step with client demand and fashion trend. For the laundry garment patrons continually mention accurately what varieties of garment laundry they require for the order. On the material surfaces differing kinds of look square measure seen in every wash. Physical Changes of denim cloth wash sorts square measure chiefly reckoning on the merchandise sorts [8].

Without denim today's fashion is completely incomplete. clothes fabricated from denim cloth comes all told forms, appearance and washes to match with each dress. for creating denim the style icon that it's these days a large variety of technological factors have contributed– together with immense enhancements in spinning, weaving, finishing etc. the foremost vital a part of creation of the trendy denim jeans is that the laundry. currently laundry plays such a significant half within the denim sector simply because of such a big amount of effects that the customers square measure searching for on their jeans. each very little step in denim garment laundry makes a large distinction as a result of indigo dye encompasses a dry rubbing and really poor wet fastness. All the parameters square measure terribly important to keep up for repetitive results [9]. Denim laundry technique currently a day's creates new fashion like blasting, tagging, whickering, permanent wrinkle, destroy, grinding, hand crapping , deep dye , tie dye,

permanganate spray, permanganate sponging etc. These laundry techniques have some important activity in denim clothes [7].

Enzyme wash, bleach wash, acid wash, traditional wash, stone wash, etc square measure the foremost ordinarily denim laundry strategies. Among these laundry strategies, bleach laundry methodology is wide used methodology within the trade particularly for denim laundry by salt bleaching to induce the specified color shade. the method of denim Bleach may be wont to decolourize indigo from denim [10].

This paper investigates the impact of blue stone wash, blue stone wash & blue bleached wash on the physical properties of denim cloth as these properties verify the wearers feel and lifetime of the tip product. The paper conjointly investigates the optimum use of accelerator with the mounted proportion of rock stones.

2.4.1 Physical Appearance after Different Types of Denim Wash

Denim wash gives aesthetic finish. It enhances the appeal. It also provides strength. With the time being the fabric will be faded in such a manner like similar to that way which is artificially obsessed denim trends to ditto. With dry denim, however, such type of fading is influenced by the person's body who wears the denim garment and their daily life activities. This can create what many people feel to be a more unique, natural look than the pre-distressed denim. Garment made from denim processed like jeans can go through so many processes in order to get realist fading effect or different types of special wash effects [11].

Chapter – 03

Survey Details, Methods and Materials

3.1 Materials

3.1.1 Fabric Samples

Fabric samples were collected from Jeans& Polo Ltd.'s store house and these were remanufactured by Chittagong Denim Mills Ltd.

3.1.2 Chemicals

- Enzyme
- Acetic Acid (CH_3COOH)
- Bleaching powder
- Soda Ash (Na_2CO_3)
- Sodium **Meta** Bi-Sulphite ($\text{Na}_2\text{S}_2\text{O}_5$)
- Sodium hypochlorite (NaClO)
- Softener (Anti ozone)

- Desizing agent.
- Anti Creasing Agent (BBIQ)

3.1.3 Washing Machine

Washing M/C: Taiyet by Taiwan

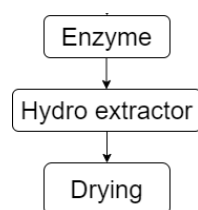
Hydro extractor: Greenmac by Singapore

Dryer: Triveneta Grandi by Italy

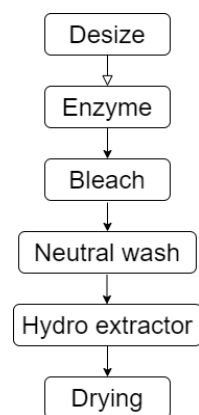
3.2 Methods

3.2.1 Stretch Denim Fabric

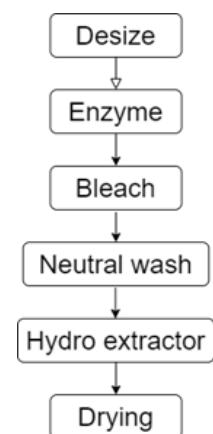
Dark Blue Stone



Blue Stone

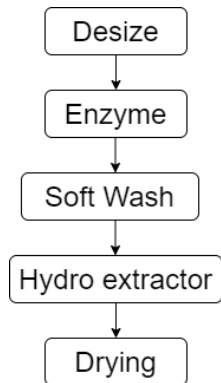


Blue Bleach

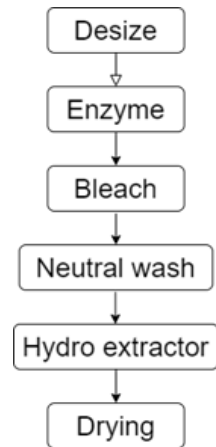


3.2.2 Non-Stretch Denim Fabric

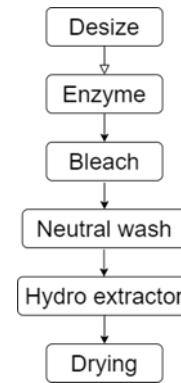
Dark Blue Stone



Blue Stone



Blue Bleach

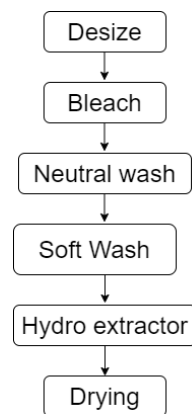


3.2.3 Tencel Fabric

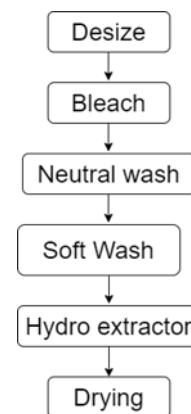
Dark Blue Stone



Blue Stone



Blue Bleach



3.2.4 Drying

Hydro extracting for 2-2.5 minutes & Drying for 45-50 minutes at 75°C.

3.3 Recipe

3.3.1 Stretch Denim Fabric

Dark Blue Stone	Blue Stone	Blue Bleach
<p>Step-1: Enzyme ACL-150gm Acetic Acid (CH_3COOH)-80gm For 8 min. at 45°C</p> <p>Step-2: Rinse wash</p>	<p>Step-1: Desize Caustic Soda(NaOH) -100gm BBIQ-100gm Time: 10 min, Temp: 50°C Step-2: Rinse wash</p> <p>Step-3: Enzyme Stone-200gm BBIQ-100gm Time:15 min, Temp: 45°C Step-4: Rinse wash</p> <p>Step-5: Bleach HCL-500gm Temp: 50°C Step-6: Rinse</p> <p>Step-7: Checking the Color</p> <p>Step-8: Neutral Sodium Meta Bi-Sulphite ($\text{Na}_2\text{S}_2\text{O}_5$) -300gm Step-9: Rinse</p>	<p>Step-1: Desize caustic soda(NaOH) - 100gm BBIQ-100gm Time: 10 min, Temp: 50°C Step-2: Rinse</p> <p>Step-3: Enzyme Stone-200gm BBIQ-100gm Time:15 min, Temp: 45°C Step-4: Rinse</p> <p>Step-5: Bleach HCL-1kg Temp: 50°C Step-6: Rinse</p> <p>Step-7: Checking the Color</p> <p>Step-8: Neutral Sodium Meta Bi-Sulphite</p>

		(Na ₂ S ₂ O ₅) -300gm Step-9: Rinse
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3.3.2 Non-Stretch Denim Fabric

Dark Blue Stone	Blue Stone	Blue Bleach
Step-1: Enzyme ACL-150gm Acetic Acid (CH ₃ COOH)-100gm Time: 8 min. Temp: 45°C Step-2: Rinse wash Step-3: Soft Wash Softener(Anti ozone)-200gm Time: 2 min	Step-1: Desize Caustic Soda(NaOH) -100gm Peroxide-100gm Time: 10 min. Temp: 50 °C Step-2: Rinse Step-3: Enzyme Blue-B-Malic-150gm BBIQ-100gm Time:10 min. Temp: 45°C Step-4: Rinse Step-5: Bleach Japanese Bleach-100gm Time: 40°C Step-6: Rinse	Step-1: Desize caustic soda(NaOH)-100gm Peroxide-100gm Time: 10 min. Temp: 50 °C Step-2: Rinse Step-3: Enzyme Blue-B-Malic-150gm BBIQ-100gm Time: 10 min. Temp: 45°C Step-4: Rinse Step-5: Bleach Japanese Bleach-1kg Temp: 40°C Step-6: Rinse

	Step-7: Checking the Color Step-8: Neutral Sodium Meta Bi-Sulphite ($\text{Na}_2\text{S}_2\text{O}_5$)-300gm Step-9: Rinse	Step-7: Checking the Color Step-8: Neutral Sodium Meta Bi-Sulphite ($\text{Na}_2\text{S}_2\text{O}_5$)-300gm Step-9: Rinse
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3.3.3 Tencel Denim Fabric

Dark Blue Stone	Blue Stone	Blue Bleach
Step-1: Enzyme ACL-150gm Acetic Acid(CH_3COOH) -100gm Time: 8 min. Temp: 45°C Step-2: Rinse wash Step-3: Soft Wash Softener (Anti ozone)-200gm Time: 2 min.	Step-1: Desize Desizer- 200gm BBIQ-200gm Time: 10 min. Temp: 50 °C Step-2: Rinse Step-3: Bleach HCL-200gm At 40°C Step-4: Rinse Step-5: Checking the Color Step-6 : NeutralSodium hypochlorite(NaClO)-200gm Time: 10min. Step-7: Rinse Step-8: Soft Wash	Step-1: Desize Soda- 100gm BBIQ-100gm Time: 10 min. Temp: 50 °C Step-2: Rins Step-3: Bleach HCL-1kg Temp: 40°C Step-4: Rinse Step-5: Checking the Color Step-6: Neutral Sodium hypochlorite(NaClO)- 300gm Time: 10min. Step-7: Rinse


	Softener (Anti ozone)-200gm Time: 2 min.	Step-8: Soft Wash Softener (Anti ozone)-200gm Time: 2 min
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3.4 Survey Report

3.4.1 Determination of weight

Weight of the fabric in apparel industries is measured by manual method; where we have to cut fabric by GSM cutter and measure the weight by Digital Balance Meter. GSM is a metric measurement meaning grams per square meter- it is how much 1 square meter of fabric weighs. Ounce per square yard (oz/yd²) is the imperial measurement which is also commonly used.

Figure 1: Effect in weight of Stretch Denim Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.


NATURAL DENIMS LTD.
 Tongabari, Ashulia, Savar, Dhaka.
 Daily Quality Report

Buyer Name: <i>Just</i>		100 100
Style No: <i>182454</i>		
Qc Name: <i>Faisal</i>	Shift: <i>Day</i>	Date: <i>13-02-21</i>

Fabric	GSM of Before wash	Dark Blue Stone GSM of after wash	Changes
Stretch Denim Fabric	315	347	10.1% Increases

Fabric	GSM of Before wash	Blue Stone GSM of after wash	Changes
Stretch Denim Fabric	315	350	11.1% Increases

Fabric	GSM of Before wash	Blue Bleached GSM of after wash	Changes
Stretch Denim Fabric	315	353	12% Increases

Signature: *Faisal*
13-02-21

Table-1: Effect in weight of Stretch Denim Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.


Fabric	GSM of Before wash	Dark Blue Stone GSM of after wash	Changes
Stretch Denim Fabric	315	347	10.1% Increase

Fabric	GSM of Before wash	Blue Stone GSM of after wash	Changes
Stretch Denim Fabric	315	350	11.1% Increase

Fabric	GSM of Before wash	Blue Bleached GSM of after wash	Changes
Stretch Denim Fabric	315	353	12% Increase

After wash of the stretch denim fabrics, the GSM is increase then before wash. As, the shade of the fabric goes deeper to lighter, GSM is increase and the increasing percentages are 10.1%, 11.1% & 12%

Figure 2: Effect in weight of Cotton-Polyester Blend Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.

 **NATURAL DENIMS LTD.**
Tongabari, Ashulia, Savar, Dhaka.
Daily Quality Report

Buyer Name: Just
 Style No: 182454

Qc Name: Faisal Shift: Day Date: 12-02-21

Fabric	GSM of Before wash	Dark Blue Stone GSM of after wash	Changes
Non-stretch Denim Fabric	420	347	1.1% Decreases

Fabric	GSM of Before wash	Blue Stone GSM of after wash	Changes
Non-stretch Denim Fabric	420	408	2.8% Decreases

Fabric	GSM of Before wash	Blue Bleached GSM of after wash	Changes
Non-stretch Denim Fabric	420	402	4.2% Decreases

Signature: Faisal
12-02-21

Table-2: Effect in weight of Cotton-Polyester Blend Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.


Fabric	GSM of Before wash	Dark Blue Stone GSM of after wash	Changes
Non-Stretch Denim Fabric	420	347	1.1% Decrease

Fabric	GSM of Before wash	Blue Stone GSM of after wash	Changes
Non-Stretch Denim Fabric	420	408	2.8% Decrease

Fabric	GSM of Before wash	Blue Bleached GSM of after wash	Changes
Non-Stretch Denim Fabric	420	402	4.28% Decrease

After wash of the Non-Stretch Denim Fabric, the GSM is decrease then before wash. As the shade of the fabric goes deeper to lighter, GSM decrease & the Decreasing percentages are 1.1%, 2.8% & 4.28%

Figure-3: Effect in weight of Tencel Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.


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Buyer Name: <u>Just</u>		13-02-21 13-02-21
Style No: <u>182454</u>		
Qc Name: <u>Faisal</u>	Shift: <u>Day</u>	Date: <u>13-02-21</u>

Fabric	GSM of Before wash	Dark Blue Stone GSM of after wash	Changes
Tencel Fabric	225	222	1.3% Decreases

Fabric	GSM of Before wash	Blue Stone GSM of after wash	Changes
Tencel Fabric	225	215	4.44% Decreases

Fabric	GSM of Before wash	Blue Bleached GSM of after wash	Changes
Tencel Fabric	225	209	7.11% Decreases

Signature: Faisal
 13-02-21

Table-3: Effect in weight of Tencel Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.

Fabric	GSM of Before wash	Dark Blue Stone GSM of after wash	Changes
Tencel Fabric	225	222	1.3% Decrease

Fabric	GSM of Before wash	Blue Stone GSM of after wash	Changes
Tencel Fabric	225	215	4.44% Decrease

Fabric	GSM of Before wash	Blue Bleached GSM of after wash	Changes
Tencel Fabric	225	209	7.11% Decrease

After wash of the Tencel fabrics, the GSM is decrease then before wash. As the shade of the fabric goes deeper to lighter, GSM decrease & the Decreasing percentages are 1.3%, 4.4% & 7.11%


3.4.2 Determination of Shrinkage %

The textile fabric has a common feature that it shrinks in wet processing. Shrinkage means the length of the fabric gets shorten after wash. So prior to cutting fabric for bulk production, you must check its shrinkage percentage in washing. The shrinkage percentage needed to add to the production pattern. Otherwise, you would not get garment of correct fit and measurement could not match the specification sheet.

For determine the shrinkage percentage we have cut each fabric according to 50/50 cm (length/width) for each wash. Then send them to washing and after done with washing process we measure the both length and width and calculate shrinkage percentages for each fabric's. We do by using below formula:

Fabric Shrinkage % = (Length before washing - length after washing)*100/Length before washing

Figure -4: Change in length of Stretch Denim Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.

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Fabric	Before Wash length in cm. Dark Blue Stone	After Wash Length (in cm.) Dark Blue Stone	Changes
Stretch Denim Fabric	50 cm	49 cm	shrinkage 2%.

Fabric	Before Wash length in cm. Blue Stone	After Wash Length (in cm.) Blue Stone	Changes
Stretch Denim Fabric	50 cm	47.3 cm	shrinkage 2%.

Fabric	Before Wash length in cm. Blue Bleached	After Wash Length (in cm.) Blue Bleached	Changes
Stretch Denim Fabric	50 cm	45.5 cm	shrinkage 2%.

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Table-4: Change in length of Stretch Denim Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.


Fabric	Before Wash length in cm. Dark Blue Stone	After Wash Length (in cm.) Dark Blue Stone	Changes
Stretch Denim Fabric	50	49	Shrinkage 2%

Fabric	Before Wash length in cm. Blue Stone	After Wash Length (in cm.) Blue Stone	Changes
Stretch Denim Fabric	50	47.3	Shrinkage 5.4%

Fabric	Before Wash length in cm. Blue Bleached	After Wash Length (in cm.) Blue Bleached	Changes
Stretch Denim Fabric	50	45.5	Shrinkage 9%

This above table shows only length wise fabric shrinkages. After doing the wash the length of the stretch denim fabric decreases then before wash. So as the shade of the fabric goes deeper to lighter the shrinkage percentage of stretch denim fabric increases.

Figure -5: Change in length of Cotton-Polyester Blend Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.


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Fabric	Before Wash length in cm. Dark Blue Stone	After Wash Length (in cm.) Dark Blue Stone	Changes
Non-stretch Denim Fabric	50cm	49.5cm	shrinkage 1%.

Fabric	Before Wash length in cm. Blue Stone	After Wash Length (in cm.) Blue Stone	Changes
Non-stretch Denim Fabric	50cm	49.5cm	shrinkage 1%.

Fabric	Before Wash length in cm. Blue Bleached	After Wash Length (in cm.) Blue Bleached	Changes
Non-stretch Denim Fabric	50cm	49.5cm	shrinkage 1%.

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Table-5: Change in length of Cotton-Polyester Blend Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.


Fabric	Before Wash length in cm. Dark Blue Stone	After Wash Length (in cm.) Dark Blue Stone	Changes
Non-Stretch Denim Fabric	50	49.5	Shrinkage 1%

Fabric	Before Wash length in cm. Blue Stone	After Wash Length (in cm.) Blue Stone	Changes
Non-Stretch Denim Fabric	50	49.5	Shrinkage 1%

Fabric	Before Wash length in cm. Blue Bleached	After Wash Length (in cm.) Blue Bleached	Changes
Non-Stretch Denim Fabric	50	48	Shrinkage 4%

This above table shows only length wise fabric shrinkages. After doing the wash the length of the Non-Stretch Denim Fabric decrease then before wash. For Dark Blue Stone & Blue Stone wash the percentage of shrinkage has not that much different. Both have only 1% Shrinkage in length, but by doing blue bleached wash, cotton-polyester blend fabric gain 4% shrinkage. Which has a good difference then previous two wash.

Figure-6: Change in length of Tencel Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.


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Date: <u>17-02-21</u>	

Fabric	Before Wash length in cm. Dark Blue Stone	After Wash Length (in cm.) Dark Blue Stone	Changes
Tencel Fabric	50	47.5	shrinkage 5%.

Fabric	Before Wash length in cm. Blue Stone	After Wash Length (in cm.) Blue Stone	Changes
Tencel Fabric	50	47.5	shrinkage 5%.

Fabric	Before Wash length in cm. Blue Bleached	After Wash Length (in cm.) Blue Bleached	Changes
Tencel Fabric	50	46	shrinkage 8%.

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Table-6: Change in length of Tencel Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.

Fabric	Before Wash length in cm. Dark Blue Stone	After Wash Length (in cm.) Dark Blue Stone	Changes
Tencel Fabric	50	47.5	Shrinkage 5%

Fabric	Before Wash length in cm. Blue Stone	After Wash Length (in cm.) Blue Stone	Changes
Tencel Fabric	50	47.5	Shrinkage 5%

Fabric	Before Wash length in cm. Blue Bleached	After Wash Length (in cm.) Blue Bleached	Changes
Tencel Fabric	50	46	Shrinkage 8%


This above table shows only length wise fabric shrinkages. After doing the wash the length of the Tencel fabric decreases then before wash. For Dark Blue Stone & Blue Stone wash the percentage of shrinkage has not that much different. Both have 4% Shrinkage in length, but by doing blue bleached wash, Tencel fabric gain 8% shrinkage. Which has a big difference then previous two wash?

3.4.3 Determination of EPI & PPI

EPI means “**Ends Per Inch**” and PPI means “**Picks Per Inch**”. In woven fabric EPI and PPI is measured to the number of yarn on a fabric. Normally, EPI is the number of warp threads per inch of fabric & PPI is the number of weft threads of per inch of fabric.

To measure EPI & PPI we have cut a square of 1/1 inch from our every sample of the fabric. Then we have count number of warp and number of weft in that 1/1 inch cutting part and note down the amount for each of the fabric sample.

Figure-7: Effect in EPI and PPI of Stretch Denim Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.


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Fabric		Before Wash Dark Blue Stone	After Wash Dark Blue Stone	Changes
Stretch Denim Fabric	EPI	76	72	4 Decreases
	PPI	57	54	3 Decreases

Fabric		Before Wash Blue Stone	After Wash Blue Stone	Changes
Stretch Denim Fabric	EPI	76	70	6 Decreases
	PPI	57	50	7 Decreases

Fabric		Before Wash Blue Bleached	After Wash Blue Bleached	Changes
Stretch Denim Fabric	EPI	76	67	8 Decreases
	PPI	57	48	9 Decreases


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Table-7: Effect in EPI and PPI of Stretch Denim Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.

Fabric		Before Wash Dark Blue Stone	After Wash Dark Blue Stone	Changes
Stretch Denim Fabric	EPI	76	72	4 Decrease
	PPI	57	54	3 Decrease

Fabric		Before Wash Blue Stone	After Wash Blue Stone	Changes
Stretch Denim Fabric	EPI	76	70	6 Decrease
	PPI	57	50	7 Decrease

Fabric		Before Wash Blue Bleached	After Wash Blue Bleached	Changes
Stretch Denim Fabric	EPI	76	67	8 Decrease
	PPI	57	48	9 Decrease

This above table shows before and after washing EPI and PPI of Stretch Denim Fabric as well as the increasing number of EPI and PPI. As the fabric shade goes deeper to lighter the EPI and PPI number increase with a good variation. Before we have seen that their GSM increase as the shade goes deeper to lighter so, the number of ends and picks in 1 inch of the fabric must increase.

Figure-8: Effect in EPI and PPI of Cotton-Polyester Blend Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.

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Fabric		Before Wash Dark Blue Stone	After Wash Dark Blue Stone	Changes
Non-Stretch Denim Fabric	EPI	85	82	3 Decreases
	PPI	57	55	2 Decreases

Fabric		Before Wash Blue Stone	After Wash Blue Stone	Changes
Non-Stretch Denim Fabric	EPI	85	80	5 Decreases
	PPI	57	51	6 Decreases

Fabric		Before Wash Blue Bleached	After Wash Blue Bleached	Changes
Non-Stretch Denim Fabric	EPI	85	78	7 Decreases
	PPI	57	49	8 Decreases

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 20-2-21

Table-8:Effect in EPI and PPI of Cotton-Polyester Blend Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.


Fabric		Before Wash Dark Blue Stone	After Wash Dark Blue Stone	Changes
Non-Stretch Denim Fabric	EPI	85	82	3 Decrease
	PPI	57	55	2 Decrease

Fabric		Before Wash Blue Stone	After Wash Blue Stone	Changes
Non-Stretch Denim Fabric	EPI	85	80	5 Decrease
	PPI	57	51	6 Decrease

Fabric		Before Wash Blue Bleached	After Wash Blue Bleached	Changes
Non-Stretch Denim Fabric	EPI	85	78	7 Decrease
	PPI	57	49	8 Decrease

This above table shows before and after washing EPI and PPI of Non-Stretch Denim Fabric as well as the decreasing number of EPI and PPI. As the fabric shade goes deeper to lighter the EPI and PPI number decrease with a good variation. Before we have seen that their GSM decrease as the shade goes deeper to lighter, so the number of ends and picks in 1 inch of the fabric must decrease.

Figure-9: Effect in EPI and PPI of Tencel Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.


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Buyer Name: <u>S. Oliver</u>	
Style No: <u>102545</u>	
Qc Name: <u>Faisal</u>	Shift: <u>Day</u>
Date: <u>22-02-21</u>	

Fabric		Before Wash Dark Blue Stone	After Wash Dark Blue Stone	Changes
Tencel Fabric	EPI	106	99	7 Decreases
	PPI	67	62	5 Decreases

Fabric		Before Wash Blue Stone	After Wash Blue Stone	Changes
Tencel Fabric	EPI	106	97	9 Decreases
	PPI	67	59	8 Decreases

Fabric		Before Wash Blue Bleached	After Wash Blue Bleached	Changes
Tencel Fabric	EPI	106	94	10 Decreases
	PPI	67	57	8 Decreases

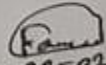
Signature:  22-02-21

Table-9:Effect in EPI and PPI of Tencel Fabric for Dark Blue Stone, Blue Stone and Blue Bleached wash.

Fabric		Before Wash Dark Blue Stone	After Wash Dark Blue Stone	Changes
Tencel Fabric	EPI	106	99	7 Decrease
	PPI	67	62	5 Decrease

Fabric		Before Wash Blue Stone	After Wash Blue Stone	Changes
Tencel Fabric	EPI	106	97	9 Decrease
	PPI	67	59	8 Decrease

Fabric		Before Wash Blue Bleached	After Wash Blue Bleached	Changes
Tencel Fabric	EPI	106	94	10 Decrease
	PPI	67	57	10 Decrease

This above table shows before and after washing EPI and PPI of Tencel Fabric as well as the decreasing number of EPI and PPI. As the fabric shade goes deeper to lighter the EPI and PPI number decrease with a good variation. Before we have seen that their GSM decrease as the shade goes deeper to lighter, so the number of ends and picks in 1 inch of the fabric must decrease.

3.5 Out look

We have dyed our fabric by making single small mockup leg, whose length was 40cm. Before wash we have measured GSM and EPI & PPI of the fabrics. For measuring shrinkage% we have cut our fabric in 50x50cm (lengthxwidth). Then we send these legs and 50x50cm cutting fabric parts into wash.

After dark blue stone wash , blue stone wash, blue bleach wash we have measured GSM, EPI & PPI and shrinkage% to understand the changes of denim fabric properties due to these washes.

3.5.1 Stretch Denim Fabric



Fig-10: Before and after wash out look of Stretch denim fabric.

3.5.2 Non-Stretch Denim Fabric



Fig-11: Before and after wash out look of Non-stretch denim fabric.

3.5.3 Tencel Fabric

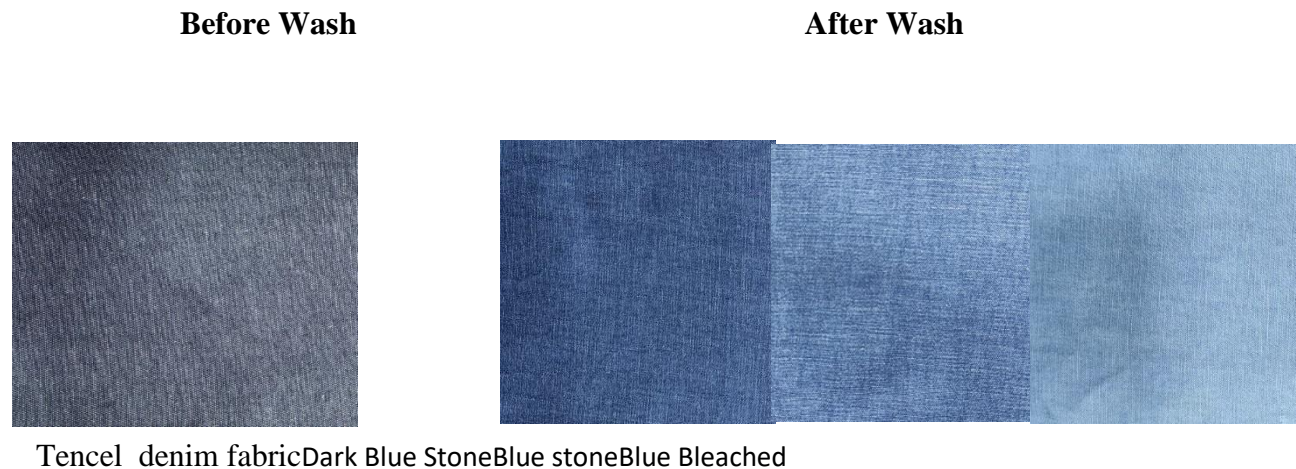


Fig-12: Before and after wash out look of Tencel fabric

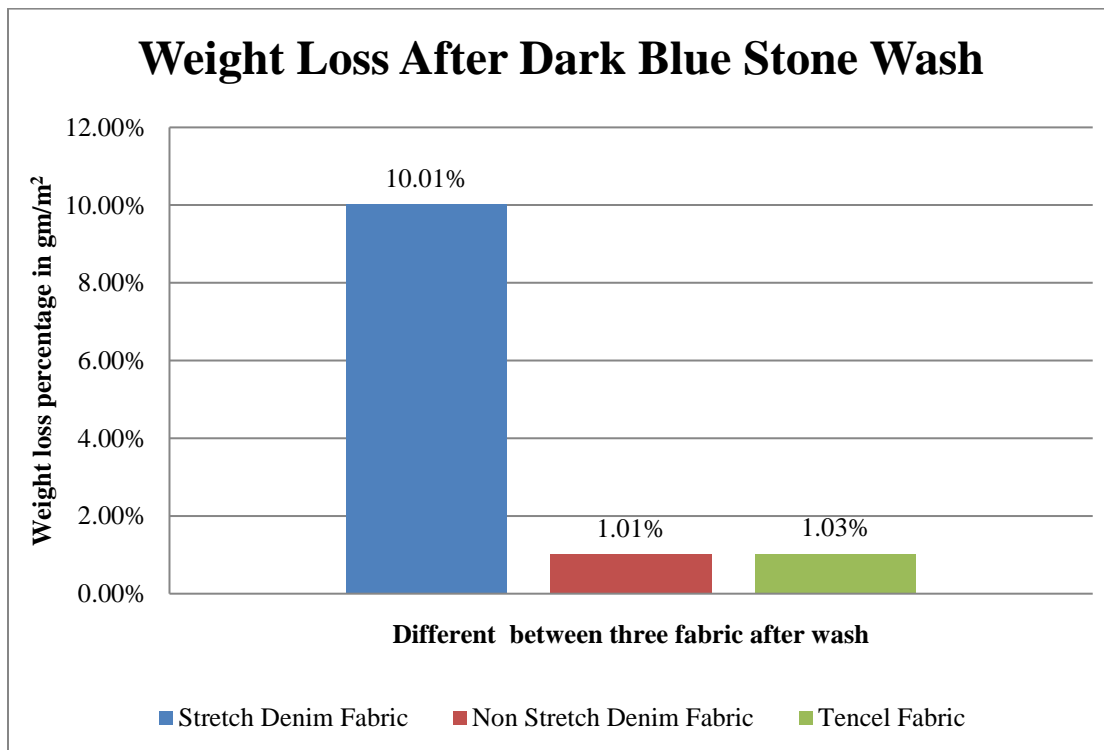
Chapter -04

Discussion & Result

To investigate the physical properties of denim fabrics for Dark Blue Stone, Blue Stone and Blue Bleached wash for both warp and weft are evaluated. At table (1), table (2), table (3) effect in weight of Stretch Denim Fabric, Non-Stretch Denim Fabric and Tencel Fabric due to Dark Blue Stone, Blue Stone and Blue Bleach wash has evaluate. At table (3), table (4), table (5) change in length of Stretch Denim Fabric, Non-Stretch Denim Fabric and Tencel Fabric due to Dark Blue Stone, Blue Stone and Blue Bleach wash has evaluate. At table (7), table (8), table (9) effect in EPI and PPI of Stretch Denim Fabric, Non-Stretch Denim Fabric and Tencel Fabric due to Dark Blue Stone, Blue Stone and Blue Bleach wash has evaluate.

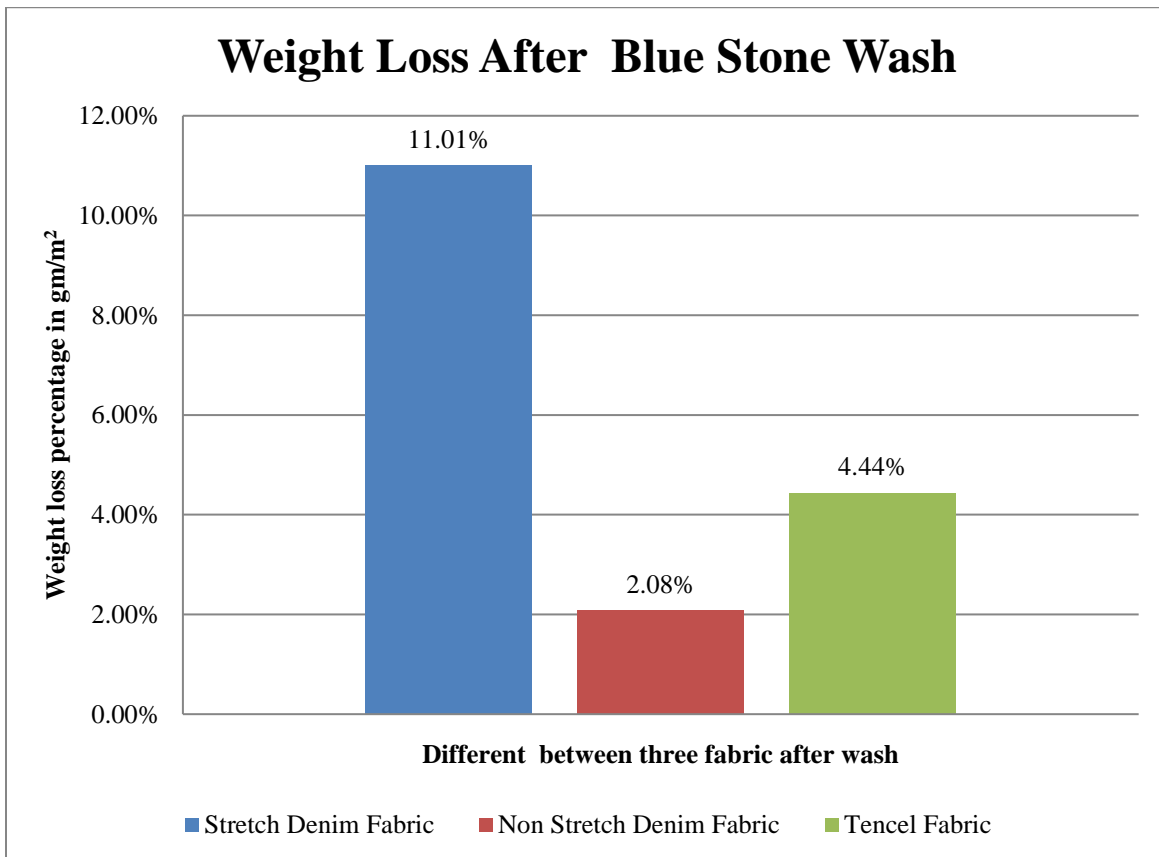
4.1 Comparison of Weight loss gm/m² in percentage (%)

Under Dark Blue Stone wash Stretch Denim Fabric increase its weight 10.1% where Non-Stretch Denim Fabric and Tencel Fabric decrease its weight 1.1% & 1.3% than before washing weight. By below graph we can understand the comparison:



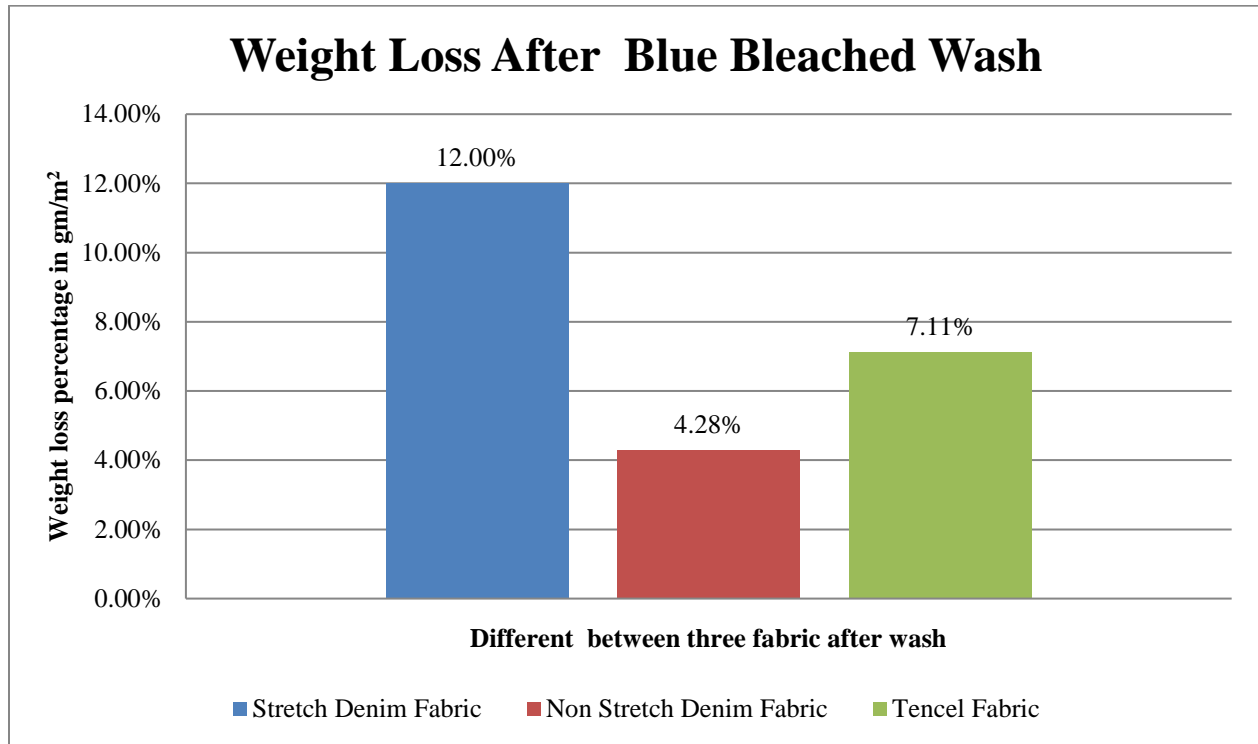
Graph-1: Weight loss after dark blue stone wash

Again under Blue Stone wash Stretch Denim Fabric increase its weight 11.1% where Non-Stretch Denim Fabric and Tencel Fabric decrease its weight 2.8% & 4.44% than before washing weight. By below graph we can understand the comparison:



Graph-2: Weight loss after blue stone wash

Lastly under Blue Bleach wash Stretch Denim Fabric increase its weight 12% where Non-Stretch Denim Fabric and Tencel Fabric decrease its weight 4.28% & 7.11% than before washing weight. By below graph we can understand the comparison:

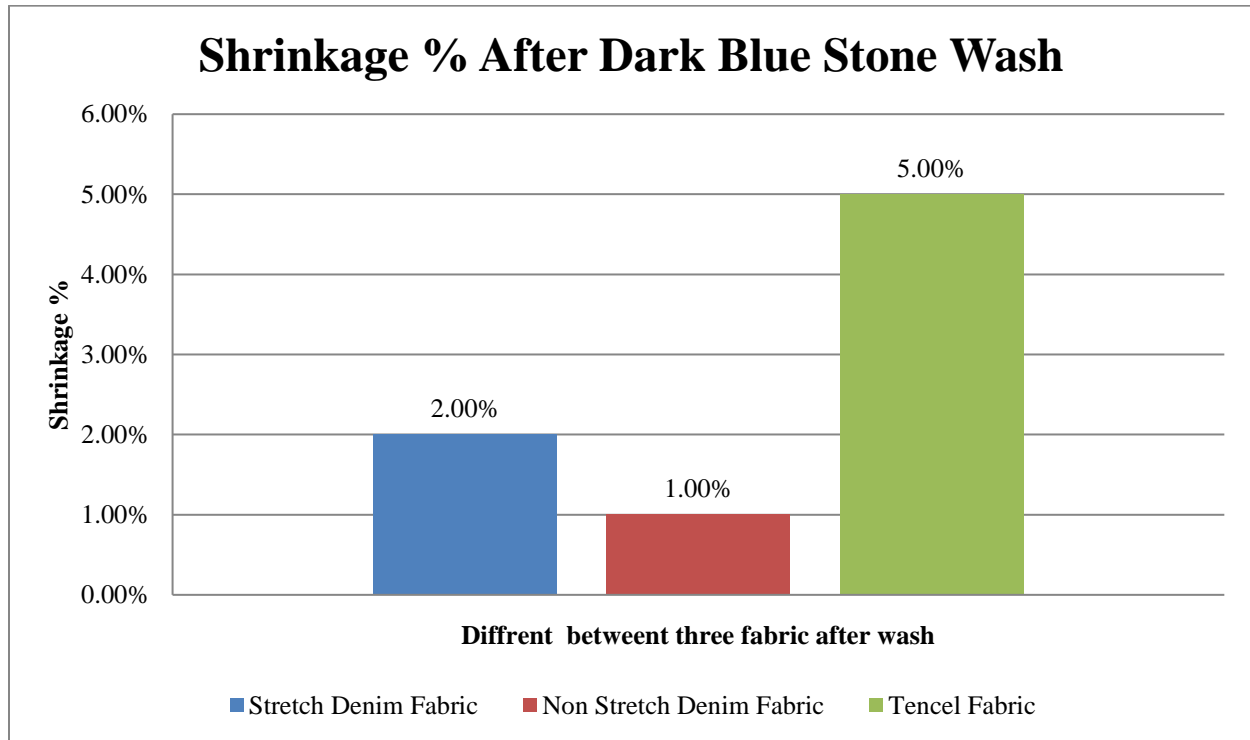


Graph-3:Weight loss after blue bleached wash

From the avoid comparison we can say that, stretch denim fabric always increase its weight after wash as the shade goes deeper to lighter than rest of two fabric.

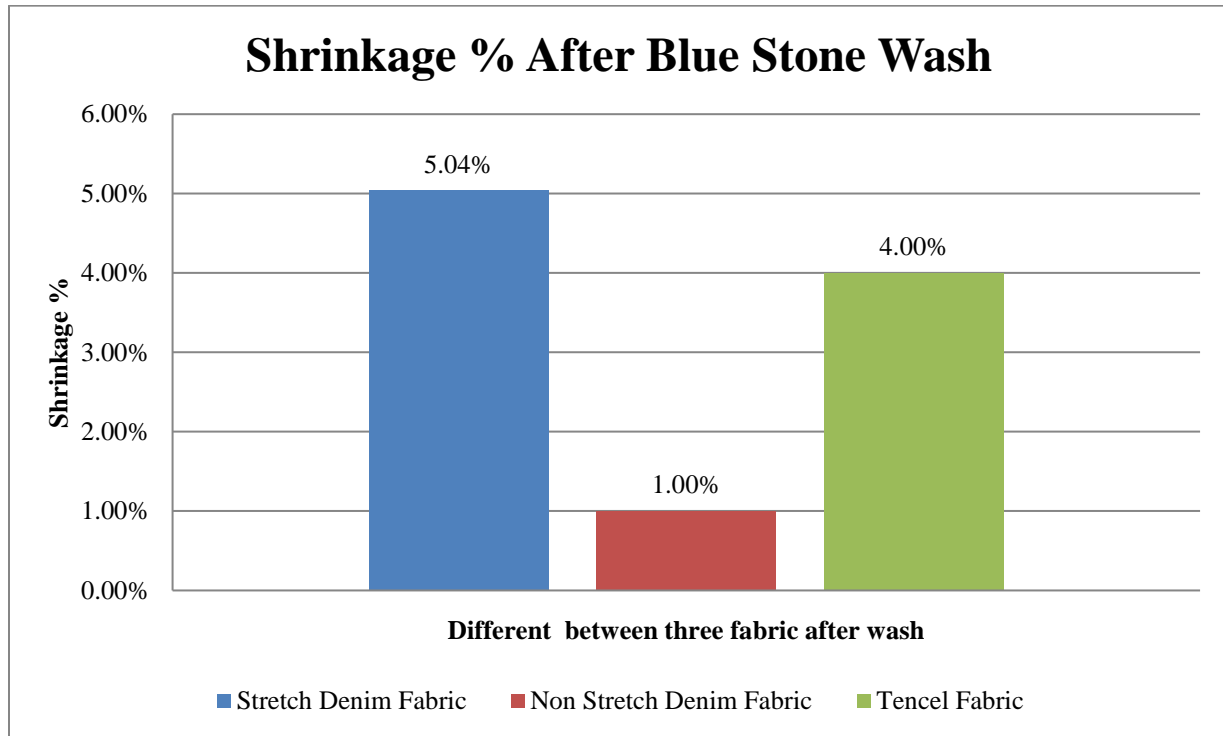
4.2 Comparison of shrinkage%

Under Dark Blue Stone wash Non-Stretch Denim Fabric shrink 1% where Stretch Denim Fabric and Tencel Fabric shrink 2% & 5%. By below graph we can understand the comparison:



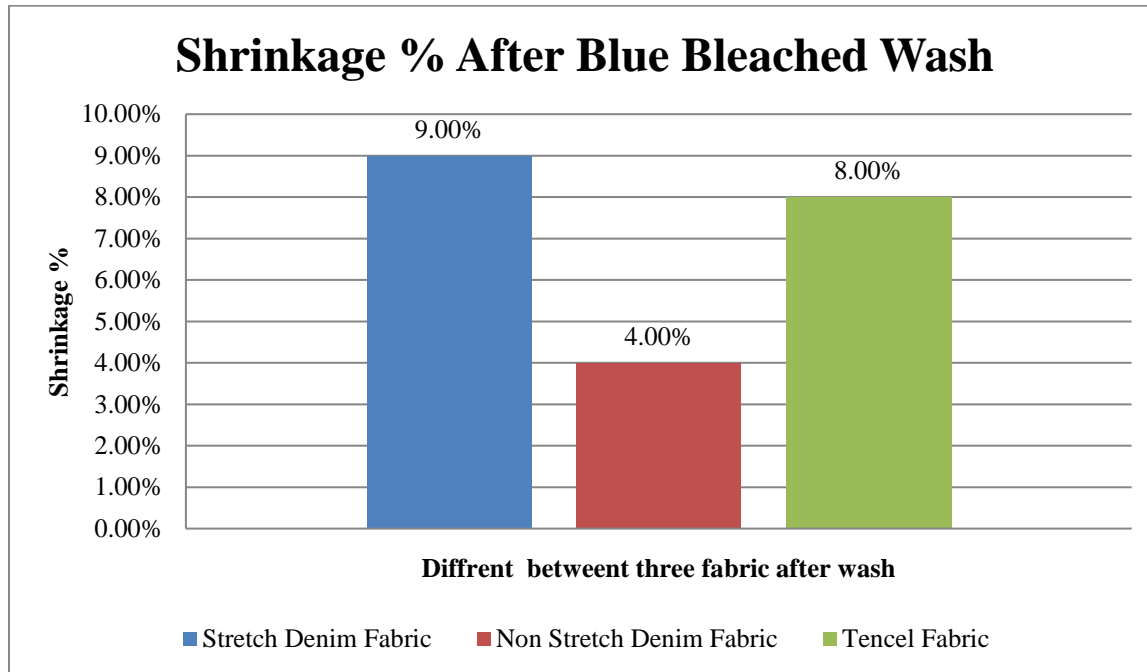
Graph-4: Shrinkage % after dark blue stone wash

Again under Blue Stone wash Non-Stretch Denim Fabric shrink 1% where Stretch Denim Fabric and Tencel Fabric shrink 5.4% & 4%. By below graph we can understand the comparison:



Graph-5:Shrinkage % after blue stone wash

Lastly under Blue Bleached wash Non-Stretch Denim Fabric shrink 4% where Stretch Denim Fabric and Tencel Fabric shrink 9% & 8%.By below graph we can understand the comparison:



Graph-6: Shrinkage % after blue bleached wash

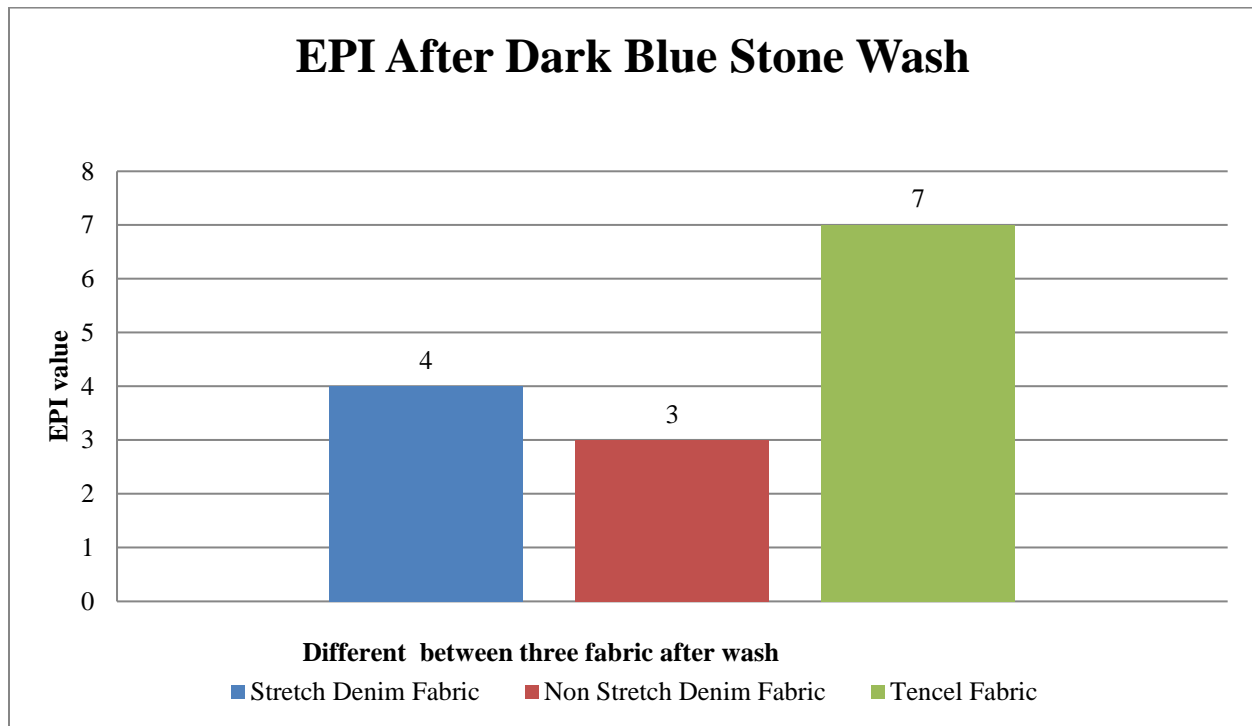
From the avoid comparison we can say that, Non-Stretch Denim Fabric always shrink less then Stretch Denim Fabric and Tencel Denim Fabric after wash.

4.3. EPI & PPI Variation Comparison

As we know EPI and PPI can be changed due to shrinkage. We also found that in our investigation, we have found Tencel Fabric with high shrinkage% as a result its EPI & PPI before and after wash variation is high for Tencel Fabric then Stretch Denim Fabric and Non-Stretch Denim Fabric.

4.3.1 EPIV ariation Comparison

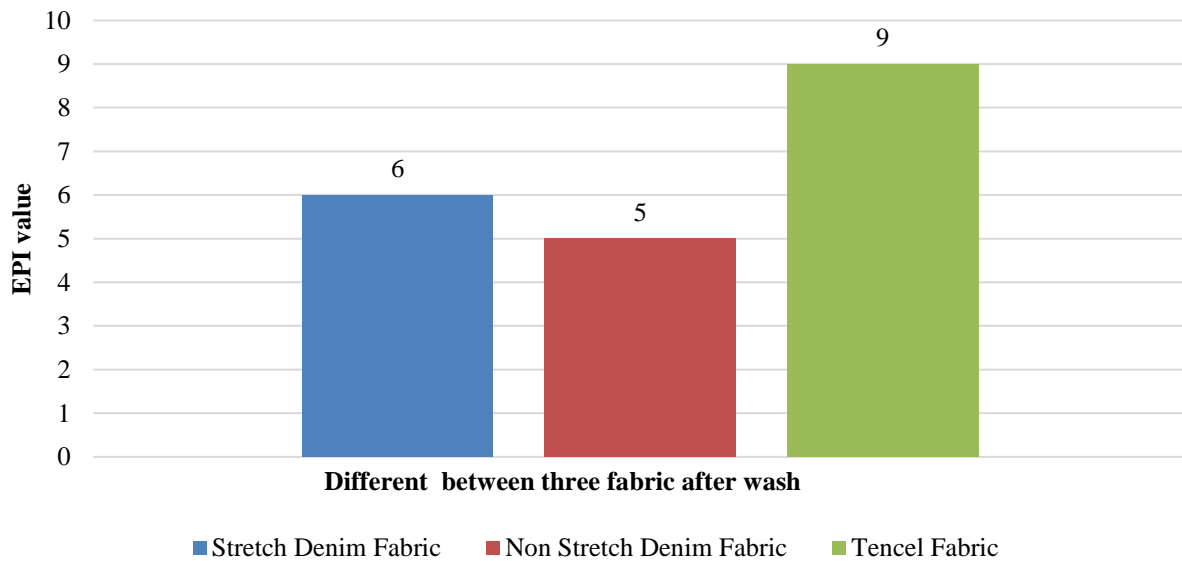
Under Dark Blue Stone wash wherethe variation of EPI value for non-stretch denim fabric is 3, there the variation of EPI value for stretch denim fabric is 4 andfor Tencelfabric is7. That means, under same washthe variation of EPI value for non-stretch denim fabric is less than rest of two types of fabric .By below graph we can understand the comparison:



Graph-7:EPI after Dark Blue Stone Wash

Again under blue stone wash where the variation of EPI value for non-stretch denim fabric is 5, there the variation of EPI value for stretch denim fabric is 6 and for Tencel fabric is 9. That means, under same wash the variation of EPI value for non-stretch denim fabric is less than rest of two types of fabric .By below graph we can understand the comparison:

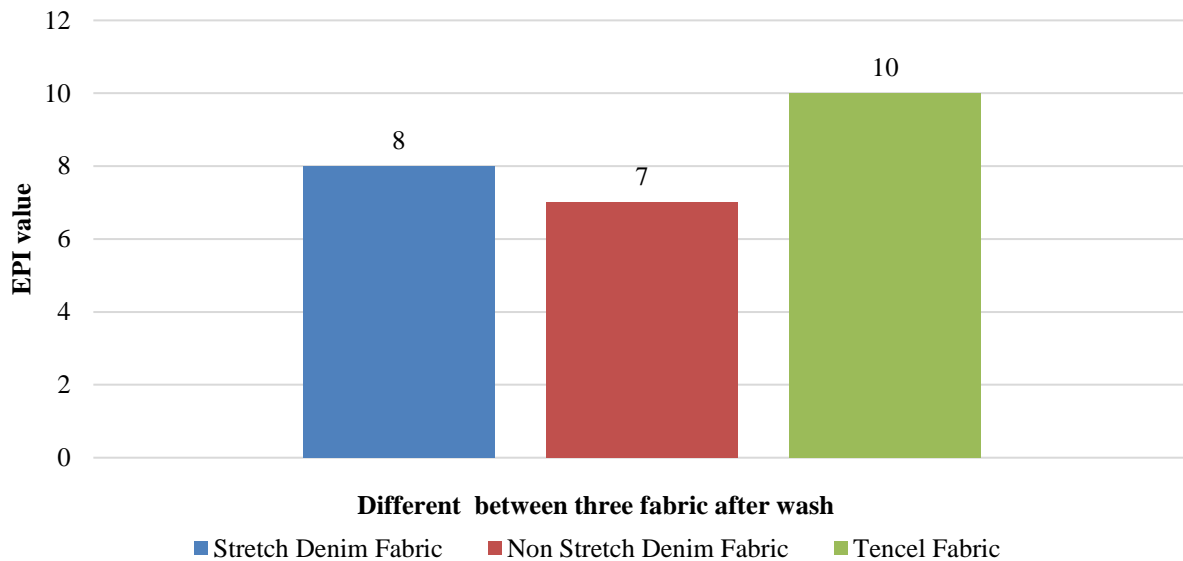
EPI After Blue Stone Wash



Graph-8:EPI after Blue Stone Wash

Lastly under blue bleached wash where the variation of EPI value for non-stretch denim fabric is 7, there the variation of EPI value for stretch denim fabric is 8 and for Tencel fabric is 10. That means, under same wash the variation of EPI value for non-stretch denim fabric is less than rest of two types of fabric .By below graph we can understand the comparison:

EPI After Blue Bleached Wash



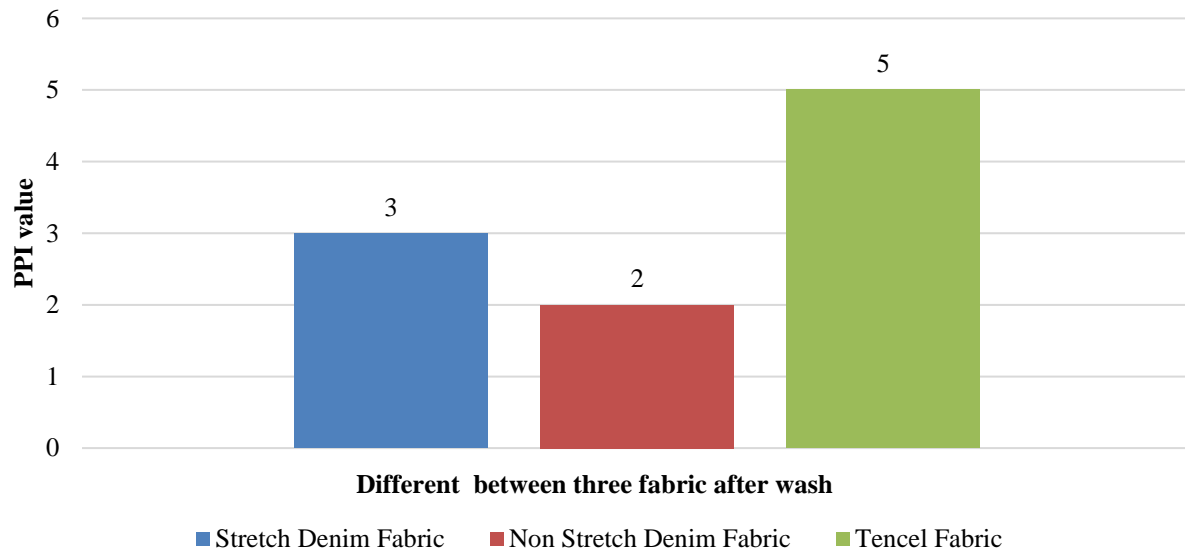
Graph-9:EPI After Blue Bleached Wash

From the avoid comparison we can say that, the variation of EPI value for non-stretch denim fabric is always less than stretch denim fabric and Tencel denim fabric.

4.3.2 PPI Variation Comparison

Under Dark Blue Stone wash where the variation of PPI value for non-stretch denim fabric is 2, there the variation of PPI value for stretch denim fabric is 3 and for Tencel fabric is 5. That means, under same wash the variation of PPI value for non-stretch denim fabric is less than rest of two types of fabric .By below graph we can understand the comparison.

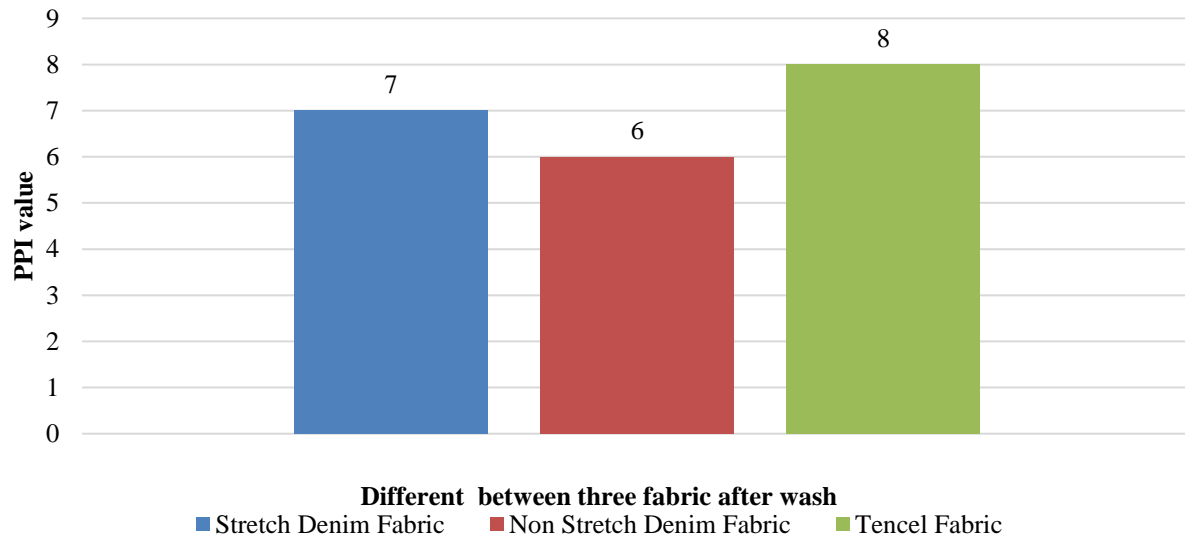
PPI After Dark Blue Stone Wash



Graph-10:PPI after Dark Blue Stone Wash

Again under blue stone wash where the variation of PPI value for non-stretch denim fabric is 6, there the variation of PPI value for stretch denim fabric is 7 and for Tencel fabric is 8. That means, under same wash the variation of PPI value for non-stretch denim fabric is less than rest of two types of fabric .By below graph we can understand the comparison.

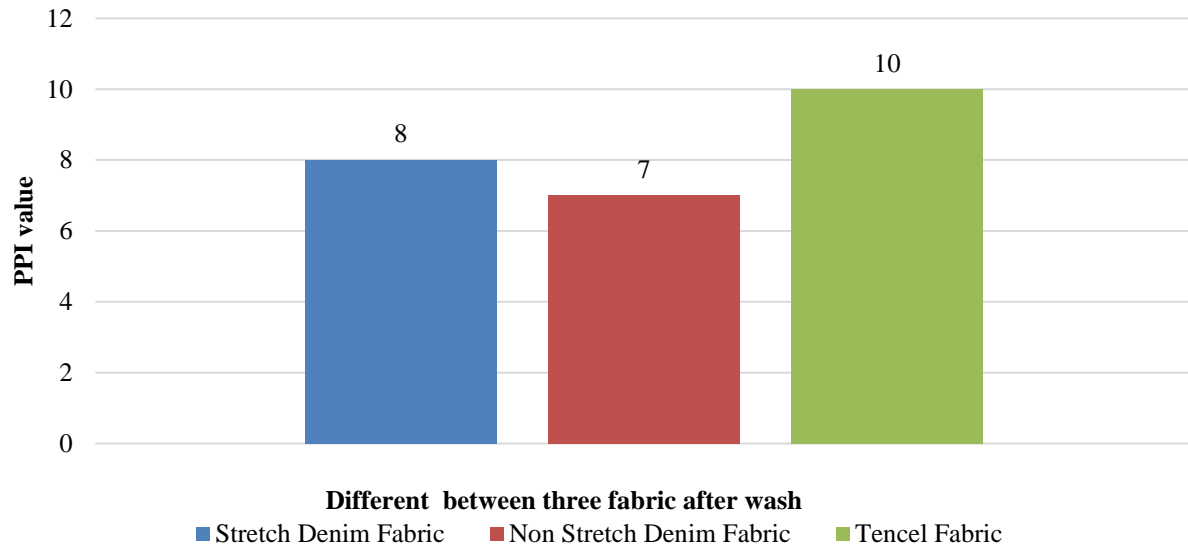
PPI After Blue Stone Wash



Graph-11:PPI After Blue Stone Wash

Lastly under blue bleached wash where the variation of PPI value for non-stretch denim fabric is 7, there the variation of PPI value for stretch denim fabric is 8 and for Tencel fabric is 10. That means, under same wash the variation of PPI value for non-stretch denim fabric is less than rest of two types of fabric .By below graph we can understand the comparison.

PPI After Blue Bleached Wash



Graph-12:PPI After Blue Bleached Wash

From the avoid comparison we can say that, the variation of PPI value for non-stretch denim fabric is always less than stretch denim fabric and Tencel denim fabric.

Chapter-5

Conclusion

This report revealed some analytical data for shrinkage, EPI & PPI and weight loss of denim fabric.

These are:

- ❖ Stretch denim fabric always increase its weight after wash as the shade goes deeper to lighter due to Dark Blue Stone, Blue Stone, Blue Bleach wash.
- ❖ The changes in length of the fabric are reduced because shrinkage is increased.
- ❖ Non-Stretch Denim Fabric has low shrinkage% ratio.
- ❖ Due to shrinkage, EPI and PPI value is decrease for non-stretch denim fabric and increase for Tencel fabric.

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