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Effects of Washing on Properties of Various Types of Denim Garments.

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

Advance in Apparel Manufacturing Technology

LETTER OF APPROVAL

To

The Head

Department of Textile Engineering


102, Shukrabad, Mirpur Road, Dhaka 1207

Dear Sir,

I am just writing to let you know that this project report titled as "Effects of Washing on Properties of Various Types of Denim Garments" has been prepared by the student bearing IDs 161-23-4605 and 161-23-4591 are completed for final evaluation. The whole report is prepared based on the proper investigation and interruption through critical analysis of empirical data with required belongings. 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



06.12.2019

.....
Md. Mominur Rahman

Assistant Professor

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ACKNOWLEDGEMENT

First of all we are grateful to Allah who gives us sound mind and sound health to accomplish this project successfully.

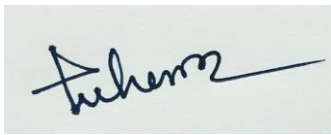
We are also grateful to our supervisor Mr. Md. Mominur Rahman, Assistant Professor & Associate Head, Department of Textile Engineering, Faculty of Engineering, Daffodil International University. His endless patience, scholarly guidance, continual encouragement, energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting these at all stages have made it possible to complete this project.

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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.

DECLARATION

We hereby declare that, this project has been done by us under the supervisor of Mr. Md. Mominur Rahman, Assistant Professor & Associate Head, Department of Textile Engineering, Faculty of Engineering, Daffodil International University. We also declare that, neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.



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ABSTRACT

This project is on “Effects of Washing on Properties of Various Types of Denim Garments.” Washing is a very important procedure in garments manufacturing. Every buyer wants to buy good quality product. As a result buyers are very sincere about washing quality of the product. That’s why supplier is facing market leading competition. So it is very important to improve the washing quality and improve to ensure the finely washed product. Now a day’s necessary to apply right system and process of wash quality so that only quality goods will be produced. The main purpose of washing is to remove faults for increase the quality of product to the competitive global market. This paper clearly explains the differences between before and after wash changes on denim washing. Mainly two types of wash can be done in the washing industry. One is Dry Process and another is Wet Process. During this project work, we found the report of Color fastness to rubbing, Color fastness to perspiration in acid & alkali media, Color fastness to water, Tear strength and Tensile strength in before and after wash. The result of Color fastness to rubbing, Color fastness to perspiration in acid & alkali media, Color fastness to water are very similar but the main different is tear strength & tensile strength.

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CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Denim washing have a different physical change, given on the buyer requirement. In garments after sewing denim garments are sending to the wash. The measurements and quality of the garments are changed due to wash. But we have to make sure that garments quality have to be equal to the buyer's requirement. That's why this thesis has written to understand the changes of the denim garments before and after wash. Some types of test report data have taken to find out the outer changes of garments such as color fastness to rubbing, color fastness to perspiration, color fastness to water, Tear strength, and Tensile strength etc. By this thesis it will help to understand the change of quality of the garments after wash.

1.2 Objectives of the Study

- Different types of denim wash.
- To find out the reason to change of test report after different wash.
- To find out the test report of same composition of fabric by applying different types of wash.
- To find out the test report of different fabric by applying same wash.
- To compare the test report.
- Find out the properties of various types of denim garments after wash.

1.3 Importance of the Study

As a fresher textile engineer it is very important to know about the behavior of garments before and after wash. This knowledge will support us some times in planning, sometime in production, some time to full fill the buyer requirement. On the other hand now days we have a great opportunity to work under denim manufacturer company. So washing knowledge for denim will be very helpful for our future carrier.

1.4 Limitations of the Study

There are some limitation of the study. During our project, we gathered information about our topic and prepared the project within a short time. That is why, there may have some unexpected mistake and also some lakes in the Project. We are regret very much for this unexpected mistake in this project.

CHAPTER 2

LITERATURE REVIEW

2.1 Denim wash

In the textile sector garment washing is one of the major processes followed in industry. Dust, dirt and infectious materials can be removed from garments by industrial garments washing. A variety of wash techniques can be followed as per fashion requirement, for improving special look on garments. Normally after stitching garment washing is done. Buyer ask for garment washing according to customer demand and fashion trend. For the washing garment buyers always mention accurately what types of garment washing they want for the order. Here we give an example that ZARA buyer asked for wash look like- Acid wash, Towel bleach and softener wash etc. On the fabric surfaces different types of appearance are seen in each wash. Physical changes of garment wash types are mainly depends on the product types.

Without denim today's fashion is totally incomplete. Denim garments comes in all forms, looks and washes to match with every dress. For making denim the fashion icon that it is today a huge number of technology factors have contributed including vast improvements in spinning, weaving and finishing etc. The most important part of creation of the fashionable denim jeans is the washing. Now washing plays such a vital part in the denim sector just because of so many effects that the consumers are looking for on their on their jeans. Every little step in denim garment washing makes a huge difference because indigo dye has a dry rubbing and very poor wet fastness. All the parameters are very critical to maintain for repetitive results. Denim washing technique now a day's creates new fashion such as blasting, tagging, whiskering, permanent wrinkle, destroy, grinding, hand scrapping, deep dye, tie dye, PP spray etc. These washing techniques have some significant physical change in denim garments.

Enzyme wash, bleach wash, acid wash, normal wash, stone wash etc are the most commonly denim washing methods. Among these washing methods, bleach washing method is widely used method in the industry especially for denim washing by hypochlorite bleaching to get the required color shade. The process of denim Bleach can be used to decolorize indigo from denim.

This paper shows the different types of washing effect on denim washing.

Object of Garments Washing

Garment washing is the best touch of a garment. Same type of garments can produce several effects for several wash. Like this:

- To create wash look appearance, seems the new touch of fashion.
- By the washing technique, faded/old, color or tinted affect.
- Washing technique creates new fashion such as tagging, grinding, destroy, blasting, whiskering, permanent wrinkle, deep dye, tie dye, p.p spray, hand crapping, p.p spoonzing etc.
- To reduce size materials that imports soft hand feels.
- To attraction the customers/buyer by different types of fashionable washing and market development.
- Due to washing, shrinkage occurs in the garments. There is no possibility of further shrinkage of the wash garments.
- Any dirt, spot or germ if added in the garments during manufacturing is also removed due to washing.

2.2 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 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 also their daily life activities. This can create that 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.

2.3 Different Types of Denim Wash

2.3.1 Rinse wash

It is most basic wash for denim garment. Typically named Dark Wash. The only purpose of this wash is to make the garment wearable. During the construction of denim fabric, starch is applied

to strengthen the warp. This makes the fabric pretty stiff and harsh to skin. In rinse wash the garment is Desized and some softening agent is applied to improve the hand feel of garment.

2.3.2 Desizing wash

Desizing is the process of removing the size material from the warp yarns after the textile fabric is woven. This is the most important part of denim washing.

During sizing, the warp yarn threads are treated with auxiliary chemicals known as sizing chemicals which impart the strength, friction resistance during weaving. The purpose of sizing is to protect the thread by coating. Different types of sizing chemicals are used like Starch, Modified starch, polyester, polyacrylates, polyvinyl alcohol, polyvinyl acetate, CMC etc. During washing, those chemicals must be removed to bring desired look on the fabric.

Its main objectives are given below:

- Removing the impurities which came from fibre or different manufacturing processes like oil, acedic or alkaline chemicals, dirt, dusts etc.
- Removing the sizing chemicals used in weaving
- Decreasing the crease risk on the garment etc.

2.3.3 Enzyme wash

Enzyme washing is a laundering process which uses enzymes to soften and finish fabric; providing jeans and other garments with a worn-in look and feel. The use of enzymes comes with various benefits both economically and environmentally. Enzyme can be used for garment washing as well as fabric washing.

Enzyme wash is required for the following reasons:-

- To remove the size materials from the garments.
- To remove the starch presents on the garments fabrics.
- To achieve the high low abrasion (stone affect) on garment and seam abrasion in sewing area.
- Enzyme attack as chemically not mechanically for this reason low damage/wastage then stone wash.
- For soft feeling to wear the garment.

- To achieve the buyer reference sample.
- To increase the color fastness & rubbing fastness.
- Especially develop the "Bio-Polishing" affect of cotton/denim.
- Enzyme improves the anti-pilling properties.
- Enzyme attacks more the surface of the fabrics and gives a very smooth surface.

2.3.4 Bleaching

Bleach wash is one of the garments washing process which is done by using strong oxidative bleaching agent. Sodium hypochlorite and potassium per-manganate (KMnO₄) are two bleaching agents. By applying bleaching agent, color can be removed uniformly from the garment and removal of color have done as per requirement (as buyer's provided wash approval). It should be noted that, there are three categories of bleaching, such as light bleach (where maximum color is removed), medium bleach and bleach. By applying bleaching wash special types of fading effect can be produced in the garments. Bleach wash can be applied on all types of garments such as woven, knit etc.

Main objective of Bleach wash:

- To achieve fading effect on the garments.
- To remove the starch present on the garments.
- To remove the size material from the garments.
- To achieve soft effect on the garments.
- To increase color fastness.
- To increase rubbing fastness.

2.3.5 Stone Wash

Denim is the most fashionable and preferred dress among the young generation. To modify the denim appearance, comfort ability, outlook and fashion of the dress various types of washing are done on denim garments. Stone wash is one of the most common wash on denim dress. Stone wash is done to bring "Used effect" or "Vintage effect" on the denim garments. Pumice stones are the key elements of stone washing. Because the fabric is washed along with pumice stones. During

stone washing process, these stones scrap off dye particles from the surface of the yarn of the denim fabric which shows a faded, worn out and brilliance effect in the denim fabric.

Purposes of stone wash:

- To get irregular fading or old looking affect on garments.
- To increase softness feeling of the denim cloth.
- To achieve the buyer washing standard.
- To produced correct size.
- Wash look appearance is developed.
- To remove dust, oil spot, impurities from the garments.

2.3.6 Acid wash

To change the look of denim or jeans different types of washing process are done. Among various washing process of denim, acid wash is the most popular.

Purpose of acid wash

- To get regular fading effect on jeans.
- To increase softness of the denim or jeans.
- “Wash look” appearance is developed.

2.3.7 Tinting

This is when different dyes have been added to the denim during the washing process. It follows that different colour dyes create different colour finishes. Commonly used are Brown and Green tints to give a browned off or green finish.

CHAPTER 3

EXPERIMENTAL DETAILS

3.1 Comparison for Different Wash Process

A. 95% BCI COTTON + 5% PCW COTTON DENIM FABRIC

3.1.1 Details of Fabric

Here is given below the Fabric details of 95% BCI COTTON + 5% PCW COTTON DENIM FABRIC

Table 3.1: Fabric Details

Sample	Details of Fabric		
	Fabric weight	Yarn count	Density
Sample 1	11 oz/yd ²	10×10	76×54
Sample 2	11 oz/yd ²	10×10	76×54
Sample 3	11 oz/yd ²	10×10	76×54
Sample 4	12.50 oz/yd ²	8×8	65×46

Table 3.1 shows the details of fabric which contain the fabric weight, yarn count & density for same composition of fabric. Here First 3 samples fabric weight 11 oz/yd², yarn count 10×10 and density 76×54 are same. But sample 4, Fabric weight 12.50 oz/yd², Yarn count 8×8 and Density 65×46 which is different to other 3 sample.

3.1.2 Process of 1st washing

Here is given below the Processes of 1st washing

Table 3.2: Processes of 1st washing

Serial no	Recipe							
	Rinse wash	Desizing	Enzyme	Acid wash	Towel potash	PP	Scouring	Softener
Sample 1	-	-	Power wash 200 gm, Antiback stain 50gm, Temp 45® C,				Hydrogen Peroxide 200gm, Caustic soda 100gm , Temp 60® C,	

			Time 12min				Time 10min	
Sample 2		Amylase 200gm, Antiback stain 50gm, Temp 50® C, Time 15min	Power wash 200 gm, Antiback stain 50gm, Stone 1bag, Temp 45® C, Time 10min		Towel 100pcs, KMnO4 6gm	KMnO4 10 gm		Eurosoft textile softner: 500gm
Sample 3	Water 200Ltr, Time 15 min		Power wash 200 gm, Antiback stain 50gm, Temp 45® C, Time 15min					
Sample 4		Amylase 200gm, Antiback stain 50gm, Temp 50® C, Time 15min	Power wash 200 gm, Antiback stain 50gm, Temp 45® C, Time 15min	Stone 1 bag KMnO4 2gm		KMnO4 2gm		

Table 3.2 shows the different wash process. We can apply different types of wash in same composition of fabric like Rinse wash, Desizing, Enzyme wash, Acid wash, Towel potash, PP, Scouring, and Softener. In this chart the Rinse wash which can apply only sample 3. We can use only water in rinse wash. We can run this process 15 minute. We can apply Desizing process in sample 2 & 4. In desizing process we can use Amylase 200gm, Antiback stain 50gm and also increase the temperature 50°C. We can run this process 15 minute. In this chart we can apply the

Enzyme process in all sample. Power wash 200 gm, Antiback stain 50gm chemical are used in this process. Temperature should maintain 45°C and the process running 15 minute. Acid wash also called ashu magic is applied only sample 4. We can use small stone and potassium per manganite 2 gm. Towel potash is applied only sample 2. We can use towel and potassium per manganite 6 gm. Scouring process is applied on sample 1. We can use Hydrogen Peroxide 200gm, Caustic soda 100gm and also increase the temperature 60°C. The process is run 15 minute. Softener process is applied on sample 2. We can use Eurosoft textile softener 500gm.

3.1.3 Test Report after 1st wash

Here is given below the test report after 1st wash

Table 3.3 Test Report after 1st wash

Sample	CF to rubbing		CF to perspiration		CF to Water		Tear strength		Tensile strength	
	Dry	Wet	Color staining	Change in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)
Sample 1	Face 3 Back3/4	Face 1 Back 1	4	4/5	4	4/5	36	35.2	790	490
Sample 2	Face4/5 Back4/5	Face1/2 Back1/2	4	4/5	4	4/5	23.70	20.83	732	532
Sample 3	Face 4 Back 4	Face1/2 Back1/2	4/5	4/5	4/5	4/5	26	21	760	500
Sample 4	Face4/5 Back4/5	Face 1 Back 1	3/4	4	3/4	4	43.05	37.04	993	676

Table 3.3 shows the test report of 4 sample after 1st wash. Here we show the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. In the chart we can see the color fastness to rubbing in sample 1 dry rubbing face 3, back 3/4 & wet rubbing face 1, back 1; sample 2 dry rubbing face 4/5, back 4/5 & wet rubbing face 1/2 , back 1/2 ; sample 3 dry rubbing face 4, back 4 & wet rubbing face 1/2 , back 1/2 ; sample 4 dry rubbing face 4/5, back 4/5 & wet rubbing face 1, back 1. Color fastness to perspiration are

same in sample 1, sample 2, and sample 3. Result of color fastness to perspiration color staining 4 & change in color 4/5. In sample 4 color staining 3/4 & change in color 4. Color fastness to water are same in sample 1, sample 2, and sample 3. Result of color fastness to water color staining 4 & change in color 4/5. In sample 4 color staining 3/4 & change in color 4. In sample 1 Tear strength is warp 36 N & weft 35.2 N, Tensile strength warp 790N & weft 490N. In sample 2 Tear strength is warp 23.70N & weft 20.83N, Tensile strength warp 732N & weft 532N. In sample 3 Tear strength is warp 26 N & weft 21 N, Tensile strength warp 760N & weft 500N. In sample 4 Tear strength is warp 43.05 N & weft 37.04 N, Tensile strength warp 993N & weft 676N.

3.1.4 Process of 2nd washing

Here is given below the process of 2nd washing

Table 3.4 Process of 2nd washing

Serial no	Recipe							
	Desizing	Enzyme	Towel bleach	Bleach	Acid Wash	Tint	All over PP	Softener
Sample 1	Amylase 200gm, Antiback stain 50gm, Temp 50 [®] C, Time 15min	Power wash 200 gm, Antiback stain 50gm, Temp 45 [®] C, Time 15min	Towel , calciu m hypo chlorit e 35%	Calcium hypo chlorite 35%, Temp 50 [®] C, Time 10min				
Sample 2	Amylase 200gm, Antiback stain 50gm, Temp 50 [®] C, Time 15min	Power wash 200 gm, Antiback stain 50gm, Stone 1bag, Temp 45 [®] C, Time 15min		Calcium hypochlorite 35%, Temp 50 [®] C, Time 7min	Stone 1 bag KMn O4 6gm	Brown GGL : 3gm, Salt: 100gm		Eurosoft textile softner: 500gm
Sample 3	Amylase 200gm, Antiback stain 50gm,	Power wash 200 gm, Antiback stain 50gm,		Calcium hypochlorite 35%, Temp				

	Temp 50® C, Time 10min	Temp 45® C, Time 15min		50® C, Time 7min				
Sample 4	Amylase 200gm, Antiback stain 50gm, Temp 50® C, Time 15min	Power wash 200 gm, Antiback stain 50gm, Temp 45® C, Time 15min		Calcium hypo chlorite 35%, Temp 50® C, Time 8min			KMnO4 2gm	

Table 3.4 shows the different wash process. We can apply different types of wash in same composition of fabric like Desizing, Enzyme wash, Acid wash, Towel bleach, Bleach, Tint, PP, and Softener. We can apply Desizing process in all sample. In desizing process we can use Amylase 200gm, Antiback stain 50gm and also increase the temperature 50°C. We can run this process 15 minute. In this chart we can apply the Enzyme process in all sample. Power wash 200 gm, Antiback stain 50gm chemical are used in this process. Temperature should maintain 45°C and the process running 15 minute. Acid wash also called ashu magic is applied only sample 2. We can use small stone and potassium per manganite 2 gm. Towel bleach is applied only sample 1. We can use towel and bleach. We can apply bleach process in all process. Calcium hypo chlorite 35% used in this process. Temperature should be increase the 50°C. We can run this process in different time to achieve the standard. Softener process is applied on sample 2. We can use Eurosoft textile softener 500gm. We can apply tint process in sample 2. Moderdirect brown GGL 3gm and salt 100gm are used in tint process.

3.1.5 Test Report after 2nd wash

Here is given below the test report after 2nd wash

Table 3.5 Test Report after 2nd wash

Sample	CF to rubbing		CF to perspiration		CF to Water		Tear strength		Tensile strength	
	Dry	Wet	Color stainin g	Chang e in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)

Sample 1	Face 4 Back 4	Face1/2 Back1/2	4	4/5	4	4/5	20.65	22.85	651	456
Sample 2	Face4/5 Back4/5	Face3/4 Back3/4	4/5	4/5	4	4/5	21.11	19.46	630	454
Sample 3	Face 4 Back 4	Face1/2 Back1/2	4/5	4/5	4/5	4/5	22	20	650	431
Sample 4	Face4/5 Back4/5	Face2/3 Back2/3	4/5	4/5	4/5	4/5	25.70	29.83	790	490

Table 3.5 shows the test report of 4 sample after 2nd wash. Here we show the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. In the chart we can see the color fastness to rubbing in sample 1 dry rubbing face 4, back 4 & wet rubbing face 1/2, back 1/2; sample 2 dry rubbing face 4/5, back 4/5 & wet rubbing face 3/4, back 3/4; sample 3 dry rubbing face 4, back 4 & wet rubbing face 1/2, back 1/2; sample 4 dry rubbing face 4/5, back 4/5 & wet rubbing face 2/3, back 2/3. Color fastness to perspiration are same in sample 1, sample 2, sample 3 and sample 4. Result of color fastness to perspiration color staining 4/5 & change in color 4/5. Color fastness to water are same in sample 1, sample 2, sample 3 and sample 4. Result of color fastness to water color staining 4 & change in color 4/5. In sample 1 Tear strength is warp 20.65 N & weft 22.85 N, Tensile strength warp 651N & weft 456N. In sample 2 Tear strength is warp 21.11N & weft 19.46N, Tensile strength warp 630N & weft 454N. In sample 3 Tear strength is warp 22 N & weft 20 N, Tensile strength warp 650N & weft 431N. In sample 4 Tear strength is warp 25.70 N & weft 29.83 N, Tensile strength warp 790N & weft 490N.

3.1.6 Process of 3rd washing

Here is given below the process of 3rd washing

Table 3.6 Process of 3rd washing

	Recipe
--	--------

Serial no	Desizing	Enzyme	Bleach	Acid Wash	PP	All over PP	Tint	Scouring	Softener
Sample 1		Power wash 200 gm, Antiback stain 50gm, Temp 45 ^o C, Time 15min	Calcium hypochlorite 35%, Temp 50 ^o C, Time 8min	Stone 1 bag KMnO ₄ 2gm	KMnO ₄ 5gm		yellow RL: 3gm, Salt 500gm		Eurosoft Textile Softener 500 gm
Sample 2									
Sample 3		Power wash 200 gm, Antiback stain 50gm, Temp 45 ^o C, Time 15min	Calcium hypochlorite 35%, Temp 50 ^o C, Time 8min	Stone 1 bag KMnO ₄ 2gm		KMnO ₄ 5gm	yellow RL: 3gm, Salt 500gm		Eurosoft Textile Softener 500 gm
Sample 4	Amylase 200gm, Antiback stain 50gm, Temp 50 ^o C, Time 10min	Power wash 200 gm, Antiback stain 50gm, Temp 45 ^o C, Time 15min	Calcium hypochlorite 35%, Temp 50 ^o C, Time 8min		KMnO ₄ 5gm			Hydrogen peroxide 200gm, Temp 60 ^o C, Time 10min	

Table 3.6 shows the different wash process. We can apply different types of wash in same composition of fabric like Desizing, Enzyme wash, Acid wash, Bleach, Tint, PP, Scouring and Softener. We can apply Desizing process in sample 4. In desizing process we can use Amylase 200gm, Antiback stain 50gm and also increase the temperature 50°C. We can run this process 15 minute. In this chart we can apply the Enzyme process in sample 1, sample 2, sample 3. Power

wash 200 gm, Antiback stain 50gm chemical are used in this process. Temperature should maintain 45°C and the process running 15 minute. Acid wash also called ashu magic is applied only sample 1 and sample 3. We can use small stone and potassium per manganite 2 gm. We can apply bleach process in sample 1, sample 2, and sample3. Calcium hypo chlorite 35% used in this process. Temperature should be increase the 50°C. We can run this process in different time to achieve the standard. Softener process is applied on sample 1 and sample 3. We can use Eurosoft textile softener 500gm. We can apply tint process in sample 1 and sample 3. Moderdirect brown GGL 3gm and salt 100gm are used in tint process. Scouring process is applied on sample 4. We can use Hydrogen Peroxide 200gm and also increase the temperature 60°C. The process is run 10 minute. We can also apply PP process in sample 1 and sample 4.

3.1.7 Test Report after 3rd wash

Here is given below the test report after 3rd wash

3.7 Test Report after 3rd wash

Sample	CF to rubbing		CF to perspiration		CF to Water		Tear strength		Tensile strength	
	Dry	Wet	Color staining	Change in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)
Sample 1	Face4/ Back 4	Face1/ 2 Back1/ 2	4/5	4/5	4	4/5	26.2 7	21.8 8	427	262
Sample 2	Face4/ 5 Back4/ 5	Face1/ 2 Back1/ 2	4	4/5	4	4/5	21.1 1	19.4 6	630	454
Sample 3	Face 4 Back 4	Face1/ 2 Back1/ 2	4/5	4/5	4/5	4/5	14.1 2	17.0 2	472	291
Sample 4	Face4/ 5 Back4/ 5	Face 1 Back 1	3/4	4	3/4	4	19.8 1	16	621	412

Table 3.7 shows the test report of 4 sample after 3rd wash. Here we show the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. The result of sample 2 is unchanged because we cannot apply 3rd wash process in this sample. In the chart we can see the color fastness to rubbing in sample 1 dry rubbing face 4, back 4 & wet rubbing face 1/2, back 1/2; sample 3 dry rubbing face 4, back 4 & wet rubbing face 1/2, back 1/2; sample 4 dry rubbing face 4/5, back 4/5 & wet rubbing face 2/3, back 2/3. Color fastness to perspiration are same in sample 1, sample 3 and sample 4. Result of color fastness to perspiration color staining 4/5 & change in color 4/5. Color fastness to water are same in sample 1, sample 3 and sample 4. Result of color fastness to water color staining 4 & change in color 4/5. In sample 1 Tear strength is warp 26.27 N & weft 21.88 N, Tensile strength warp 427N & weft 262N. In sample 2 Tear strength is warp 21.11N & weft 19.46N, Tensile strength warp 630N & weft 454N. In sample 3 Tear strength is warp 14.12 N & weft 17.02 N, Tensile strength warp 472N & weft 291N. In sample 4 Tear strength is warp 19.81 N & weft 16 N, Tensile strength warp 621N & weft 412N.

B. 100% COTTON DENIM FABRIC

3.1.8 Details of Fabric

Here is given below the details of 100% COTTON DENIM FABRIC

Table 3.8 Details of Fabric

Sample	Details of Fabric		
	Fabric weight	Yarn count	Density
Sample 1	10 oz/yd ²	10×10	74×52
Sample 2	11 oz/yd ²	10×10	76×54
Sample 3	12.50 oz/yd ²	7×8	76×49

Table 3.8 shows the details of fabric which contain the fabric weight, yarn count & density for same composition of fabric. Here sample 1 fabric weight 10 oz/yd², yarn count 10×10 and density

74×52. In sample 2 fabric weight 11 oz/yd², yarn count 10×10 and density 76×54. In sample 3 Fabric weight 12.50 oz/yd², Yarn count 7×8 and Density 76×49.

3.1.9 Process of washing

Here is given below the process of washing

Table 3.9 Process of washing

Serial no	1 st wash	2 nd wash	3 rd wash
Sample 1	Rinse wash	Enzyme+ Scouring+ softener	Enzyme+ Towel potash+ Bleach+ Tint+ Softener
Sample 2	Desizing + Stone Enzyme	Desizing + Enzyme+ Bleach	Desize+ Enzyme + Acid wash+ Bleach+PP+ Tint+ Softener
Sample 3	Rinse wash+ softener+ Fixing	Enzyme+ Dyeing+ Fixing	Enzyme + Bleach+ Acid wash+ All over PP+ Tint+ Softener

Table 3.9 shows the different wash process in 3 types of sample.

3.1.10 Process of 1st washing

Here is given below the process of 1st washing-

Table 3.10: Process of 1st washing

Serial no	Recipe				
	Rinse Wash	Desizing	Enzyme	Softener	Fixing
Sample 1	Water 250 Ltr, Time 10 min				
Sample 2		Amylase 200gm, Antiback stain 50gm, Temp 50 ^o C, Time 15min	Power wash 200 gm, Antiback stain 50gm, Stone 1bag, Temp 45 ^o C, Time 25min		
Sample 3	Water 200Ltr, Time 15 min			Eurosoft Textile Softner 500gm	Fixing agent 500 gm

Table 3.10 shows the different wash process. We can apply different types of wash in same composition of fabric like Rinse wash, Desizing, Enzyme wash, Softener and Fixing. In this chart the Rinse wash which can apply only sample 1 and sample 3. We can use only water in rinse wash. We can run this process 10 minute for sample 1 and 15 minute for sample 3. We can apply Desizing process in sample 2. In desizing process we can use Amylase 200gm, Antiback stain 50gm and also increase the temperature 50°C. We can run this process 15 minute. In this chart we can apply the Enzyme process in sample 2. Power wash 200 gm, Antiback stain 50gm chemical are used in this process. Temperature should maintain 45°C and the process running 15 minute. Softener process is applied on sample 3. We can use Eurosoft textile softener 500gm. Fixing process is applied on sample 3.

3.1.11 Test Report after 1st wash

Here is given below the test report after 1st wash

Table 3.11: Test Report after 1st wash

Sample	CF to rubbing		CF to perspiration		CF to Water		Tear strength		Tensile strength	
	Dry	Wet	Color staining	Change in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)
Sample 1	Face 3 Back3/4	Face1 Back1	4	4/5	4	4/5	46	41	913	506
Sample 2	Face4/5 Back4/5	Face3 Back3	4	4/5	4	4/5	25	22	785	493
Sample 3	Face 4 Back 4	Face2 Back2	4/5	4/5	4/5	4/5	52	48.20	821	568

Table 3.11 shows the test report of 3 sample after 1st wash. Here we show the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. In the chart we can see the color fastness to rubbing in sample 1 dry

rubbing face 3, back 3/4 & wet rubbing face 1, back 1; sample 2 dry rubbing face 4/5, back 4/5 & wet rubbing face 3, back 3; sample 3 dry rubbing face 4, back 4 & wet rubbing face 2, back 2. Color fastness to perspiration are same in sample 1, sample 2, and sample 3. Result of color fastness to perspiration color staining 4 & change in color 4/5. Color fastness to water are same in sample 1, sample 2, and sample 3. Result of color fastness to water color staining 4 & change in color 4/5. In sample 1 Tear strength is warp 46 N & weft 41 N, Tensile strength warp 913N & weft 506N. In sample 2 Tear strength is warp 25N & weft 22N, Tensile strength warp 785N & weft 493N. In sample 3 Tear strength is warp 52 N & weft 48.20 N, Tensile strength warp 821N & weft 568N.

3.1.12 Process of 2nd washing

Here is given below the process of 2nd washing

Table 3.12 Process of 2nd washing

Serial no	Recipe						
	Desizing	Enzyme	Bleach	Dyeing	Scouring	Fixing	Softening
Sample 1		Power wash 200 gm, Antiback stain 50gm, Temp 45 ^o C, Time 15min			Hydrogen Peroxide 200gm, Caustic soda 100gm, Temp 60 ^o C, Time 10min		Eurosoft Textile Softner 500gm
Sample 2	Amylase 200gm, Antiback stain 50gm, Temp 50 ^o C, Time 15min	Power wash 200 gm, Antiback stain 50gm, Temp 45 ^o C, Time 25min	Calcium hypochlorite 35%, Temp 50 ^o C, Time 10min				
Sample 3		Power wash 200 gm,		Moder direct Brown		Fixing agent 500 gm	

		Antiback stain 50gm, Temp 45 [®] C, Time 15min		3gm, Salt 500gm			
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Table 3.12 shows the different wash process. We can apply different types of wash in same composition of fabric like Desizing, Enzyme wash, Bleach, Dyeing, Scouring, Fixing and Softener. We can apply Desizing process in sample 2. In desizing process we can use Amylase 200gm, Antiback stain 50gm and also increase the temperature 50°C. We can run this process 15 minute. In this chart we can apply the Enzyme process in sample 1, sample 2, and sample 3. Power wash 200 gm, Antiback stain 50gm chemical are used in this process. Temperature should maintain 45°C and the process running 15 minute. We can apply bleach process in sample 2. Calcium hypo chlorite 35% used in this process. Temperature should be increase the 50°C. We can run this process 10 minute to achieve the standard. Softener process is applied on sample 1. We can use Eurosoft textile softener 500gm. Scouring process is applied on sample 1. We can use Hydrogen Peroxide 200gm, Caustic soda 100gm and also increase the temperature 60°C. The process is run 10 minute. We can apply dyeing on sample 3. Moderdirect Brown 3gm, Salt 500gm are used in dyeing process. We can also apply Fixing process on sample 3.

3.1.13 Test Report after 2nd wash

Here is given below the test report after 2nd wash

3.13 Test Report after 2nd wash

Sample	CF to rubbing		CF to perspiration		CF to Water		Tear strength		Tensile strength	
	Dry	Wet	Color staining	Change in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)
Sample 1	Face 3 Back3/4	Face1 Back1	4	4/5	4	4/5	38	33	791	410
Sample 2	Face4/5 Back4/5	Face 3 Back 3	4	4/5	4	4/5	22	20	621	402

Sample 3	Face 4 Back 4	Face 2 Back 2	4/5	4/5	4/5	4/5	59.75	47.88	810	460
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Table 3.13 shows the test report of 3 sample after 2nd wash. Here we show the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. In the chart we can see the color fastness to rubbing in sample 1 dry rubbing face 3, back 3/4 & wet rubbing face 1, back 1; sample 2 dry rubbing face 4/5, back 4/5 & wet rubbing face 3, back 3; sample 3 dry rubbing face 4, back 4 & wet rubbing face 2, back 2. Color fastness to perspiration are same in sample 1, sample 2, and sample 3. Result of color fastness to perspiration color staining 4 & change in color 4/5. Color fastness to water are same in sample 1, sample 2, and sample 3. Result of color fastness to water color staining 4 & change in color 4/5. In sample 1 Tear strength is warp 38 N & weft 33 N, Tensile strength warp 791N & weft 410N. In sample 2 Tear strength is warp 22N & weft 20N, Tensile strength warp 621N & weft 402N. In sample 3 Tear strength is warp 59.75 N & weft 47.88 N, Tensile strength warp 810N & weft 460N.

3.1.14 Process of 3rd washing

Here is given below the process of 3rd washing

Table 3.14 Process of 3rd washing

Serial no	Recipe							
	Desizing	Enzyme	Towel potash	Bleach	Acid Wash	Tint	PP	Softener
Sample 1		Power wash 200 gm, Antiback stain 50gm, Temp 45°C, Time 15min	Towel, KMnO ₄ 6gm 10 min	Calcium hypo chlorite 35%, Temp 50°C, Time 8min		Yellow RL 3gm, Salt: 100gm		Eurosoft textile softner: 500gm
Sample 2	Amylase 200gm,	Power wash 200		Calcium hypochl	Stone 1 bag	Brown	KMnO ₄ 5gm	Eurosoft textile

	Antiback stain 50gm, Temp 50°C, Time 10min	gm, Antiback stain 50gm, Stone 1bag, Temp 45°C, Time 15min		orite 35%, Temp 50°C, Time 7min	KMnO ₄ 6gm	GGL : 3gm, Salt: 100gm		softner: 500gm
Sample 3		Power wash 200 gm, Antiback stain 50gm, Temp 45°C, Time 15min		Calcium hypo chlorite 35%, Temp 50°C, Time 7min	Stone 1 bag KMnO ₄ 6gm	Yellow RL 3gm, Salt: 100gm	KMnO ₄ 5gm	Eurosoft textile softner: 500gm

Table 3.14 shows the different wash process. We can apply different types of wash in same composition of fabric like Desizing, Enzyme wash, Towel potash, Acid wash, Bleach, Tint, PP, and Softener. We can apply Desizing process in sample 2. In desizing process we can use Amylase 200gm, Antiback stain 50gm and also increase the temperature 50°C. We can run this process 10 minute. In this chart we can apply the Enzyme process in sample 1, sample 2, and sample 3. Power wash 200 gm, Antiback stain 50gm chemical are used in this process. Temperature should maintain 45°C and the process running 15 minute. Acid wash also called ashu magic is applied only sample 2 and sample 3. We can use small stone and potassium per manganite 2 gm. We can apply bleach process in sample 1, sample 2, and sample3. Calcium hypo chlorite 35% used in this process. Temperature should be increase the 50°C. We can run this process in different time to achieve the standard. We can apply Towel potash process on sample 1. Softener process is applied on sample 1, sample 2 and sample 3. We can use Eurosoft textile softner 500gm. We can apply tint process in sample 1, sample 2 and sample 3. Moderdirect brown GGL 3gm and salt 100gm are used in tint process. We can also apply PP process in sample 2 and sample 3.

3.1.15 Test Report after 3rd wash

Here is given below the test report after 3rd wash

Table 3.15 Test Report after 3rd wash

Sample	CF to rubbing		CF to perspiration		CF to Water		Tear strength		Tensile strength	
	Dry	Wet	Color staining	Change in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)
Sample 1	Face 3 Back 3/4	Face 1 Back 1	4	4/5	4	4/5	22	20	485	251
Sample 2	Face 4/5 Back 4/5	Face 3 Back 3	4	4/5	4	4/5	20	18	427	260
Sample 3	Face 4 Back 4	Face 2 Back 2	4/5	4/5	4/5	4/5	34.10	30.4	612	315

Table 3.15 shows the test report of 3 sample after 3rd wash. Here we show the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. In the chart we can see the color fastness to rubbing in sample 1 dry rubbing face 3, back 3/4 & wet rubbing face 1, back 1; sample 2 dry rubbing face 4/5, back 4/5 & wet rubbing face 3, back 3; sample 3 dry rubbing face 4, back 4 & wet rubbing face 2, back 2. Color fastness to perspiration are same in sample 1, sample 2, and sample 3. Result of color fastness to perspiration color staining 4 & change in color 4/5. Color fastness to water are same in sample 1, sample 2, and sample 3. Result of color fastness to water color staining 4 & change in color 4/5. In sample 1 Tear strength is warp 22 N & weft 20 N, Tensile strength warp 485N & weft 251N. In sample 2 Tear strength is warp 20N & weft 18N, Tensile strength warp 427N & weft 260N. In sample 3 Tear strength is warp 34.10 N & weft 30.40 N, Tensile strength warp 612N & weft 315N.

3.2 Comparison for Different Fabric Composition

3.2.1 Details of Fabric

Here is given below the details of different types of fabric

Table 3.16 Details of Fabric

Sample	Details of Fabric			
	Composition	Fabric weight	Yarn count	Density
Sample 1	Denim fabric 20% post-consumer Recycle cotton 80%	12.50 oz/yd ²	8×10	66×52
Sample 2	95% BCI Cotton+ 5% PCW Cotton Denim fabric	11.00 oz/yd ²	10×10	76×54
Sample 3	5% Recycled post-consumer cotton, 95% Better cotton	11 oz/yd ²	9×8	72×54

3.2.2 Wash Process

- Desize
- Enzyme
- Bleach

3.2.3 Wash Recipe

Here is given below the wash recipe of different composition of fabric

Table 3.17 Wash Recipe

Sample	Recipe		
	Desize	Enzyme	Bleach
Sample 1	Amylase 200gm, Antiback stain 50gm, Temp 50® C, Time 10min	Power wash 200 gm, Antiback stain 50gm, Temp 45® C, Time 15min	Calcium hypochlorite 35%, Temp 50® C, Time 10min
Sample 2	Amylase 200gm, Antiback stain 50gm, Temp 50® C, Time 10min	Power wash 200 gm, Antiback stain 50gm, Temp 45® C, Time 15min	Calcium hypochlorite 35%, Temp 50® C, Time 10min
Sample 3	Amylase 200gm, Antiback stain 50gm, Temp 50® C, Time 10min	Power wash 200 gm, Antiback stain 50gm, Temp 45® C, Time 15min	Calcium hypochlorite 35%, Temp 50® C, Time 10min

Table 3.17 shows the different wash process. We can apply same types of wash in different composition of fabric like Desizing, Enzyme wash and Bleach. We can apply Desizing process in all sample. In desizing process we can use Amylase 200gm, Antiback stain 50gm and also increase the temperature 50°C. We can run this process 10 minute. In this chart we can apply the Enzyme process in sample 1, sample 2, and sample 3. Power wash 200 gm, Antiback stain 50gm chemical are used in this process. Temperature should maintain 45°C and the process running 15 minute. We can apply bleach process in all sample. Calcium hypo chlorite 35% used in this process. Temperature should be increase the 50°C. We can run this process 10 minute to achieve the standard.

3.2.4 Test Report after wash

Here is given below the test report after wash

Table 3.18 Test Report after wash

Sample	CF to rubbing		CF to perspiration		CF to Water		Tear strength		Tensile strength	
	Dry	Wet	Color staining	Change in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)
Sample 1	Face4/5 Back4/5	Face2/3 Back2/3	4	4	4	4/5	40.97	35.85	910	451
Sample 2	Face4/5 Back4/5	Face1/2 Back1/2	4/5	4/5	4	4/5	17.5	20.5	670	435
Sample 3	Face4/5 Back4/5	Face 3 Back 3	4/5	4/5	4/5	4/5	30.19	29.26	700	450

Table 3.18 shows the test report of 3 sample after wash. Here we show the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. In the chart we can see the color fastness to rubbing in sample 1 dry rubbing face

4/5, back 4/5 & wet rubbing face 2/3, back 2/3; sample 2 dry rubbing face 4/5, back 4/5 & wet rubbing face 1/2, back 1/2; sample 3 dry rubbing face 4/5, back 4/5 & wet rubbing face 3, back 3. Color fastness to perspiration are same in sample 2, and sample 3. Result of color fastness to perspiration color staining 4/5 & change in color 4/5. In sample 1 the result of color fastness to perspiration are color staining 4 & change in color 4. Color fastness to water are same in sample 1 and sample 2. Result of color fastness to water color staining 4 & change in color 4/5. In sample 3 result of color fastness to water color staining 4/5 & change in color 4/5. In sample 1 Tear strength is warp 40.97 N & weft 35.85N, Tensile strength warp 910N & weft 451N. In sample 2 Tear strength is warp 17.5N & weft 20.5N, Tensile strength warp 670N & weft 435N. In sample 3 Tear strength is warp 30.19 N & weft 29.26N, Tensile strength warp 700N & weft 450N.

CHAPTER 4

DISCUSSION OF RESULTS

4.1 Comparison of Wash Process

4.1.1 Comparison for Different Wash Processes (95% BCI COTTON + 5% PCW COTTON)

Table 4.1: Comparison after 1st Wash

Sample	CF to Rubbing		CF to Perspiration		CF to Water		Tear Strength		Tensile Strength		Wash process
	Dry	Wet	Color staining	Change in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)	
Sample 1	Face 3 Back 3/4	Face 1 Back 1	4	4/5	4	4/5	36	35.2	790	490	Enzyme, Scouring
Sample 2	Face 4/5 Back 4/5	Face 1/2 Back 1/2	4	4/5	4	4/5	23.70	20.83	732	532	Desizing, Enzyme, Towel potash, PP, Softening
Sample 3	Face 4 Back 4	Face 1/2 Back 1/2	4/5	4/5	4/5	4/5	26	21	760	500	Rinse wash, Enzyme
Sample 4	Face 4/5 Back 4/5	Face 1 Back 1	3/4	4	3/4	4	43.05	37.04	993	676	Desizing, Enzyme, Acid wash, PP

Table 4.1 shows the test report of 95% BCI COTTON + 5% PCW COTTON DENIM FABRIC After first wash. It shows the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. In the test report the highest tear and tensile strength value is sample 4. In sample 4 the fabric weight is higher than the other 3 sample. This should be the cause of increase the tear and tensile strength of sample 4. In sample the tear strength is higher than sample 2 and 3. Because in sample 1 we can apply only enzyme and scouring process. On the other hand in sample 2 we can apply desize, enzyme, towel potash, PP, softener that's why the test result is lower than sample 1.

Table 4.2: Comparison after 2nd Wash

Sample	CF to rubbing		CF to perspiration		CF to Water		Tear strength		Tensile strength		Wash process
	Dry	Wet	Color staining	Change in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)	
Sample 1	Face 4 Back 4	Face1/2 Back1/2	4	4/5	4	4/5	20.65	22.85	651	456	Desize, Enzyme, Towel bleach, Bleach
Sample 2	Face4/5 Back4/5	Face3/4 Back3/4	4/5	4/5	4	4/5	21.11	19.46	630	454	Desizing, Enzyme, Acid wash, Bleach, Tint, Softener
Sample 3	Face 4 Back 4	Face1/2 Back1/2	4/5	4/5	4/5	4/5	22	20	650	431	Desize, Enzyme, Bleach
Sample 4	Face4/5 Back4/5	Face2/3 Back2/3	4/5	4/5	4/5	4/5	25.70	29.83	790	490	Desizing, Enzyme, Bleach, All over PP

Table 4.2 shows the test report of 95% BCI COTTON + 5% PCW COTTON DENIM FABRIC After second wash. It shows the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. In this chart the highest tear and tensile strength value is sample 4. In sample 4 the fabric weight is higher than the other 3 sample. This should be the cause of increase the tear and tensile strength of sample 4. In sample 2 and 3 the tear and tensile strength value in sample 3 is higher than sample 2 because we can apply more wash process in sample 2. In sample 1 the strength value is lower than sample 2 and 3 because in sample 1 we apply bleach process more time than other sample.

Table 4.3: Comparison after 3rd Wash

Sample	CF to rubbing		CF to perspiration		CF to Water		Tear strength		Tensile strength		Wash process
	Dry	Wet	Color staining	Change in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)	
Sample 1	Face4 Back 4	Face1/2 Back1/2	4/5	4/5	4	4/5	26.27	21.88	427	262	Enzyme,Bleach,Acid wash,PP,Tint,Softener
Sample 2	Face4/5 Back4/5	Face1/2 Back1/2	4	4/5	4	4/5	21.11	19.46	630	454	
Sample 3	Face 4 Back 4	Face1/2 Back1/2	4/5	4/5	4/5	4/5	14.12	17.02	472	291	Enzyme,Bleach,Acid wash,All over,PP,Tint,Softener
Sample 4	Face4/5 Back4/5	Face 1 Back 1	3/4	4	3/4	4	19.81	16	621	412	Desizing,Enzym, Bleach,All over PP,Scouring

Table 4.2 shows the test report of 95% BCI COTTON + 5% PCW COTTON DENIM FABRIC After third wash. It shows the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. In this chart the highest tear and tensile strength value is sample 4. In sample 4 the fabric weight is higher than the other 3 sample. This should be the cause of increase the tear and tensile strength of sample 4. In sample 2 the tear and tensile strength value is unchanged because we didn't apply 3rd wash process in sample 2. In sample 1 the tear strength value is improve because finally we apply softener process which should improve the tear strength value. In sample 3 the strength value is decrease because we apply more wash process in 3rd wash.

4.1.2 Comparison of 100% COTTON DENIM FABRIC

Table 4.4 Comparison after 1st wash

Sample	CF to rubbing		CF to perspiration		CF to Water		Tear strength		Tensile strength		Wash process
	Dry	Wet	Color staining	Change in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)	
Sample 1	Face 3 Back3/4	Face1 Back1	4	4/5	4	4/5	46	41	913	506	Rinse wash
Sample 2	Face4/5 Back4/5	Face 3 Back 3	4	4/5	4	4/5	25	22	785	493	Desizing, Stone Enzyme
Sample 3	Face 4 Back 4	Face 2 Back 2	4/5	4/5	4/5	4/5	52	48.20	821	568	Rinse Wash, Softener, Fixing

Table 4.4 shows the test report of 100% COTTON DENIM FABRIC after first wash. It shows the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. In this table the lower tear and tensile strength value is lower than other 2 sample because we apply stone enzyme in in this sample. In both sample 1 & 3 we can apply rinse wash but in 3 we can apply softener and fixing. For this the tear strength of sample 3 is higher than sample 1.

Table 4.5: Comparison after 2nd Wash

Sample	CF to rubbing		CF to perspiration		CF to Water		Tear strength		Tensile strength		Wash process
	Dry	Wet	Color staining	Change in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)	
Sample 1	Face 3 Back3/4	Face1 Back1	4	4/5	4	4/5	38	33	791	410	Enzyme, Scouring, softener

Sample 2	Face4/5 Back4/5	Face 3 Back 3	4	4/5	4	4/5	22	20	621	402	Desizing, Enzyme, Bleach
Sample 3	Face 4 Back 4	Face 2 Back 2	4/5	4/5	4/5	4/5	59.75	47.88	810	460	Enzyme, Dyeing, Fixing

Table 4.5 shows the test report of 100% COTTON DENIM FABRIC after second wash. It shows the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. In sample 1 the test report is decrease because we apply enzyme, scouring and softener process in this wash process. That's why the result is decrease than previous one. In sample 2 the result also decrease because we apply desize, enzyme, bleach in this wash process. In sample 3 the result is increase because in final process we apply fixing process in this sample.

Table 4.6: Comparison after 3rd Wash

Sample	CF to rubbing		CF to perspiration		CF to Water		Tear strength		Tensile strength		Wash Process
	Dry	Wet	Color staining	Change in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)	
Sample 1	Face 3 Back 3/4	Face 1 Back 1	4	4/5	4	4/5	22	20	485	251	Enzyme+ Towel potash+ Bleach+ Tint+ Softener
Sample 2	Face4/5 Back4/5	Face 3 Back 3	4	4/5	4	4/5	20	18	427	260	Desize+ Enzyme + Acid wash+ Bleach+PP+ Tint+ Softener
Sample 3	Face 4 Back 4	Face 2	4/5	4/5	4/5	4/5	34.10	30.4	612	315	Enzyme + Bleach+ Acid wash+

		Back 2									All over PP+ Tint+ Softener
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Table 4.6 shows the test report of 100% COTTON DENIM FABRIC after third wash. It shows the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. In all sample the tear and tensile strength value is decrease because we apply more wash process in that time. We apply bleach process in all 3 sample. This is the main reason to decrease the test result.

4.2 Comparison Between 95% BCI COTTON + 5% PCW COTTON DENIM FABRIC & 100% COTTON DENIM FABRIC

4.2.1 Comparison after First wash

Here is given below the difference between 95% BCI COTTON + 5% PCW COTTON DENIM FABRIC & 100% COTTON DENIM FABRIC after first wash.

Table 4.7: Comparison after 1st Wash

Test name		Test Report					
		95% BCI COTTON + 5% PCW COTTON DENIM FABRIC			100% COTTON DENIM FABRIC		
		Sample 1	Sample 3	Sample 4	Sample 1	Sample 2	Sample 3
CF to rubbing	Dry	Face 3 Back 3/4	Face 4 Back 4	Face 4/5 Back 4/5	Face 3 Back 3/4	Face 4/5 Back 4/5	Face 4 Back 4
	Wet	Face 1 Back 1	Face 1/2 Back 1/2	Face 1 Back 1	Face 1 Back 1	Face 3 Back 3	Face 2 Back 2
CF to perspiration	Stain	4	4/5	3/4	4	4	4/5
	Change	4/5	4/5	4	4/5	4/5	4/5
CF to water	Stain	4	4/5	3/4	4	4	4/5
	Change	4/5	4/5	4	4/5	4/5	4/5
Tear Strength(N)	Warp	36	26	43.05	46	25	52
	Weft	35.2	21	37.04	41	22	48.20
Tensile Strength(N)	Warp	790	760	993	913	785	821
	Weft	490	500	676	506	493	568

Table 4.7 show the difference test report after first wash between Fabric A & Fabric B where Fabric A (95% BCI COTTON + 5% PCW COTTON DENIM FABRIC) and Fabric B (100% COTTON DENIM FABRIC). In sample 1 for fabric A & B the tear and tensile strength value of fabric B is higher than fabric A. In fabric B we can apply rinse wash for sample 1 where in fabric A for sample 1 we can apply enzyme and scouring process. Another reason to change the tear and tensile strength value is different composition of fabric A and B. The tear and tensile value of fabric A sample 3 is very similar to fabric B sample 2. In fabric A sample 3 we can apply rinse wash and enzyme wash where in fabric B sample 2 we can apply disize and enzyme wash process. In fabric B sample 3 the tear strength value is higher than fabric A sample 4. In fabric B sample 3 we can apply rinse wash, softener and fixing where in fabric A sample 4 we can apply desize, enzyme, acid wash and PP process.

4.2.2 Comparison after 2nd wash

Here is given below the difference between 95% BCI COTTON + 5% PCW COTTON DENIM FABRIC & 100% COTTON DENIM FABRIC after second wash.

Table 4.8: Comparison after 2nd Wash

Test name		Test Report					
		95% BCI COTTON + 5% PCW COTTON DENIM FABRIC			100% COTTON DENIM FABRIC		
		Sample 1	Sample 3	Sample 4	Sample 1	Sample 2	Sample 3
CF to rubbing	Dry	Face 4 Back 4	Face 4 Back 4	Face 4/5 Back 4/5	Face 3 Back 3/4	Face 4/5 Back 4/5	Face 4 Back 4
	Wet	Face 1/2 Back 1/2	Face 1/2 Back 1/2	Face 2/3 Back 2/3	Face 1 Back 1	Face 3 Back 3	Face 2 Back 2
CF to perspiration	Stain	4	4/5	4/5	4	4	4/5
	Change	4/5	4/5	4/5	4/5	4/5	4/5
CF to water	Stain	4	4/5	4/5	4	4	4/5
	Change	4/5	4/5	4/5	4/5	4/5	4/5
Tear Strength(N)	Warp	20.65	22	25	38	22	59.75
	Weft	22.85	20	29.83	33	20	47.88
Tensile Strength(N)	Warp	651	650	790	791	621	810
	Weft	456	431	490	410	402	460

Table 4.8 show the difference test report after second wash between Fabric A & Fabric B where Fabric A (95% BCI COTTON + 5% PCW COTTON DENIM FABRIC) and Fabric B (100%

COTTON DENIM FABRIC). In sample 1 for fabric A & B the tear and tensile strength value of fabric B is higher than fabric A. In fabric B for sample 1 we can apply enzyme wash, scouring and softener process where in fabric A for sample 1 we can apply disize, enzyme wash, towel bleach and bleach process. The tensile strength value in warp of fabric B sample 1 is higher than fabric A sample 1 but the tensile strength value in weft of fabric B sample 1 is lower than fabric A sample 1. The tear strength value of fabric A sample 3 and fabric B sample 2 are same. We can apply different types of wash in this 2 sample but the composition are different so we can find the same result. But the tensile strength value of fabric A sample 3 is higher than fabric B sample 2. After second wash the tear strength value of fabric B sample 3 is growing up because we apply enzyme, dyeing, fixing process and fixing process is help to growing up the test result. In fabric A sample 4 the tear strength is decrease because we apply desize, enzyme, bleach and all over PP which cause to decrease the fabric strength.

4.2.3 Comparison after 3rd wash

Here is given below the difference between 95% BCI COTTON + 5% PCW COTTON DENIM FABRIC & 100% COTTON DENIM FABRIC after third wash.

Table 4.9: Comparison after 3rd Wash

Test name		Test Report					
		95% BCI COTTON + 5% PCW COTTON DENIM FABRIC			100% COTTON DENIM FABRIC		
		Sample 1	Sample 3	Sample 4	Sample 1	Sample 2	Sample 3
CF to rubbing	Dry	Face 4 Back 4	Face 4 Back 4	Face 4/5 Back 4/5	Face 3 Back 3/4	Face 4/5 Back 4/5	Face 4 Back 4
	Wet	Face 1/2 Back 1/2	Face 1/2 Back 1/2	Face 1 Back 1	Face 1 Back 1	Face 3 Back 3	Face 2 Back 2
CF to perspiration	Stain	4/5	4/5	3/4	4	4	4/5
	Change	4/5	4/5	4	4/5	4/5	4/5
CF to water	Stain	4	4/5	3/4	4	4	4/5
	Change	4/5	4/5	4	4/5	4/5	4/5
Tear Strength(N)	Warp	26.27	14.12	19.81	22	20	34.10
	Weft	21.88	17.02	16	20	18	30.4
Tensile Strength(N)	Warp	427	472	621	485	427	612
	Weft	262	291	412	251	260	315

Table 4.9 shows the difference test report after third wash between Fabric A & Fabric B where Fabric A (95% BCI COTTON + 5% PCW COTTON DENIM FABRIC) and Fabric B (100% COTTON DENIM FABRIC). In sample 1 for fabric A & B the tear and tensile strength value of fabric A is higher than fabric B. In fabric A sample 3 tear strength is lower than fabric B sample 2. Because we can apply more wash process in sample A. The tear strength of fabric B sample 3 is higher than fabric A sample 4. We can apply more wash process in sample A that's why the result of tear strength is lower than sample B.

4.3 Comparison between different types of fabric

Here we can apply same wash in different composition of fabric. We can apply desize, enzyme and bleach process in all 3 sample.

Sample 1: Denim fabric 20% post-consumer Recycle cotton 80%

Sample 2: 95% BCI Cotton+ 5% PCW Cotton Denim fabric

Sample 3: 5% Recycled post-consumer cotton, 95% Better cotton

Here is given below the test report after wash.

Table 4.10: Comparison after Wash

Sample	CF to rubbing		CF to perspiration		CF to Water		Tear strength		Tensile strength	
	Dry	Wet	Color staining	Change in color	Color staining	Change in color	Warp (N)	Weft (N)	Warp (N)	Weft (N)
Sample 1	Face4/5 Back4/5	Face2/3 Back2/3	4	4	4	4/5	40.97	35.85	910	451
Sample 2	Face4/5 Back4/5	Face1/2 Back1/2	4/5	4/5	4	4/5	17.5	20.5	670	435
Sample 3	Face4/5	Face 3 Back 3	4/5	4/5	4/5	4/5	30.19	29.26	700	450

	Back4/ 5									
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Table 4.10 shows the test report after wash. It shows the report of color fastness to rubbing, color fastness to perspiration, color fastness to water, tear strength, tensile strength. In the test report the color fastness result are very similar but the main different is tear strength and tensile strength. The tear and tensile strength of sample 1 is higher than sample 2 and 3. The tear and tensile value of sample 3 is higher than sample 2. But they all are pass the buyer requirement.

CHAPTER 5

CONCLUSION

The project has come to a termination finally after lots of thinking, discussion and our continuous trying. We wished to make it as a replica of changes on garments washing. So that it provides a complete knowledge about investigation on changes on garments washing between before and after wash. The paper is concluded as-

- The Tear & Tensile strength is high when we apply normal wash or rinse wash.
- The Tear & Tensile strength is also high when the fabric weight is high.
- Tint washing has no significant effect on the tearing strength.
- Scouring & Bleaching reduces the tearing strength of fabric.
- Finishing of fabric with a softener increases its tearing strength.

In our internship period we tried our best to collecting the original data for completing the report. Due to some limitations we didn't get the all information but we think further research will come in this topic.

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