

Research

Washing Effects Investigation on Physical Properties of Denim Fabric

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Abstract: *Garments washing is a significant part of garments industry and it's mainly applied on denim garments. It is provided with a lucrative and classy outlook by chemical or wet washing process and mechanical or dry washing process. The most widely used dry washing process for garments are scraping, sparing, whickering, damage, rubbing to develop a new look and effect. This paper deals with three types of washing (Enzyme, Acid, Bleach) effects on denim fabric .Typical industrial washing procedures and techniques were followed and then physic-mechanical properties were analyzed under standard condition .This study will give an indication of the effect of different washing method by changing physical and chemical properties also imparting desired effect on garments.*

Keywords: *Bleach Wash, Enzyme Wash, Acid Wash, Imparting Agent*

1. Introduction

Washing is a technology which is used to modify the appearance, size outlook, comfort ability and fashion of the garments. To execute the buyer requirement washing is important process of garments product. The wet washing process of garment to create better look by normal wash or rinse wash, pigment wash, caustic wash, silicon wash, Enzyme wash, acid and bleach wash. They all are aimed at new possible effects of fabric appearance. Enzymes are important in regulating the chemical reactions that occur within all living organisms. Without enzymes, many of these reactions would not be able to take place at a perceptible rate. Fabric softener (also called fabric conditioner) is a chemical compound that prevents static cling and confers many other desirable properties to laundry that has been machine-washed.

This paper investigates the impact of enzymes; acid and bleach wash on the physical and mechanical properties of the denim fabric.

2. Literature review

2.1 Enzymes washing

Enzymes are protein produced by living organisms. It is very popular washing method. After the stone wash, to reduce the adverse effect enzyme wash is done. Enzyme hydrolysis the cellulose, during the wash it attacks the projecting fiber and hydrolyzed them for making fabric smooth.

2.2 Acid wash

Pumice stones are first pre-soaked in a solution of a strong oxidizing agent or potassium permanganate and are then applied to the garments by means of dry tumbling. This results in a localized washing effect with clear blue. This technique is also termed 'acid washing' or ice washing.

2.3 Bleach wash

Bleach wash or light stone wash refers to light blue shade of denim. It means lightening the color of the indigo dyed garments and apparels are normally dyed with direct or reactive dye. It is also a separate process, which can be applied instead of stone washing or together of stone washing. To avoid yellowing problems this process must be followed by the neutralizing the garments. This bleaching is usually carried out by strong oxidizing agent in industry most widely used chemicals are sodium hypo-chlorite, calcium hypo-chlorite and hydrogen per oxide.

3. Materials and Methods

3.1 Materials

Denim Fabric (50x50)cm.

Chemicals

Enzymes, Acid, Bleach, Sodium meta-bi-sulphate, Softener and Anti-back-stanning.

Washing Machine

AZIZ Metal Engineering Works Ltd, M/C capacity-60 kg, Max speed-50 k.m, temp 100⁰C, Heating source- Steam.

3.2 Methods

3.2.1 Enzyme Wash

At first denim sample is taken to the washing machine. Here material and liquor ratio is 1:5. Approximately 550mL amylase powder enzymes (RUCOLASE ZSS), 100mL Anti-back

staining is used. This process carried out for 15 minutes at a temperature of 40⁰C. Then rinse the samples for 2 minutes. Finally hydro extract dryer is used to dry the fabric samples.

3.2.2 Bleach Wash

At first denim fabrics samples are taken to the washing machine. Here material and liquor ratio is 1:5. Approximately bleach 450mL, Sodium Meta bisulphate 200mL for 4 minutes at the temp 50⁰C. Finally hydro extract dryer is used to dry the fabric samples.

3.2.3 Acid Wash

At first denim fabrics samples are taken to the washing machine. Here material and liquor ratio is 1:5. Approximately Potassium permanganate 500mL, Phosphoric acid 150mL is used during the process. Then 100mL anti back staining and Sodium meta bisulphate 200mL used to neutral Potassium permanganate. This process carried out for 10 minutes at a temperature of 60⁰C. Finally hydro extract dryer is used to dry the fabric samples.

4. Results and Discussion

4.1 Effects of Fabric Weight after Washing on Denim fabric

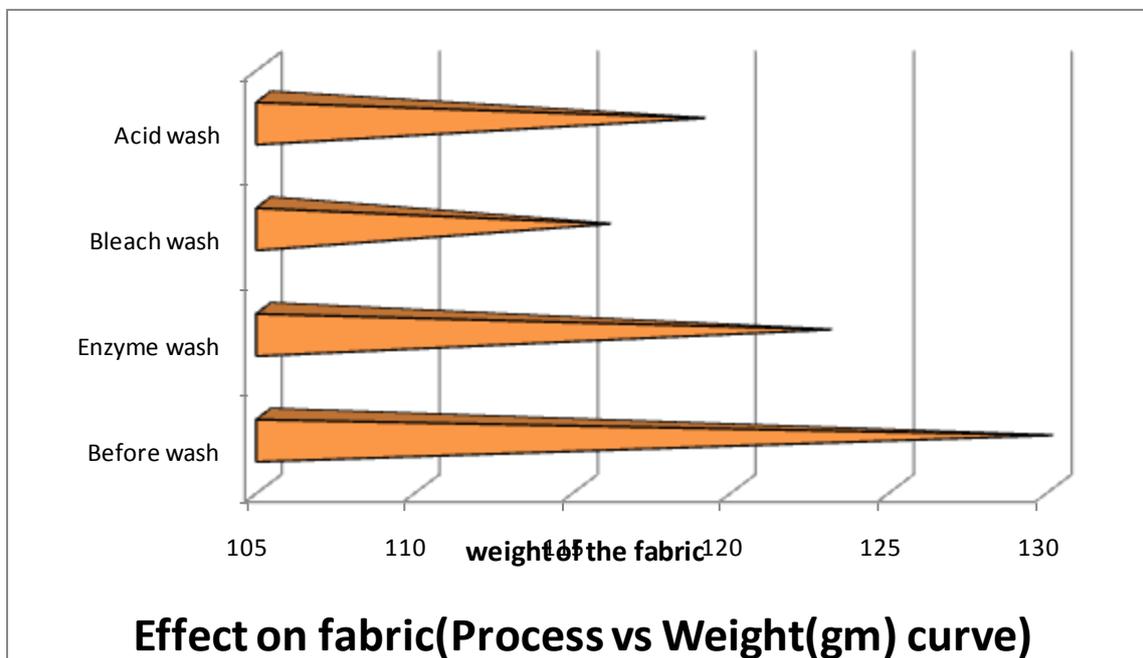


Fig. 4.1: Process vs Weight

Here horizontal axis denote the weight of the fabrics & vertical axis denote the washing process of denim fabrics. We got 130 gm weight for normal wash. After reducing the weight we got the lowest weight for bleach wash which was 116 gm.

The less reduce of weight for enzyme wash & the weight was 123 gm. So enzyme wash is more suitable in denim washing.

Determination of Fabric Weight

We cut three pieces of the fabric with the GSM cutter (gram per square inch) and Weight the fabric with the electric balance. Then multiplied by 100 and took the average results.

4.2 Determination of picks per Inch (PPI)

PPI of the fabric is calculated by counting the number of the yarn (Picks) contents in 1 inch of the fabric. For this the fabric is marked by 1 inch in rectangular area. Then the yarn is open out and count the number picks contains in 1 inch.

Effects on PPI after Washing of Different Denim Garments

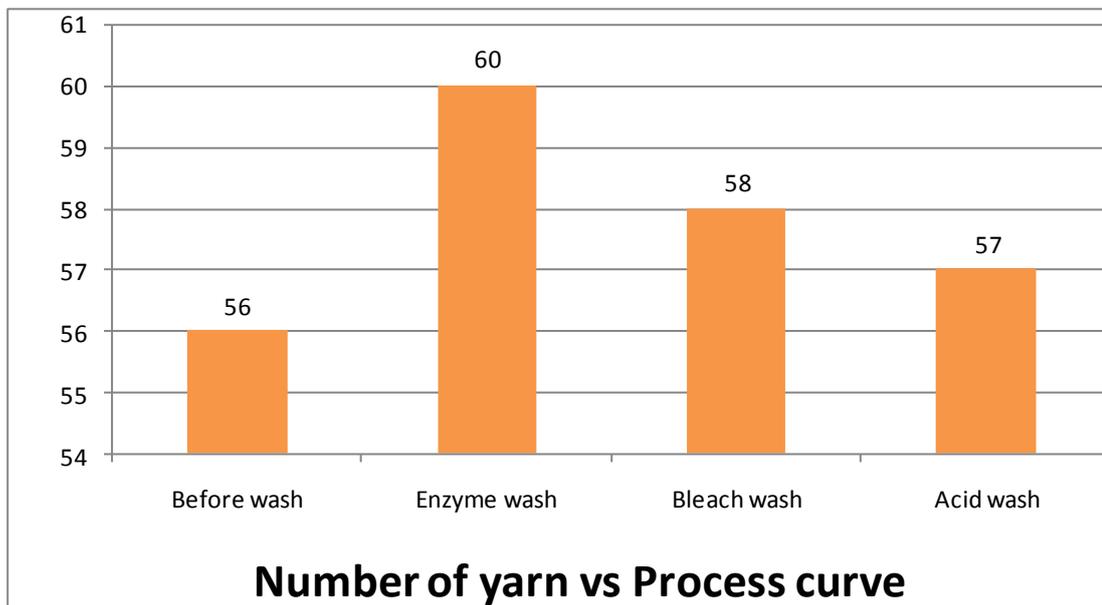


Fig. 4.2: Number of Yarn(Picks) vs Process Curve

Here vertical axis denote the PPI of the fabrics & horizontal axis denote the washing process of denim fabrics. We got 56 PPI for normal wash. After washing we got the lowest PPI for bleach wash which was 58.

The less reduce of PPI for enzyme wash & the PPI was 60. So enzyme wash is more suitable in denim washing.

4.3 Determination of Ends per Inch (EPI)

EPI of the fabric is calculated by counting the number of the yarn (Ends) contents in 1 inch of the fabric. For this the fabric is marked by 1 inch in rectangular area. Then the yarn is open out and count the number Ends contains in 1 inch.

Effects on EPI after Washing of Different Denim Garments

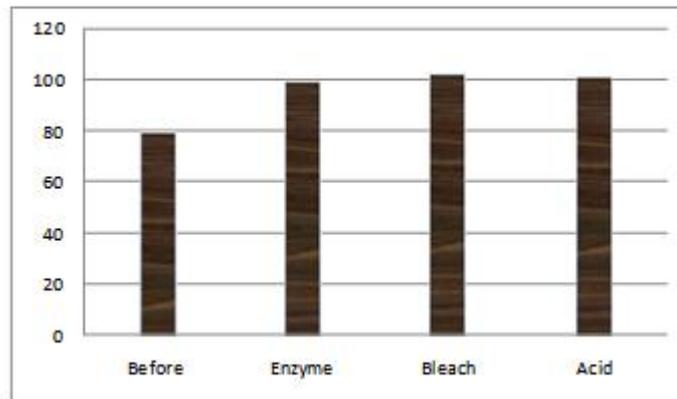


Fig. 4.3: Number of Yarn (Ends) vs Process Curve

Here vertical axis denote the EPI of the fabrics & horizontal axis denote the washing process of denim fabrics. We got 80 EPI for normal wash. After washing we got the lowest EPI for Enzyme wash which was 100. The less reduce of EPI for Bleach wash & the EPI was 104. So enzyme wash is more suitable in denim washing.

4.4 Determination of Shrinkage

According to ASTM D 2259 shrinkage of these sample garments were tested. At first we Cut 3 specimens, each $50 \times 50 \text{ cm}^2$. We marked the fabric $35 \text{ cm} \times 35 \text{ cm}$, inside $50 \text{ cm} \times 50 \text{ cm}$ are of fabric. Then the fabric samples are boiled for 10 - 15 minutes with distilled water. Boiling tumble dryer is used to dry that fabric. Finally, length and width of the fabric sample is measured .Shrinkage% = (before wash – after wash)/before wash

Effects of Shrinkages after Washing on Denim fabric in lengthwise

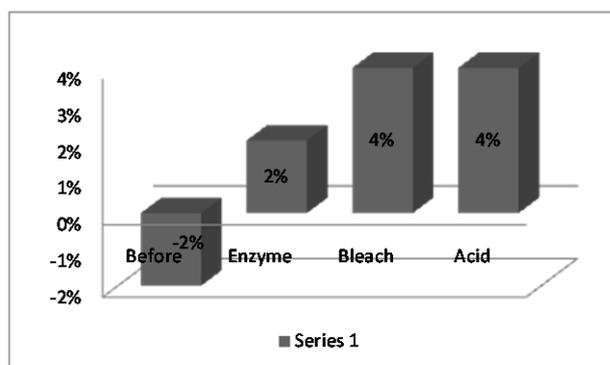


Fig. 4.4: Shrinkage Percentage (lengthwise) Effect after and before Wash

Here vertical axis denote the shrinkage % of the fabrics & horizontal axis denote the washing process of denim fabrics. We got -2% for normal wash. After washing we got the highest 4% shrinkage for Acid and Bleach wash. The less shrinkage % for enzyme wash & it was 2%. So enzyme wash is more suitable in denim washing.

4.5 Effects of Shrinkages after Washing on Denim fabric in widthwise

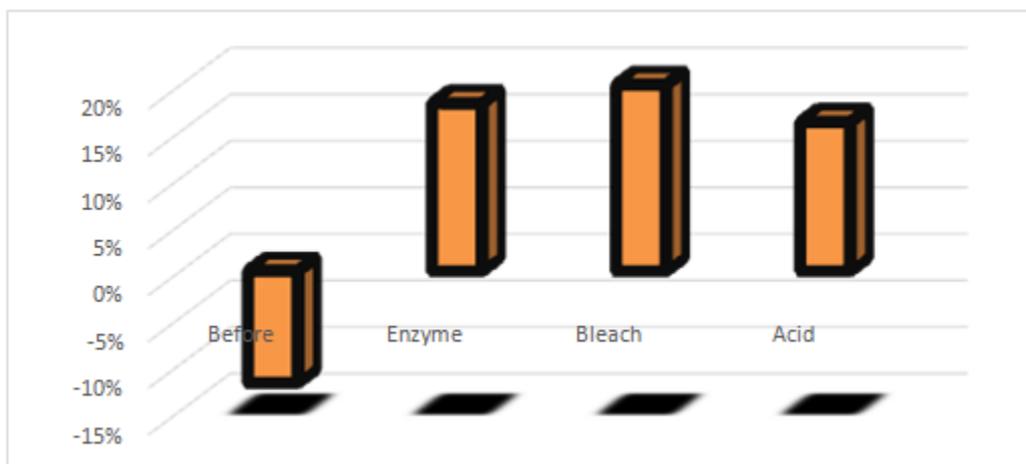


Fig. 4.5: Shrinkage Percentage (widthwise) after and before Wash

Here vertical axis denote the shrinkage % of the fabrics & horizontal axis denote the washing process of denim fabrics. We got -10% for normal wash. After washing we got the highest 18% shrinkage for Bleach wash. The less shrinkage % for Acid wash & it was 14%. So Acid wash is more suitable in denim washing.

Overall Enzyme Wash Is More Suitable In Denim Washing Than Other Washing.

4.6 Determination of Rub Property

1) Dry rubbing test

A test sample is clamped to the instrument base and a square of standard crocking cloth is fixed to a 16 mm diameter, acrylic rubbing finger. The finger rests on the sample with a pressure of 900 grams force and traverses a straight path approximately 100 mm long with each stroke of the arm. After testing textile materials, the crocking cloth is removed and compared against the AATCC Gray Scale for Staining or Chromatic Transference Scale. Based on this comparison, we assign a grade to the color change or amount of color transfer.

2) Wet rubbing test

Repeat the procedure from dry rubbing test on another sample with the white cotton test cloth wetted it in distilled water. Ensure that the rubbing test cloth will be wetted with water to 100% take up. Compare the contrast between the untreated and treated white rubbing cloth

with the staining. Grey scale rates from 1-5 and changing in the tested specimen with changing grey scale. This visual assessment is done in a color matching cabinet under standard lighting D-65.

Table 1: Effects on Rub Property after Washing on Denim fabric

Washing process	Dry	Wet
Before wash	1/3	1
Enzyme wash	3/4	2/3
Bleach wash	3/4	2/3
Acid wash	3/4	2

Finally, we investigated that, ENZYME WASHING is more suitable than Acid and Bleach wash.

5. Conclusion

The scope of garments washing like dry and wet process is very broad in textile industry. Under this investigation it is clear that after washing garments gathered some properties like appearance, softness, comfort because unwashed garments are hard and stiff. Now a day every garments industry tries their level best to create a quality full product but that company will survive who can produce best product at a competitive price. To achieve the more researches and developments on garments washing are mandatory. I hope this article will help to do more researches to develop multi qualitative products.

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