



The Effect of Acid Wash with Stone/Towel/Sponge Ball on Cotton/Polyester/Spandex Blended Stretch Denim Fabric

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Abstract

The aim of this work is to investigate the effect of the use of stone/towel/sponge balls during the acid wash of cotton/polyester/spandex raw denim fabric samples. It was found that the changes in GSM, Tensile and tearing strength were insignificant. The color fastness to wash and the dry rubbing fastness were good but the wet rubbing fastness was poor due to acid wash with different equipment such as stone, towel or sponge balls in grey scale rating.

Keywords: Acid wash, Stone, Towel pieces, Sponge balls.

I. Introduction

Finishing treatments are fundamental requirements to make the garments' softer, suppler and smooth which enhances wearer's comfort. Denim washing is one of the most widely used finishing treatments due to its effects on appearance and comfort. After weaving, dyeing and printing garments are uncomfortable to wear, without washing it is difficult to wear and feel comfort. (Liet *al.* 2008), (Yanget *al.* 2010). It is being investigated by many researchers' on the effect of various wet and dry washing on physical, mechanical and colour fastness properties of cotton and spandex consist of stretch denim fabric (El-Dessouki, 2015), (Hafeezullah *et al.*, 2014), (Solaiman, 2015), (Hasan *et al.* 2017), (Sarker *et al.*, 2016), (Hossain *et al.*, 2017), (Ahmedullah, 2012).

In acid wash, the color of the top layer of the denim fabric is faded by an acid and turned into white surface; on the other hand the color stayed in the lower layers of the fabric, giving it a faded look in face side. Pre-soaking of stones, sponge balls or towel pieces in bleach and neutralization are being carried out. The denim garments are normally tumbled with pumice stones/ towel pieces/sponge balls in a solution which contains potassium permanganate followed by neutralization.

However, the analysis of the use of stones, towel pieces or sponge balls during acid wash of cotton/polyester/spandex consisted raw denim fabric and to find out the differences are the remaining research gap. This work is to reveal the effect of stones/towel pieces/sponge balls in acid wash of the Cotton, polyester and spandex consisted denim fabric to evaluate the changes in GSM, tensile and tearing strength, color fastness to wash and rubbing of the fabric.

II. Materials and Methods

82.5% cotton, 14.5% polyester, 3% elastane blended 3/1 twill denim raw woven fabric was selected for this work. First of all the samples were desized and enzyme washed with chemicals in the washing machine in order to take away the size materials and to increase the absorbency of the fabric. The fabric samples were bleached after desizing and enzyme wash and dipped in the solution of Potassium per manganate (KMnO₄) and phosphoric acid with stones/towel pieces/sponge balls separately. The samples were washed properly followed by neutralization and drying. The figure 1 shows the stones, towel pieces and sponge balls those are normally used during acid wash of the denim garments.

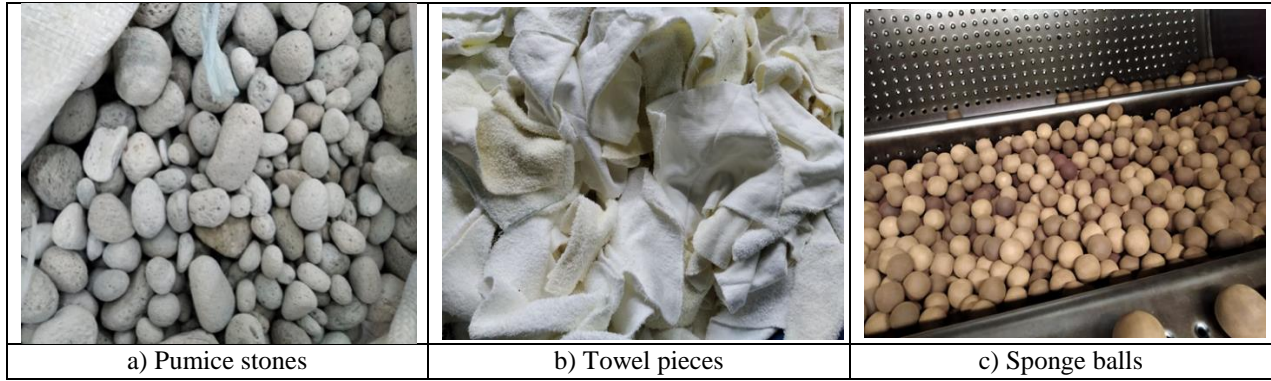


Figure 1: The equipment which are used in acid wash bath of denim fabric



Figure 2: The changes of raw denim fabric samples after wash

A. GSM, Tensile and Tearing Strength

Tensile strength test method was Fabric grab EN ISO 13934-2 and tearing test method was tear EN ISO 13937-2.

B. Color fastness to wash and rubbing

Color fastness to wash test Method was ISO 105-CO6 and color fastness to rubbing test method was ISO 105-X12.

II. Results and Discussions

From the figure 2, it is observed the fade effect of denim fabric samples acid wash with different equipment such as stone, towel and sponge ball create the fade effect on the denim fabric.

A. GSM, Tensile and Tearing Strength

The bar diagram in the figure 3 represents the changes of GSM of the raw denim fabric samples due to acid wash with different equipment such as stone, towel pieces and sponge balls. The GSM of the acid washed fabric samples were increased as compared to raw fabric sample. The GSM of raw denim fabric sample was 306 and the GSM of the

stone washed, towel washed, sponge ball washed fabric samples were 321, 320 and 319 respectively, which indicates that the changes of GSM of the washed fabric samples were almost similar. As the fabric samples were made of Cotton, Polyester and Spandex fiber, due to wash effect the samples were more shrunk and reduced the end and pick spacing, conversely increased the density of warp and weft in the washed fabric samples.

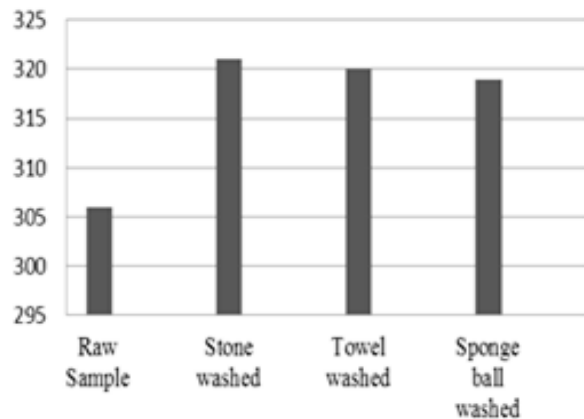


Figure 3: GSM changes due to acid washes with stone, towel and sponge balls

It was found in the figure 4 that the warp way breaking forces were greater than the weft way and the washed samples were weaker than the original raw sample. The tensile strengths were decreased gradually after acid wash with stone, towel and sponge ball sample in warp and weft direction. The breaking force of the raw denim was 743.9N along warp direction. The breaking force after acid wash with stone 631.3N, towel 638.4N, sponge ball 608.6N.

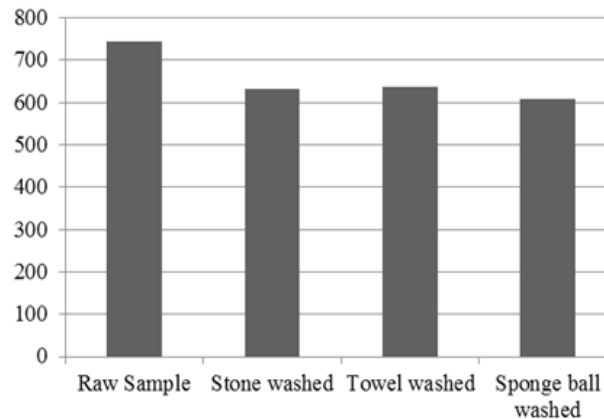


Figure 4: The changes of Tensile strength in Newton (N) warp way of the fabric samples due to acid wash with stone, towel and sponge ball as compared to raw fabric sample.

The figure 5 shows the breaking force along the weft direction of the fabric samples. It was found that the values were 347.9N, 267.71N, 308.9N, 309.8N after acid wash with stone, towel, and sponge ball washed fabric samples respectively. It indicates the strength was declined with the acid wash effect in different equipment.

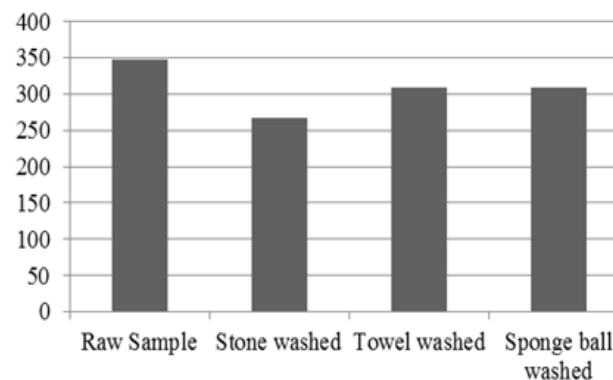


Figure 5: The changes of Tensile strength in Newton (N) weft way of the fabric samples due to acid wash with stone, towel and sponge ball as compared to raw fabric sample.

According to figure 6, it was also found that tearing forces value in warp direction of raw denim was greater than washed fabric samples. The warp wise tearing forces of the raw, stone washed, towel washed and sponge ball washed were 45.027N, 38.382N, 37.644N and 32.328N respectively. It indicates the strength was declined with the acid wash effect in different equipment.

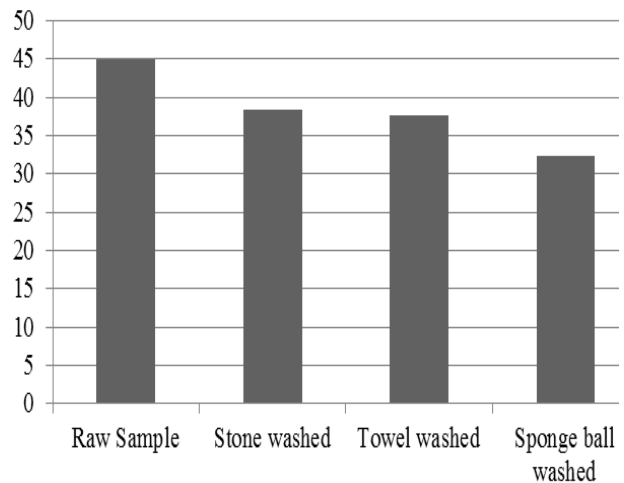


Figure 6: The changes of tearing strength in Newton (N) warp way of the fabric samples due to acid wash with stone, towel and sponge ball as compared to raw fabric sample.

B. Color fastness to wash and rubbing

Table 1 shows the wash and rubbing fastness of denim raw and acid washed fabric samples. The grey scale rating of staining on cell-acetate, bleached cotton, nylon, polyester, acrylic and wool was 4-5 for raw and acid washed with stone, towel, and sponge ball denim fabric samples. It indicated that the changed due to acid wash with different equipment are unremarkable.

The grey scale ratings of dry and wet rubbing of raw denim fabric sample were 3 and 1-2 respectively. After acid wash with stone the dry rubbing result was 4-5, and the wet rubbing result was 2. The dry rubbing result after towel wash was 4-5 and wet rubbing result was 2-3. After acid wash with sponge ball the dry rubbing result was 4-5 and wet rubbing result was 2.

Table1: The grey scale rating of color fastness to wash and rubbing test.

Tests	Fiber	Raw	Stone	Towel	Sponge balls	Grey scale rating
Color fastness to wash	Cell-acetate	4-5	4-5	4-5	4-5	5=excellent 4=good 3=average 2=poor 1=very poor
	Cotton	4-5	4-5	4-5	4-5	
	Nylon	4-5	4-5	4-5	4-5	
	Polyester	4-5	4-5	4-5	4-5	
	Acrylic	4-5	4-5	4-5	4-5	
Wool	4-5	4-5	4-5	4-5		
Color fastness to rubbing	Dry	3	4-5	4-5	4-5	
	Wet	1-2	2	2-3	2	

Conclusion

The unique point of this work is to find out the effects of acid wash with stone, towel and sponge ball on the cotton/polyester blended stretch denim raw fabric samples. A few properties of cotton/polyester/spandex blended fabrics were evaluated after acid wash with different equipment. The GSM of the washed fabric samples were increased, tensile strength was decreased, tearing strength was also decreased, colour fastness to wash and rubbing were almost similar for acid washed fabric samples with stone, towel and sponge ball. On the whole, it can be said that the differences of the acid wash effect with stone, towel and sponge balls on the Cotton, Polyester and Spandex consisted denim fabric samples are insignificant.

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