

Impact of bleaching actions of bleaching powder and hydrogen peroxide on biopolished denim garments

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This study shows the impact of bio polishing and bleach wash of two different bleaching agent one is bleaching powder and another is hydrogen peroxide on 100 % cotton denim dyed with indigo dye. Garments were washed with enzyme to remove hairiness. biopolished. Then garments were subjected to a bleach concentration with bleaching powder of 2.5 g/L for 3 and 5 minutes at 50 °C temperature and other were bleached with hydrogen peroxide of 2.5 g/L for 5 and 10 minutes. The physical and colour fastness properties were analyzed in before and after washing. The properties that were analyzed include tensile strength, seam strength, fabric weight, and colour fastness to water, acid, alkali, washing and rubbing. Bleach washed garments by two different bleaching agent exhibit a great influence on the physical and colour fastness properties than the unwashed garments.

Keyword: bleach wash, bio-polishing, denim, garment, bleaching powder, hydrogen peroxide

1. Introduction

Garments washing is a very popular process for modifying the appearance and providing the old look. Colour and outlook of the garments are modified by garments washing after making garments from solid colour from dyed or pigment printed fabrics [1]. Many researchers have been investigated the effect of enzyme and bleach washing on Denim [2-6]. A soft handle and attractive look is often the critical criterion for buying a textile. As a result, in various research works, influence of softeners on the change of handle is analyzed during washing [7-9]. The interest in the use of eco-

friendly, non-hazardous, fully decomposable enzymes in the modern textile finishing process has been increasing day by day. Enzymatic treatment improve the comfort and quality of fabrics which is used to replace a number of mechanical and chemical operations [10]. In the textile, industry enzymes are smeared mainly to remove hairiness or get a cleaner fabric surface with less fuzz, to reduce tendency to pill formation, to improve handle, to smooth the surface combining with traditional softeners. There are many studies of this area which have been focused on smearing enzymes on cellulose mate-

rials based on cotton, linen, viscose and their blends with synthetics fibers [11-15]. The major objective of this study is to inspect the effect of enzyme bio polishing and bleach wash with two different bleaching agent one is bleaching powder another is hydrogen peroxide on physical and colour fastness properties of 100% cotton indigo dyed denim pant.

2. Material and methods

2.1. Materials

100 % cotton (362 g/m²), indigo dyed denim fabric was used for this experiment.

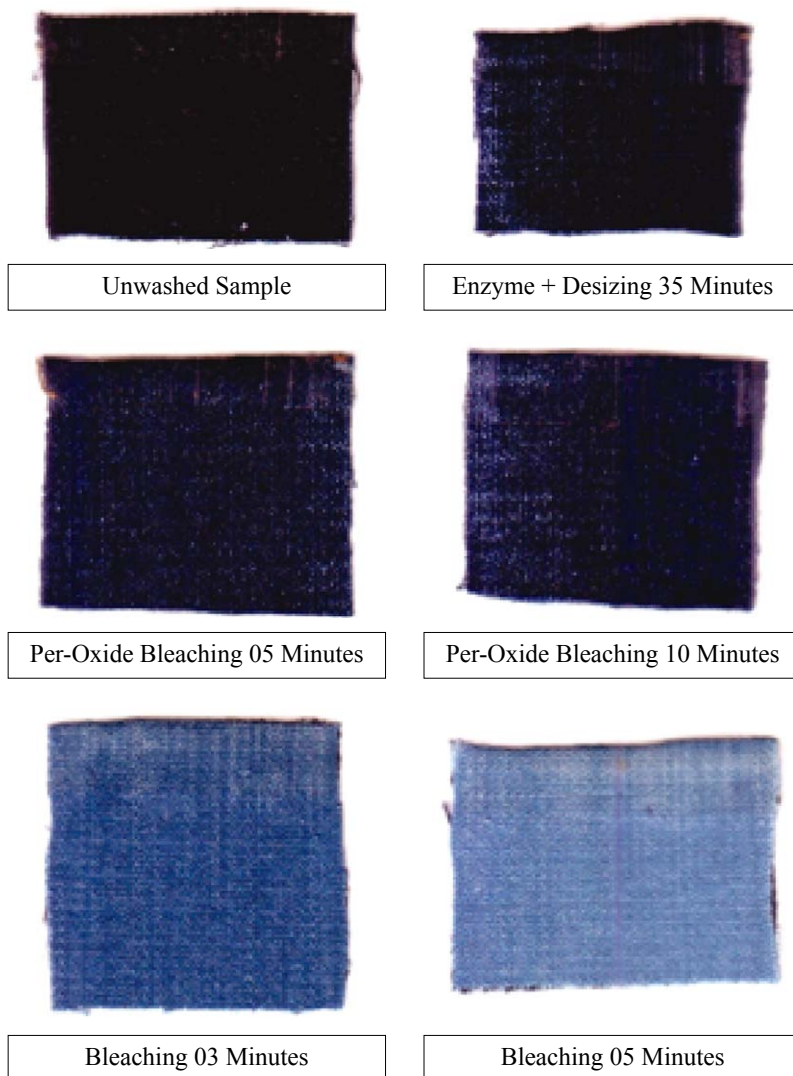


Fig.1 Views of investigated different treated samples of denim fabric

A bleaching powder (CaOCl_2) and hydrogen peroxide (H_2O_2) was used for washing denim garments. In addition, soda ash (Na_2CO_3), stabilizer, enzyme (Ecozyme 4300L), detergent, desizing agent (desizer ox); anti-backstaining (Antistain-LP30), acetic acid, softener were used for the experiment. All the chemicals are collected from the inventory of Dulal Brothers Limited (DBL).

2.2. Methodology

Desizing

The desizing was done with the liquor containing 0.6 g/L detergent, 1.5 g/L desizing agent (desizer-ox), 0.5 g/L anti-back staining agent with the liquor ratio of 1:10 at temperature 60 °C for 20 min. as pretreatment for

removing the size materials of warp yarns that was applied in fabric manufacturing for reducing yarn breakage. Then the garments were washed with hot water at 75 °C followed by cold-water (25 °C) wash.

Biopolishing

Biopolishing was conducted with the liquor containing 1.5 g/L enzyme (acidic activity), 0.5 g/L acetic acid and 0.5 g/L anti-black staining agent with liquor ratio 1:10 at temperature 45 °C for 35 minutes. Temperature was raised to 90 °C for 1 minute to deactivate the action of enzyme.

Bleaching and neutralizing

Few desized and bio polished denim trousers were treated by BP with the

concentration of 2.5 g/L and 1.25 g/L soda ash for 3 minutes and 5 minutes separately at 50 °C. Then 1.5 g/L sodium meta bisulphite was used at 40 °C for 10 minutes for neutralization. Others desized and bio polished samples were treated by HP with same concentration of 2.5 g/L and 1.25 g/L stabilizer at 50 °C for 5 and 10 minutes separately. Then neutralization was done as before.

Softening

Bleached sample were treated with 1 g/L softener at 40 °C for 10 minutes.

Hydro extracting and drying

The treated denim trousers were squeezed in a laboratory scale hydro-extractor machine to remove excess water from the garments at 200 rpm for 5 min. Then dried in a steam drier at 75 °C for 30 min. Then the physical and colour fastness properties of the treated samples were evaluated in testing machines to assess product performance.

2.3. Testing methods

The treated denim samples were conditioned at 65% RH and at 20 °C for 24 h before testing according to ASTM D1776. Tensile strength was determined according to ASTM D 5034 and seam strength was determined according to ASTM D 1683. Weight loss in fabric was calculated from the difference in fabric weight (GSM) before and after the treatment according to ASTM D 3776. Colour fastness to wash, water, acid, alkali and rubbing were measured by following the method ISO-105-C06, ISO-105-E01, ISO-105-E05, ISO-105-E06 and ISO-105-X12 respectively.

3. Results and discussion

3.1. Visual appearance

From view of samples (Fig.1) it has been seen that bleaching with bleaching powder has more faded effect within very few minutes treatment but bleaching with hydrogen perox-

ide has very slight effect on fading and takes more time.

3.2. Effect of bleach wash on tensile strength

The tensile strength in warp direction has been decreased expressively (Fig.2). Following is the graphical representation of tensile strength loss warp direction of denim pant after desizing and bleaching. The highest decrement occurred after the bleaching treatment with bleaching powder for 5 minutes.

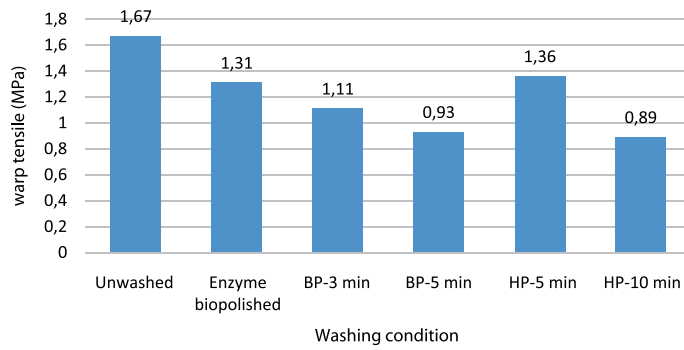
Following is the graphical representation of tensile strength loss warp direction of denim pant after desizing, enzyme biopolishing and bleaching (Fig.3). The tensile strength in warp direction has been decreased also. The highest decrement occurred after the bleaching treatment with bleaching hydrogen peroxide for 5 minutes.

3.3. Effect of bleach wash on seam strength

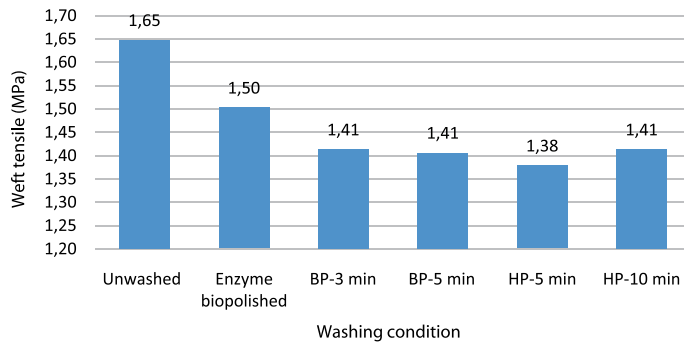
From Fig.4 it is clear that, processing in all the stages of bleach wash has influence in the decrement of the seam strength. The reduction in the seam strength has also been assisted by the friction between the machine cylinder and the sample leg panels. The highest reduction found was 57% after 5 minutes bleach with bleaching powder where hydrogen peroxide bleaching showed 37% seam strength loss.

3.4. Effect of bleach wash on fabric weight

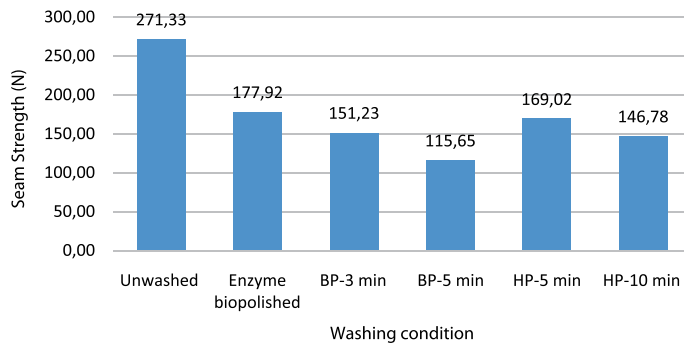
From Fig.5 can be clearly seen that after desizing and bleaching imparts a significant change in the fabric properties. Following is the graphical representation of weight loss of denim pant after desizing, enzyme biopolishing and bleaching. It has been found that, during these specific processing, the value of fabric GSM has been decreased. Bleaching with bleaching powder decreases the fabric GSM more than hydrogen peroxide bleaching. 3.5 % reduction of



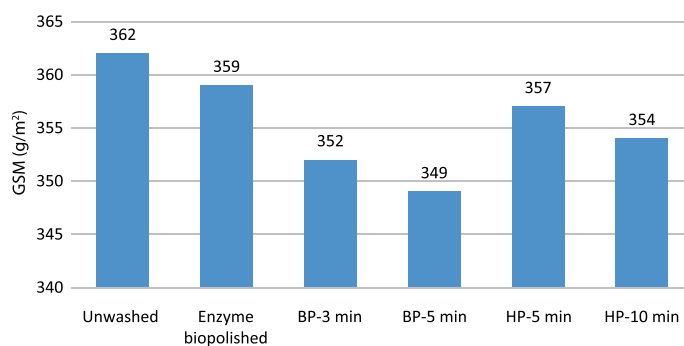
BP = Bleaching powder, HP = Hydrogen peroxide
Fig.2 Tensile strength of the samples (warp direction)



BP = Bleaching powder, HP = Hydrogen peroxide
Fig.3 Tensile strength (weft direction)



BP = Bleaching powder, HP = Hydrogen peroxide
Fig.4 Seam strength



BP = Bleaching powder, HP = Hydrogen peroxide
Fig.5 Fabric weight loss – GSM (g/m²)

Tab.1 Colour fastness to wash of the samples

Grading of the colour fastness to wash							
Samples	Colour change	Colour staining					
		CA	Cotton	PA	PES	PAN	Wool
Unwashed	4-5	4-5	4-5	4-5	4-5	4-5	4-5
Enzyme bio polished	4-5	4	4-5	4-5	4-5	3	4-5
BP-3 min	4-5	4	4-5	4-5	4-5	4-5	4-5
BP-5 min	4-5	4	4-5	4-5	4-5	4-5	4-5
HP-5 min	4-5	3-4	4	4	4-5	3	4
HP-10 min	4-5	3	4	4	4-5	3	4-5

Tab.2 Colour fastness to water of the samples

Grading of the colour fastness to water							
Sample	Colour change	Colour staining					
		CA	Cotton	PA	PES	PAN	Wool
Unwashed	4-5	4	4	4	4-5	4-5	4-5
Enzyme biopolished	4-5	4-5	4-5	4-5	4-5	4-5	4-5
BP-3 min	4-5	4-5	4-5	4-5	4-5	4-5	4-5
BP-5 min	4-5	4-5	4-5	4-5	4-5	4-5	4-5
HP-5 min	4-5	4-5	4-5	4-5	4-5	4-5	4-5
HP-10 min	4-5	4-5	4-5	4-5	4-5	4-5	4-5

Tab.3 Colour fastness to acid of the samples

Grading of the colour fastness to acid							
Sample	Colour change	Colour staining					
		CA	Cotton	PA	PES	PAN	Wool
Unwashed	4-5	4	4	4	4-5	4-5	4-5
Enzyme biopolished	4-5	4-5	4-5	4-5	4-5	4-5	4-5
BP-3 min	4-5	4-5	4-5	4-5	4-5	4-5	4-5
BP-5 min	4-5	4-5	4-5	4-5	4-5	4-5	4-5
HP-5 min	4-5	4-5	4-5	4-5	4-5	4-5	4-5
HP-10 min	4-5	4-5	4-5	4-5	4-5	4-5	4-5

Tab.4 Colour fastness to alkali of the samples

Grading of the colour fastness to alkali							
Sample	Colour change	Colour staining					
		CA	Cotton	PA	PES	PAN	Wool
Unwashed	4-5	4	4	4	4-5	4-5	4-5
Enzyme bio polished	4-5	4-5	4-5	4-5	4-5	4-5	4-5
BP-3 min	4-5	4-5	4-5	4-5	4-5	4-5	4-5
BP-5 min	4-5	4-5	4-5	4-5	4-5	4-5	4-5
HP-5 min	4-5	4-5	4-5	4-5	4-5	4-5	4-5
HP-10 min	4-5	4-5	4-5	4-5	4-5	4-5	4-5

GSM occurred after BP-5 minutes, which is 1.4 % after HP-5 minutes.

3.5. Effect of bleach wash on colour fastness

Colour fastness is a term that characterizes a material's colour's resistance to fading or running.

3.5.1 Effect of bleach wash on colour fastness to wash

Colour fastness to wash was measured by followed the method ISO-105-C06 and presented in Tab.1.

From the Tab.1, it is obvious that colour fastness to wash for all the treated sample grading as good (mean grade 4-5).

3.5.2. Effect of bleach wash on colour fastness to water

Colour fastness to water was measured by followed the method ISO-105-E01 and presented in Tab.2.

From the Tab.2, it is obvious that colour fastness to water for all the treated sample grading as good (mean grade 4-5).

3.5.3. Effect of bleach wash on colour fastness to acid

Colour fastness to acid was measured by followed the method ISO-105-E05 and presented in Tab.3.

From the Tab.3, it is obvious that colour fastness to acid for all the treated sample grading as good (mean grade 4-5).

3.5.4. Effect of bleach wash on colour fastness to alkali

Colour fastness to alkali was measured by followed the method ISO-105-E06 and presented in Tab.4.

From the Tab.4, it is obvious that colour fastness to alkali for the entire treated sample grading as good, also with mean grade 4-5.

3.5.5. Effect of bleach wash on colour fastness to rubbing

Colour fastness to rubbing (dry and wet rub) was measured by followed the method ISO-105-X12 and presented at Fig.6.

Above table show clearly that the rubbing fastness of the sample is not

good. Here wet rubbing fastness is poorer than dry rub. The lowest grading is 1.5 for wet rub of HP-5 min and unwashed sample rated as poor.

4. Conclusion

The bleaching treatment have a great influence on the mechanical and colour properties of denim fabric. The treated denim leg panels showed strength loss in both warp direction and weft direction. After bleach wash with bleaching powder for 5 minutes, this strength loss was more in both cases. The seam strength decreased in successive processing stages. The most significant decrement in the seam strength occurred after the bleach wash with bleaching powder for 5 minutes. The fabric weight reduced during the bio polishing and bleaching. A loss of 3.5% in the fabric GSM has been observed after the bleaching of BP-5 min and which is 1.4% after HP-5 min. The denims showed good colour fastness to wash, water, acid and alkali but very poor rubbing fastness. The bleaching treatment has a great influence on the colour change of the denims. It is clear that, the bleaching treatment has a lot influence on the mechanical and colour properties of the denim but the effect is more severe for bleaching powder bleaching but it takes very few times to fade colour, which is not possible with hydrogen peroxide bleaching.

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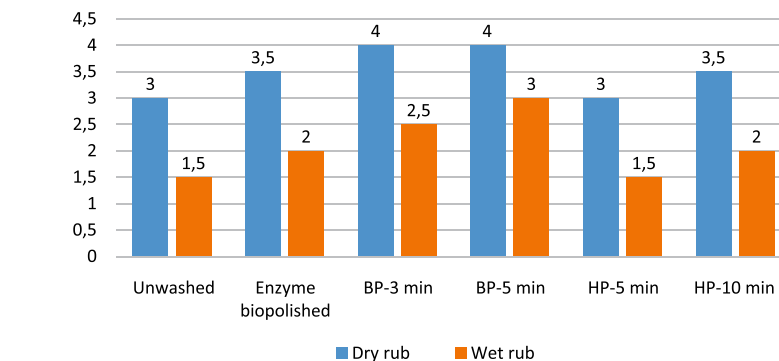


Fig.6 Colour fastness rating to dry and wet rub of the samples

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