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Research Article

Development of Permanganate-Free and Stone-Free Ecological Snow Washing Process for Denim Products

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Abstract

Denim products are still popular today, as they provide wearing comfort and a sense of specialness to those who wear them. The most important factor that makes it popular is the denim washing processes that give the final appearance to denim products. Permanganate and stone washing processes are two of the most frequently applied methods in washing processes. Although the chemical potassium permanganate provides a good bleaching effect, it is a harsh chemical that is harmful to human health and to the environment. In this study, it is aimed to eliminate the stone and permanganate used in denim washing process by imparting the snow washing process, which is also available in our company, and to eliminate the environmental pollution caused by permanganate and stone, and thus lower the problems affecting manpower. It is aimed to find a solution to the problems of loss of strength in the product, tearing in the belt parts, the formation of broken traces and the presence of stone fragments in the wastewater by performing the permanganate and stone-free ecological snow washing process without permanganate and stone. After completion of the process, the physical performance of the products (tensile strength, tear strength and stretch & growth) were tested, and color removal effectiveness was observed, and thus the effects of the snow washing process on the performance properties of the denim product were examined. It has been observed that the desired effect as well as the strength values are in accordance with the standards.

Keywords: Denim Fabric, Washing, Stone-Free, Permanganate-Free, Snow Washing

Denim Ürünleri İçin Permanganat ve Taşsız Ekolojik Kar Yıkama Prosesinin Geliştirilmesi

Öz

Denim ürünler, giyen kişiye rahatlık ve ayrıcalık hissi sağladığı için günümüzde de popülerliğini koruyor. Popüler olmasını sağlayan en önemli unsur denim ürünlere son görünümünü veren denim yıkama işlemleridir. Permanganat ve taş yıkama işlemleri, yıkama işlemlerinde en sık uygulanan yöntemlerden biridir. Potasyum permanganat kimyasalı iyi bir ağartma etkisi sağlasa da insan sağlığına ve çevreye zararlı bir kimyasaldır. Bu çalışmada firmamızda da mevcut olan kar yıkama işleminin ortadan kaldırılarak bu süreçte kullanılan taş ve permanganatın ortadan kaldırılması, permanganat ve taşın neden olduğu çevre kirliliğinin ve insan gücünü etkileyen sorunların ortadan kaldırılması amaçlanmaktadır. Permanganatsız ve taşsız ekolojik kar yıkama işlemi yapılarak üründe mukavemet kaybı, bant kısımlarında yırtılma, kırık izlerin oluşması ve atık sularda taş parçalarının bulunması sorunlarına çözüm bulunması amaçlanmaktadır. Yapılan çalışmalarda ürünlerin fiziksel özellikleri (kopma mukavemeti, yırtılma mukavemeti ve esneme & büyüme), renk değişimleri test edilmiş ve yıkama işleminin denim kumaşın performans özelliklerine etkisi incelenmiştir. İstenilen görüntü ve dayanım değerlerinin standartlara uygun olduğu görülmüştür.

Anahtar Kelimeler: Denim Kumaş, Yıkama, Taşsız, Permanganatsız, Kar Yıkama

1. Introduction

Among all textile products, no other fabric has received as wide acceptance as denim jeans [1]. Denim jeans washing is a new process to give clothes a worn look, change appearance and increase comfort ability [2]. For this reason, companies have been trying to develop various techniques in recent years to improve the visual appearance of fabrics, especially their pale appearance [3]. Potassium Permanganate ($KMnO_4$) is an inorganic salt in solid form that is widely used around the world. It is a strong oxidizing agent and used to make color fading effect on denim jeans [4]. No matter how much the negative effects of these chemicals on the environment and human health have been kept in the background for years, this situation is changing with the understanding of sustainability and nature-friendly products created by consumers. In this project, it is aimed to eliminate the stone and permanganate used in denim washing process by imparting the snow washing process, to eliminate the environmental pollution caused by permanganate and stone and the problems affecting the human power. It is aimed to find a solution to the problems of loss of strength in the product, tearing in the belt parts, the formation of fracture marks and the presence of stone fragments in the waste water by performing the permanganate and stone-free ecological snow washing process. In this study, washing recipes were prepared without using stones and trials were carried out with the supplied permanganate-free denim washing chemicals. The physical properties of the products (tensile strength, tear strength and rupture & elongation) were tested, color removal effectiveness was observed, and the effects of the washing process on the performance properties of the denim fabric were examined.

2. Material and Method

Table 1. Washing processes of denim products

Washing Processes
Pre-washing (10 min)
Hot rinsing washing (2 min)
Anhydrous enzyme (30 min)
Rinsing (2 min)
Spinning
Drying
Snow Washing (30min)
Rinsing (2 min)
Spinning
Drying

The most preferred fabric blends in the denim industry were used in the experiments (see Table 2). Washing recipes were prepared with the chemicals supplied by different companies, and washing trials were carried out. The chemical used for snow washing is a mixture of acidic, inorganic and oxidizing substances. Details on the applied washing process are given in Table 1.

3. Results and Discussion

The most preferred fabric blends in the denim industry were used in the experiments (see Table 2). Washing recipes were prepared with the chemicals supplied by different companies, and washing trials were carried out. The chemical used for snow washing is a mixture of acidic, inorganic and oxidizing substances. Details on the applied washing process are given in Table 1.

Figure 1. After snow washing denim products

Table 2. Physical test results of denim products after snow

	Tensile Strength (N)		Tear Strength (N)		Stretch & Growth (N)	
Fabric Fiber Content	Warp	Weft	Warp	Weft	Stretch	Growth
%80 ORCO %20 PRRCO	70	69	6400	6400	26	5
	67	69	6400	6400		
%79 CO %20 PCW %1 EL	67	38	6272	4608	26	5
	74	40	6144	4608		
%94 CO %2 EL %4 EME	75	32	6272	4800	36	5
	70	32	6400	4992		

4. Conclusions and Recommendations

The main factors that affect consumers while choosing are aesthetics, appearance and fashion in clothes. Denim products are subjected to industrial washing to obtain specific finish which adds value to the final product. This study analyzed the effect of washing without the use of stone and permanganate, and negative results were not encountered visually or regarding physical performance.

5. Acknowledge

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