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RESEARCH ARTICLE / ARAŞTIRMA MAKALESİ

Printability of Bamboo Jersey Fabrics in Thermal Transfer Printing System

Bambu Süprem Örme Kumaşların Termal Transfer Baskı Sistemindeki Basılabilirliği

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Abstract

Thermal transfer printing system, which works transferred onto textile fabric by heat of the image formed in the film material surface, is a printing system used in textile industry. The exactly transferring onto the textile fabric of the image on the film material and the remain stable of the transferred image after the use and washing conditions are an important indication for a quality print. In this study, firstly it was determined the physical properties of the bamboo jersey fabrics. Then, it was transferred of the image in the thermal printing system on the fabrics at 3 different temperatures. And then it was performed the washing process of fabrics before and after printing and measured the values of L*a*b*, the gloss and the light resistance of the printed fabrics. From the obtained data, the printability of the bamboo jersey fabrics in the thermal printing system and the resistance of the print after the standard washing were determined.

Keywords: Bamboo, Jersey, Thermal print, Printability

Öz

Film malzeme yüzeyinde oluşturulan görüntünün, ısı yoluyla tekstil kumaşları üzerine aktarılması yöntemiyle çalışan Termal Transfer Baskı Sistemi Tekstil sektöründe de kullanılan bir baskı sistemidir. Film malzeme üzerindeki görüntünün kumaş üzerine tam olarak aktarılması ve aktarılan bu görüntünün kullanım şartlarına ve yıkama süreçleri sonrasında stabil kalması kaliteli bir baskının önemli göstergeleridir. Çalışmada ilk olarak bambu süprem örme kumaşların fiziksel özelliklerinin belirlenmiş ve sonra kumaşlar üzerine 3 farklı sıcaklıkta termal baskı sisteminde görüntünün aktarılmıştır. Baskıdan önce ve sonra kumaşların yıkama işleminin gerçekleştirilmesi ve kumaşlara basılmış renklerinin L*a*b*, gloss ve ışığa karşı direnç değerlerinin belirlenmesi olmak üzere dört aşamalı olarak gerçekleştirilmiştir. Elde edilen verilerden, bambu süprem örme kumaşların termal baskı sistemindeki basılabilirlikleri ve baskının standart yıkanma sonrasındaki dayanımları belirlenmiştir.

Anahtar Kelimler: Bambu, Süprem örme, Termal baskı, Basılabilirlik

I. INTRODUCTION

The thermal transfer printing system is an environmentally friendly printing system that will not leave the solvent vapor harmful to the environment and the human body [1]. It is a printing system in which image transfer is carried out by using the method of adhering the pigments on the film material to the substrate under pressure with the use of temperature and pressure [2].

Heat, pressure and applied pressure duration are important pressure parameters that determine print quality in this printing system. Also, these printing parameters, which are determined according to the surface properties of the substrate, are important for high print quality [3-6].

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In thermal transfer printing systems, image on transfer papers are transferred by the screen printing or digital technology methods [7]. The solid paint particles on the transfer paper are transferred to the substrate after the heat and pressure formed during printing [8].

The temperature and the applied time period in thermal transfer printing is vary according to the substrate. In this study, it was made for determining the effect on the print quality and durability of the image transferring onto bamboo jersey fabrics at different temperatures in the thermal transfer printing.

II. MATERIALS AND METHODS

2.1. Textile Fabric Properties

In this study, bamboo jersey fabrics were used. The fabric structure is with yarn No Nm30, Twist z 402x2, 490x2, 407x2, 419x2, 401x2, grammage 1.305 g/m^2.

2.2. Creating Transfer Printing Film

Printing master films were prepared and then they were printed on polyester film by HP Indigo 5500 digital printing machine. In order to prevent spreading of the image, the surfaces of printed polyester films were coated with white dye using a semi-automatic screen-printing machine. The mesh number was 140 threads/cm (tpc). After print, they were dried at 60°C. And then, it was coated with water-based adhesive for giving binder feature using screen-printing system. The mesh number was 68 threads/cm (tpc).

2.3. Carrying out Thermal Transfer Printing

The obtained printing master films were transferred on cotton, polyamide and polyester textile fabrics using Sahok Sh 49BD thermal transfer printing machine at 160°C, 180°C and 200°C temperatures. In this process, printing pressure and printing time were kept constant.

2.4. Measurement of Printability Properties

CIE L*, a*, and b* values of the printed uncoated samples and the printed samples coated with EA oligomer were measured by the D50 illuminant/2° observer values using X-Rite eXact Densitometer [9]. BYK Portable glossmeter (BYK-Gardner Gmbh, Geretsried, Germany) was used based on ISO 2813 (2014) to determine the gloss values of the printed samples. Both CIE L*, a*, and b* color values and gloss values of the printed samples were measured immediately after printed and the washing. Also, Resistance of printed fabrics to fade was measured according to BS 4321 using Solorbox 1500 device.

2.5. Washing Conditions

The obtained printed, bamboo jersey fabrics were washed once by using ECE non-ionic detergent (4 g/L) solution in water at 40ºC for ½ h [10]. The quality of the printing process was evaluated both before and after the washing step.

III. RESULTS AND DISCUSSIONS

Figure 1 shows the print density values of Cyan, Magenta, Yellow and Black colors printed on bamboo jersey fabrics at different temperature changes and after washing process. It saw that there is a decrease in the density values depending on the increase in temperature values in all colors. After the washing process, the density values of the colors were not changed negatively.

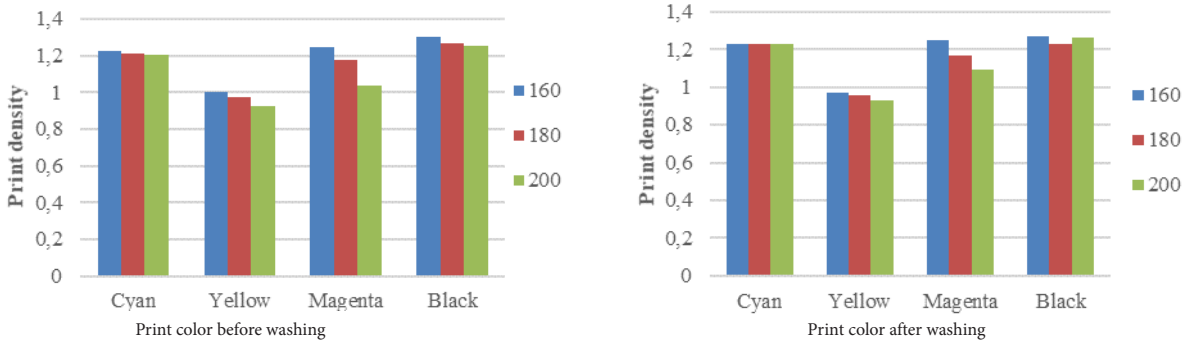

Figure 1. The print density values before and after washing

Figure 2 shows the print lightness values of Cyan, Magenta, Yellow and Black colors printed on bamboo jersey fabrics at different temperature changes and after washing process. It is understood from the obtained data that neither the change of the temperature values nor the washing process has any effect on the printing lightness values.

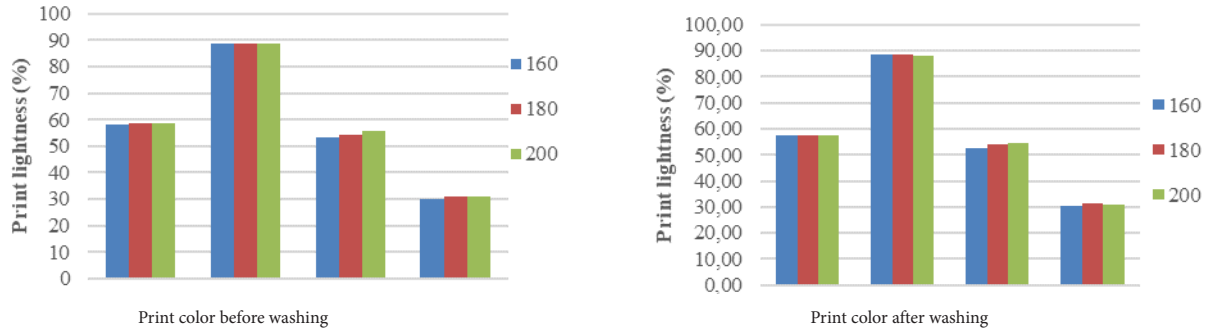

Figure 2. The print lightness values before and after the washing

Figure 3 shows the print chroma values of Cyan, Magenta, Yellow and Black colors printed on bamboo jersey fabrics at different temperature changes and after washing process. Depending on the increase in temperature, there is a slight decrease in the print chroma values of the print colors. This decrease was slightly increased after washing.

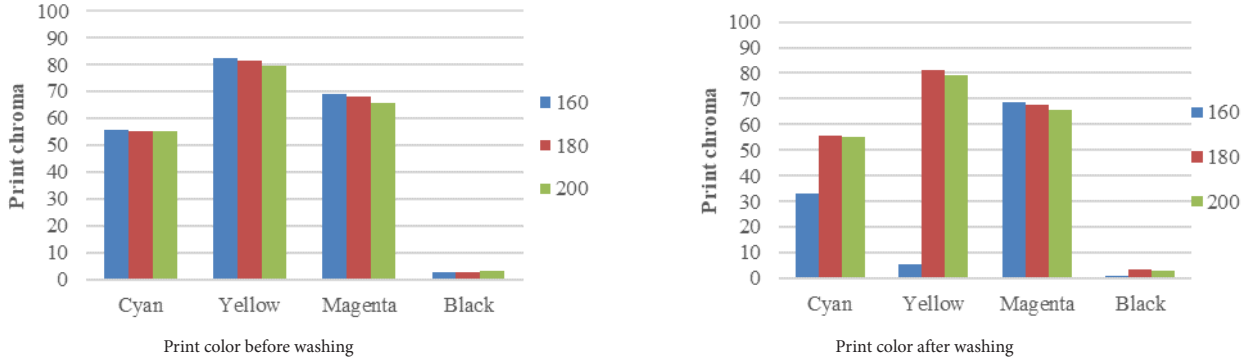

Figure 3. The print chroma values before and after the washing

Table 1. The gloss values before and after washing of bamboo jersey fabrics

Bamboo jersey fabrics	Gloss before washing	Gloss after washing
	2,3	2,6

Bamboo jersey fabrics before and after washing preserved their gloss values (Table 1).

Table 2. The print gloss values before the washing

Print Gloss before washing	160 °C	180 °C	200 °C
Cyan	1,6	2,2	2,1
Yellow	3,0	3,3	3,3
Magenta	2,0	2,1	2,0
Black	1,7	1,80	1,8

In Table 2, it is seen that the gloss values of Cyan, Magenta and Black colors after printing are slightly lower than the gloss of unprinted Bamboo jersey fabrics. However, the change in the temperature values did not significantly affect the print gloss value.

Table 3. The print gloss values after the washing

Print Gloss after washing	160 °C	180 °C	200 °C
Cyan	0,8	0,8	0,9
Yellow	2,1	1,9	2,1
Magenta	1,0	0,9	0,8
Black	0,6	0,7	0,6

Printed gloss values decreased after washing. The change in the temperature values did not affect the print gloss value (Table 3).

Light fastness measurement was made according to BS ISO 12040: 1997 [11]. According to this standard, it means 1 very little, 2 little, 3 medium, 4 fairly good, 5 good, 6 very good, 7 excellent and 8 spectacular.

Table 4. The evaluation of light fastness of printed fabrics

Light fastness before washing	160 °C	180 °C	200 °C
Cyan	7	6	5
Magenta	7	6	5
Sarı	7	6	5
Siyah	7	6	5

Table 4 shows the results of evaluating the light fastness of the printed fabrics according to the blue scale before the washing. It is seen that the light fastness values of the colors decrease due to the temperature increase in the table. The best fastness value was obtained at 160 ° C.

IV. CONCLUSIONS

The fact that the Cyan, Magenta, Yellow and Black colors printed on the Bamboo jersey fabrics do not change in the different print temperature values and the printing density after washing show that the consistency in the printing density value is maintained.

Both the change in print temperature values and the print lightness values of the wash process did not affect.

The print chroma values do not change significantly due to different print temperature values and washings. It has shown that the color universe, which is can be obtained after print, preserves consistency.

Before and after washing Bamboo jersey fabrics retained their gloss values. The value of the print gloss was not significantly influenced by the change in temperature values. But, the print gloss values were noticeably reduced after washing.

Depending on the print temperature increase reduced in light fastness of print colors. The best light fastness value was obtained at 160 ° C.

In general, it is concluded results that Bamboo jersey fabrics have a printable structure in thermal transfer printing and preserve the consistency of the print outside the print gloss after the washing process. While the increase in the print temperature value does not significantly affect the print quality, it affects the light fastness of the print.

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