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Investigation on Physical Properties of Organic Cotton T-Shirt by Bio-Scouring and Eco-Friendly Remazol Reactive Dyes Treatment

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Abstract

Wet processing treatment plays an important role in the physico-mechanical properties of finished apparel products. This paper presents an investigated result of enzymatic scouring and eco-friendly remazol reactive dyes treatment on the physical properties of finished T-shirt product. 100 % organic cotton single jersey knitted grey fabric having 160 gsm was considered. To investigate the selected physical characteristics of the finished organic cotton T-shirt, the eco-friendly enzymatic scouring with Prima Green Eco scour, Prima Fast Gold RSL and remazol ultra RGBN series reactive dyed treatment were performed following standard recipe. Selected physical properties namely washing fastness, bursting strength, fabric drapability, color fastness to rubbing, perspiration and absorption have been investigated for the newly developed organic cotton T-shirt that showed better results in terms of quality. Hence, it can be concluded that by selecting eco-friendly materials like organic cotton and chemical processing treatment, it is possible to develop finished T-shirt products with improved physical properties.

1. Introduction

Knitted fabrics are generally used to make outerwear garments such as T-shirts, polo shirt, trousers, etc. The knitted fabrics undergo a series of different processing treatments like scouring, bleaching, dyeing, softener padding and relax drying. These processes are carried out to impart a particular property related to that process like scouring for absorbency, bleaching for whiteness, dyeing to impart color to fabric and finishing for improving softness and handle of the fabric. The properties of the knitted fabrics are influenced by various parameters like raw material, yarn structure, fabric structure, processing stages and finishing [1]. The raw materials selection and process adopted affects the finished fabric properties and its overall performance. The amount of changes occurred in the properties of the fabric due to pre-treatment, dyeing and finishing process makes the subject complex. By adopting different processes and

finishing methods, different kinds of end products in a sense of aesthetic and utility properties can be produced from the same unfinished fabrics [1]. For example, by selecting eco-friendly fibre like organic cotton and environmentally low impact dyes like Remazol RGBN series it is possible to produce better quality finished fabric [2]. Enzymatic scouring method is eco-friendly and widely used during pretreatment stages of knit fabric. Further, the determination of the changes in physical and dyeing properties during different stages of wet processing is important to get the final product as per the requirements of the customer. There have been a number of studies on the influence of different fiber types, fabric structure and processing parameters on various properties of knitted fabrics [3-5]. However, limited number of studies on influence of raw materials selection & wet processing stages and process sequences on the physical, dimensional and dyeing properties of the cotton knitted fabrics has been re-ported emphasizing on eco-friendliness so far [1,6]. In this study, the influence of wet processing stages and effects on the physical, dimensional and dyeing properties of organic cotton knitted fabrics are investigated to see the finished T-shirt properties treated in a an eco-friendly way.

2. Materials and Methods

2.1. Materials

Knitted fabrics of 100 % organic cotton single jersey having gsm 160 was collected from Viyellatex Group Ltd. Dhaka, Bangladesh [7]. The grey fabric was then treated with enzymatic scouring using Prima Green Eco scour & Prima Fast Gold RSL of DuPont brand. Then the pretreated fabric was dyed with Remazol RGBN series eco-friendly reactive dyes following the standard recipe. Different chemicals, auxiliaries and dyestuffs used in pretreatment and dyeing are shown in Table 1 and Table 2 respectively. The raw materials details are given below. Yarn and knitting parameters:

Fiber type : 100% organic cotton (GOTS Certified)
Yarn type, Count : Combed, 28s
Color : Grey
Origin : African Cotton
Fabric type : Single jersey circular knitted
Finished GSM : 160
Machine dia : 30”
Machine gauge : 24 G
CPC & WPC : 32 & 10
Stitch length : 2.65 mm

Table 1. *List of pretreatment chemicals and auxiliaries*

Chemicals & Auxiliaries name	Brand/Origin
ALO (Wetting Agent/Detergent)	China
ABLUTEX ST-700 (P.Stabilizer)	Taiwan Surfactant
ALBA C (Anti-creasing Agent)	Huntsman
CAUSTIC, H_2O_2 & A.ACID	China
T-100 (Peroxide Killer)	China
Prima Green Eco scour & Prima Fast Gold RSL	DuPont
SECURON-540 (Sequestering Agent)	China

Table 2. *List of dyes, chemicals for dyeing of organic cotton*

Dyes and Chemicals name	Brand/Origin
SECURON (Sequestering Agent)	China
ALBA C (Anti-creasing Agent)	Huntsman
RDLB (Leveling Agent)	China
Remazol Ultra yellow RGBN	DyStar
Remazol Ultra Red RGB	DyStar
Remazol Deep Black RGBN	DyStar
SALT	China
SODA ASH	China
CAUSTIC	China

2.2. Methods

2.2.1. Enzymatic Scouring

The knitted cotton fabric has been subjected to scouring process for removal of natural impurities such a wax, pectin, fat, oil, pigment etc from cotton fibers [8]. The process is carried out by following suitable recipe (Figure 1, a) with maintaining proper time and temperature.

2.2.2. Dyeing of Organic Cotton Fabric

For the study, just at random basis black colored were selected for dyeing using the bio-scoured fabric ready for dyeing (RFD) cotton knitted fabrics. The selected samples were sent to the viyellatex dyeing unit to obtain the dye recipe. The recipe obtained was based on the dyeing experts on the industry and then the selected samples were verified by a marketing executive of DyStar, Bangladesh to obtain recipe based on low impact reactive dyes such as Remazol, i.e. Remazol ultra RGB series of dyes. This combination is termed as low impact reactive dyes throughout this study. Others dyes and chemicals were selected for dyeing based on no RSL list and OEKO-TEX certified list. The details methods details for dyeing is given in (Figure 1, a)

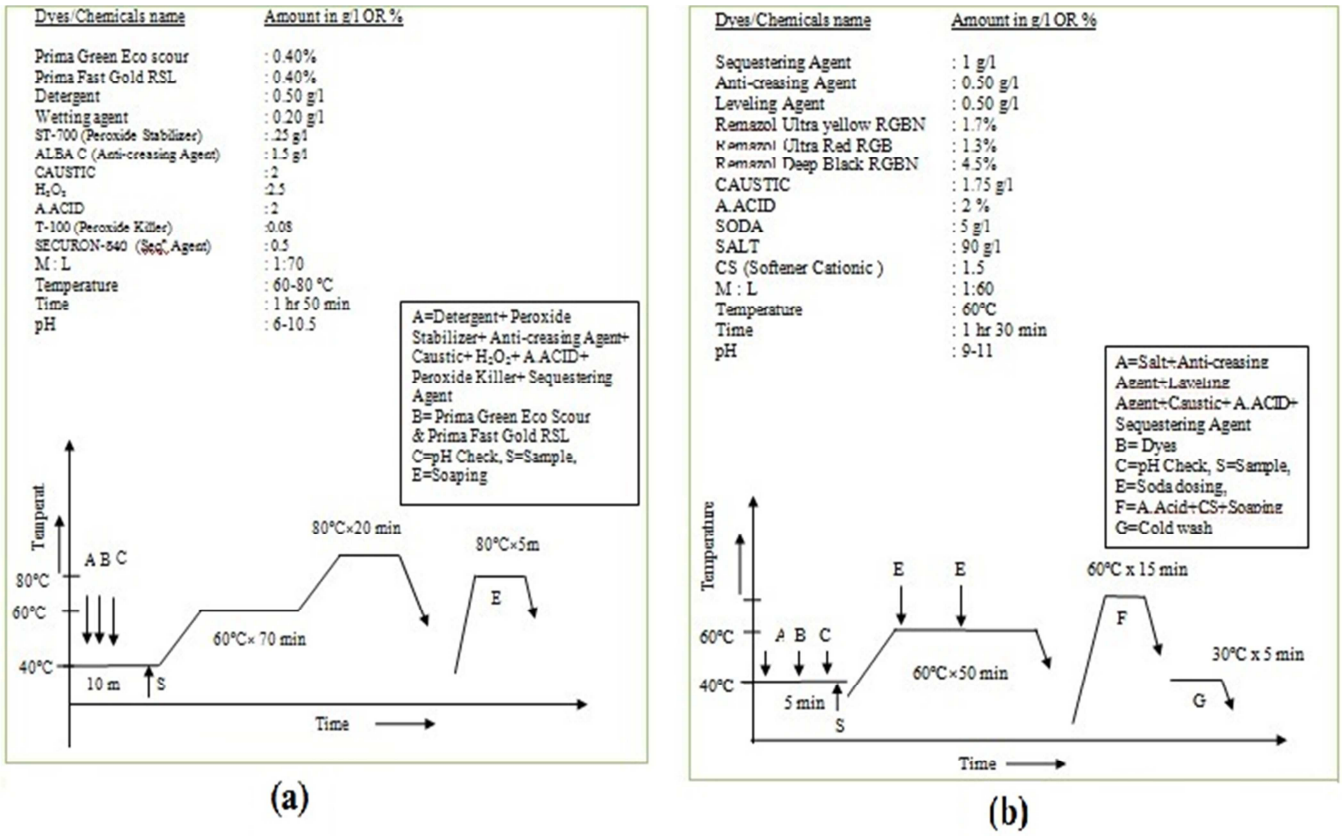

Figure 1. *Bio-Scouring (a) and dyeing procedure (b) of Organic cotton fabric*

2.2.3. Physical Properties Testing and Analysis

At first the scoured and dyed samples fabric were conditioned in 65% RH and at 20°C for 24 hrs before testing according to ASTM D1776 [9] and BS EN ISO 139:2005. Then bursting strength of the scoured and dyed organic cotton knitted fabric was determined according to ASTM D 3787 [10] (Ball Burst test). The values for color fast-ness were rated with a Grey scale for color change ac-cording to AATCC test method 61 [11]. Weight loss (%) in fabric was calculated according to ASTM D 3776. Drape test of the fabric was measured with drape meter according to BS 5058:1973. Dimensional changes (shrinkage %) was calculated from the difference in fabric length due to scouring and dyeing according to test method ASTM D 2724BS 4931. Color fastness to wash was tested in gyro wash machine according to test method ISO-105-CO3. Color fastness to perspiration was tested as per test method ISO-105-E04-1994(E) in a Perspirometer and light box. The rubbing fastness was tested in a crock meter according to Test method: (ISO 105 X12-2001)

3. Results and Discussion

3.1. Evaluation of Color Fastness to Rubbing

Color fastness to rubbing was done for knitted dyed fabrics. Figure 2 shows that the result of dry & wet rubbing was same for the both samples

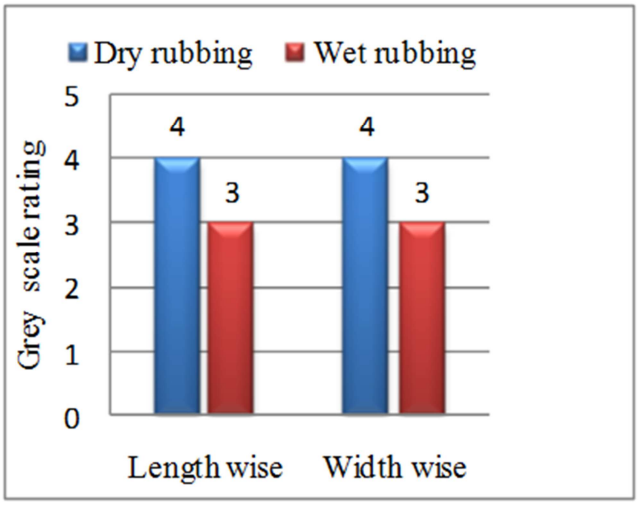

Figure 2. *Color fastness to rubbing of T-shirt fabric*

3.2. Evaluation of Color Fastness to Wash

Color fastness was usually assessed separately with respect to fading and staining. Figure 3 show the color fastness to wash of organic cotton knitted T-shirt fabric.

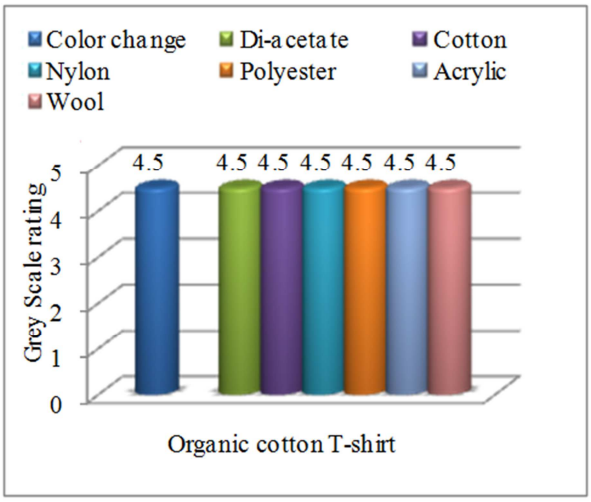

Figure 3. *Color fastness to wash for organic cotton fabric*

3.3. Evaluation of Color Fastness to Perspiration

Following figure 4 shows the color fastness to perspiration of organic cotton T-shirt fabric which seems better fastness properties.

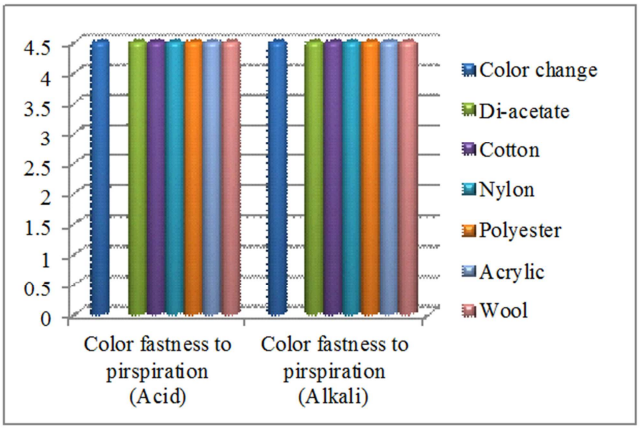

Figure 4. *Color fastness to perspiration of T-shirt fabric*

3.4. Test Results for Ball Bursting Strength

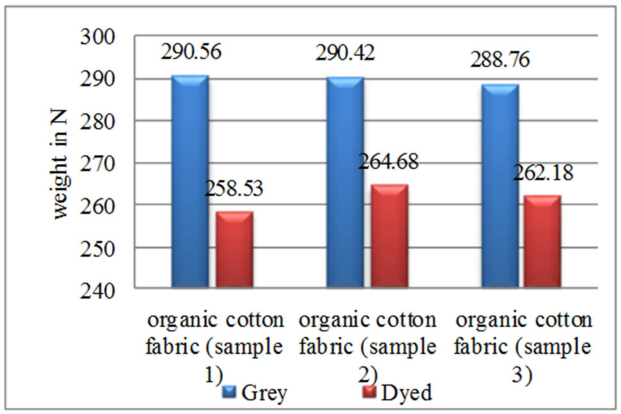

Figure 5. *Ball bursting strength of organic cotton fabric*

It was noticed that ball bursting strength for fabric of organic cotton was fall due to enzymatic scouring. Besides, organic cotton fiber molecular structure is also soft. The results are shown in figure 5.

3.5. Result for Fabric Drape Test

Result of drape test (figure 6) was well satisfactory for organic cotton sample as it shows a lower value of drape co-efficient that means the fabric is softer and easily drapable.

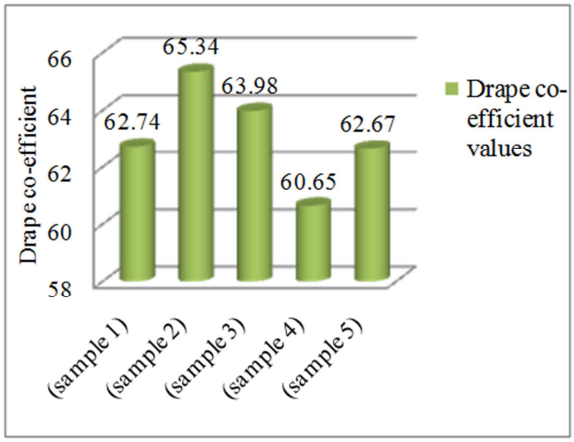

Figure 6. *Drape test result for organic cotton fabric*

3.6. Fabric Weight Loss Due to Scouring

It has been noticed from figure that weight loss% of organic cotton sample before & after scouring is comparatively higher because of organic cotton itself being soft in molecular structure and bio-scouring process [12]. The results are shown in figure 7.

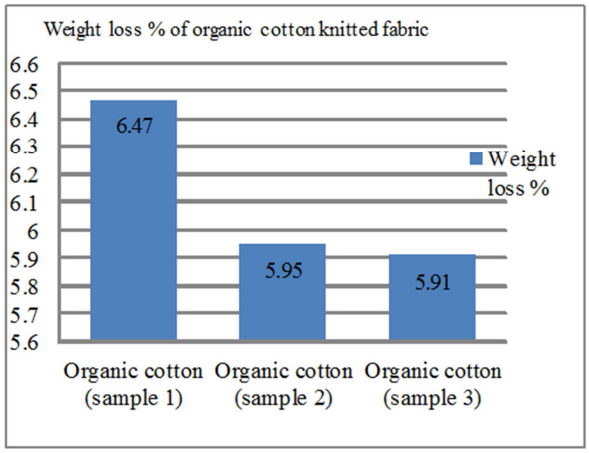

Figure 7. *Weight loss % of organic cotton fabric due to scouring*

3.7. Shrinkage Test Results

From above figure it is clear that the length wise shrinkage was combatively less than the width wise shrinkage for the organic cotton fabric. The results are shown in figure 8.

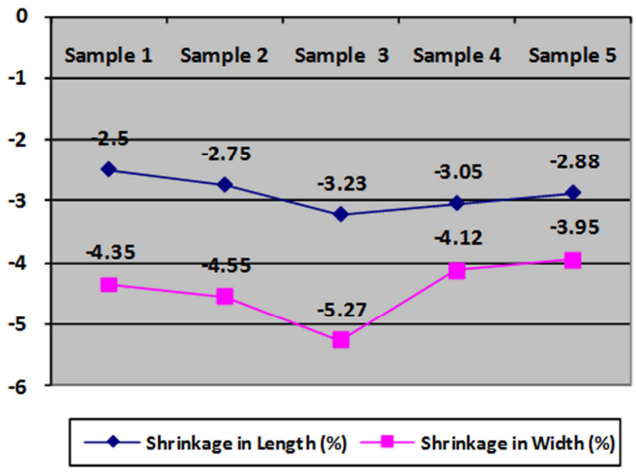

Figure 8. *Shrinkage test results for organic cotton fabric*

4. Conclusion

The works reported in this paper presents an investigated results for physical properties of a T-shirt fabric made from 100% organic cotton fibre and chemical processing with enzymatic scouring and eco-friendly Remazol series reactive dyeing. Most of the result showed better physical properties of finished organic fabric. Although due to enzymatic scouring and fibre materials being organic cotton the strength is less and weight loss % is higher but others properties are still in the satisfactory level. The tested results indicate that by selecting eco-friendly fibre, dyes & chemicals like organic cotton, bio-scouring and remazol dyes, similar or better quality T-shirt fabric production is possible in terms of physical properties which would be less harmful to the environment comparatively with others traditional manufacturing process.

References

[1] H Hasani, Effect of different processing stages on mechanical and surface properties of cotton knitted fabrics. *Indian Journal of Fibre & Textile Research,* 2010, 35:139-144.

[2] D. Fakin, D. Golob, Z. Stjepanovic, The Effect of Pretreatment on the Environment and Dyeing Properties of a selected Cotton Knitted Fabric, *FIBRES&TEXTILES in Eastern Europe*. 2008, 16(2): 67.

[3] N. Duran, and D. Marcela, Enzyme applications in the textile industry, *Review Progress in Coloration*, (2000), 30 (1): 41-44.

[4] M. Akaydin, Characteristics of fabrics knitted with basic knitting structures from combed ring and compact yarns, *Indian Journal of Fibre & Textile Research,* 2009, 34:26-30.

[5] D. Saravanan, N. Govindaraj, P. Harish, T. Ramachandran, "Scouring of special cotton and its influence on physical properties" *Indian Textile Journal,* 2008, 118(12): 46 – 49.

[6] S.N. Jayanth, Environmental issues and its impacts associated with the textile processing units in Tiruppur, Tamilnadu. International *Conference on Environmental Science and Development. 4,* (2011) pp. 120-124. Tamilnadu, India: IPCBEE.

[7] Viyellatex Group, personal communication, 297, Khairtul, Tongi, Gazipura, Gazipur-1712, Bangladesh, 2013.

[8] E.R. Trotman, M.B.E., "*Dyeing and chemical technology of textile fibers*", London, Fourth edition.

[9] ASTM D 1776, "*Standard practice for conditioning textiles for testing," American Society for Testing and Materials, Annual Book of ASTM Standards, vol. 7(1).* ASTM International, West Conshohocken, PA, USA, 2008.

[10] ASTM D5034, "Standard test method for breaking force and elongation of textile fabrics (Grab test)," *American Society for Testing and Materials, Annual book of ASTM Standards, 7(1),* ASTM International, West Conshohocken, PA, USA,

[11] AATCC test method 61, "Colorfastness to laundering, home and commercial: accelerated," *American Association of Tex Research Triangle Park*, N.C., USA, 2010.

[12] B. Mangovska, G. Dembovski, I. Jordanov, Structural characteristics of cotton knitted fabrics after enzymatic and alkaline scouring, *Bulletin of the Chemists and Technologists of Macedonia, 2004, 23(1):* 19–28.