



Reactive Dye and Pigment Printing of Knit Fabric

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Abstract

The aim of this work is to evaluate on Reactive dye and Pigment printing of knit fabric as well as test on visual appearance, Reflectance percentage, wash, rubbing and perspiration fastness properties. In this work, reactive dyes and pigments were used to create the same motif of printing design on the same quality of knitted fabric and assessed the inconsistency. It was found that the reflectance values of the reactive printed samples were more than pigment printed samples. The fastness results of the reactive printed samples were better than the pigment printed samples. This work has been done at Rahim Textiles Mills Ltd. Gazipur, Dhaka and Southeast University, Tejgaon during the time period of September' 2017 to February' 2018.

Keywords: Reactive dye, Pigment colour, Printing, Reflectance values

I. Introduction

Textile printing is one of the most versatile and important methods used for introducing color and design to textile fabrics. It can be considered as a controlled form of localized coloration in which the surface of the fabric receives the color or pattern. It enables textile manufactures to achieve various aesthetics, complex geometric patterns to more simple designs (Asaduzzaman *et al.* 2016, Yaman *et al.* 2012, Hossain *et al.* 2015, Pradhan *et al.* 2015, Madhu and Patel 2016).

Pigment textile printing is not only the oldest but also more than 80% of the printed goods are based on pigment printing (Akbarzadeh *et al.* 2011, Najafi and Aghae, 2011). The economic importance of pigments in printing is substantial since 1960 these have become the largest colorant group for textile prints (Haggag *et al.* 2015). It is perhaps the most commonly and extensively used technique for printing textiles, due to its obvious advantages, such as versatility; ease of near final print at the printing stage itself, applicable to almost every kind of fiber or mixture, and the ability to avoid any washing processes after fixation. However, pigment printing has a few problems –relatively high temperature cure, stiff hand and poor crock fastness of printed goods (Haggag *et al.* 2012).

However, reactive dyes are usually used for coloration of cotton with bright shades and good color fastness properties but it is difficult to print the fabrics than pigment. It should go through hot steam fixation and extensive washing processes after printing with reactive dye. Reactive printed fabric exhibits better air permeability. Both reactive and pigment printing have comparable color fastness in industry.

In this work, three different designs were selected to print the single jersey knit fabric samples. The samples were flat screen printed, after that the reflectance %, wash, rubbing and perspiration fastness were evaluated

II. Materials and Methods

Scoured and bleached single jersey cotton knitted fabric of 140 GSM was selected for reactive and pigment printing. The important criterion for pigment printing is, it requires binder, which ensures the pigment crosses linked to fabric surface. Tubifast AS-5087 FF was used as a binder and thickening agent Uniprint-20 was used for pigment printing. For reactive printing it was used Sodium Alginate as thickening agent. Urea-F was used as hygroscopic agent in both printing.

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Printing Procedure

The print paste was prepared by mixing the required amount of reactive dye and pigment separately for each sample. The solubility of reactive dyes and pigment was sufficient followed by high-speed stirring, to produce perfectly smooth print paste. Firstly, three pairs (each pair for both reactive and pigment print) of fabric samples were selected for printing. Printing was done by using hand strike screen and dried at 70°C. After that, steaming was done for reactive printed samples at 100°C for 10 minutes. In steam chamber, it was maintained steam pressure at 5 kg/cm². Curing was done for pigment printed samples at 160°C for 5 minutes. After steaming and curing the printed samples were rinsed washed in cold water for 10 minutes, then hot water at 80°C for 5 minutes. The samples were rinsed in softener and dried in tumble dryer.

Color Fastness to Wash, Rubbing and Perspiration Test Procedure

Wash fastness test was carried out by ISO 105 C04 method. Color Fastness to Rubbing was determined by test standard ISO 105 X 12:2002. The color fastness to perspiration (acid and alkaline) was measured by the method: ISO 105 E04.

Determination of Reflectance percentage



The values of reflectance Percentages of the samples were measured on a Spectrophotometer at 400-700 nm under a D65/10° illuminant.

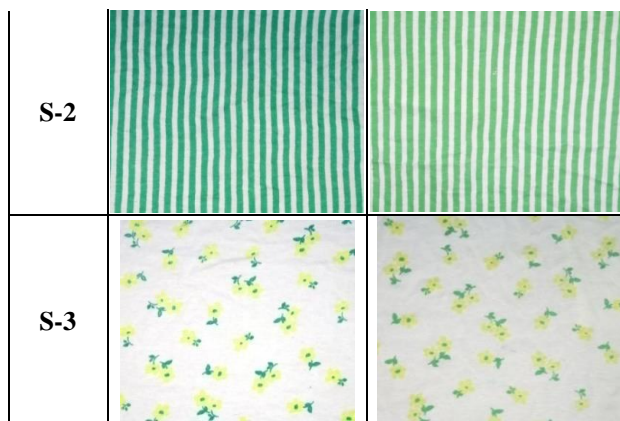
III. Results and Discussion

Photos of the Samples

Table 1 shows the photos of the reactive and pigment printed samples S-1, S-2 and S-3. The motifs were different for each pair.

Table 1 Photos of reactive and pigment printed samples

| Samples | Reactive printed | Pigment printed |
|---------|---|---|
| S-1 |  |  |



Evaluation of Reflectance Percentage

The reflectance of the sample S-1

Figure 1 shows the comparison on reflectance percentages of the reactive and pigment printed samples S-1 against the wave length in nanometer (nm). The reflectance percentages of reactive red and pigment red were 24.04, 22.72, 18.51, 55.61, 74.76, 75.85 and 4.79, 4.68, 4.15, 34.18, 67.18, 68.57 respectively at 400-450, 460-510, 520-570, 580-630, 640-690 and 700 nm. It was noticed that the reflectance values of the reactive printed sample was higher than the pigment printed sample. Similarly, The figure 1 (right) shows that the reflectance percentage of reactive black and pigment black were 4.79, 4.68, 4.15, 34.18, 67.18, 68.57 and 2.87, 2.60, 2.53, 2.51, 2.64, 2.69 respectively at 400-450, 460-510, 520-570, 580-630, 640-690 and 700 nm. It was observed that the reflectance values of reactive black were higher than pigment black printed sample.

Figure 2 shows the comparison on reflectance percentages of the reactive and pigment printed samples S-2 and S-3 aligned with the wave length in nanometer (nm). The figure 2 (left) shows that the reflectance percentage of sample S-2 reactive green and pigment green were 19.89, 49.79, 73.74, 74.45, 75.98, 77.09 and 11.79, 24.17, 32.46, 15.82, 15.95, 15.42 respectively at 400-450, 460-510, 520-570, 580-630, 640-690 and 700 nm. It was observed that the reflectance values of reactive green were higher than pigment green printed sample. Likewise, Figure 2 the reflectance percentages of reactive yellow and pigment yellow were 19.80, 49.79, 73.74, 74.45, 75.08, 77.09 and 18.42, 33.16, 66.63, 69.92, 72.92, 75.66 respectively at 400-450, 460-510, 520-570, 580-630, 640-690 and 700 nm. It was noticed that the reflectance values of reactive yellow was higher than pigment yellow printed sample.

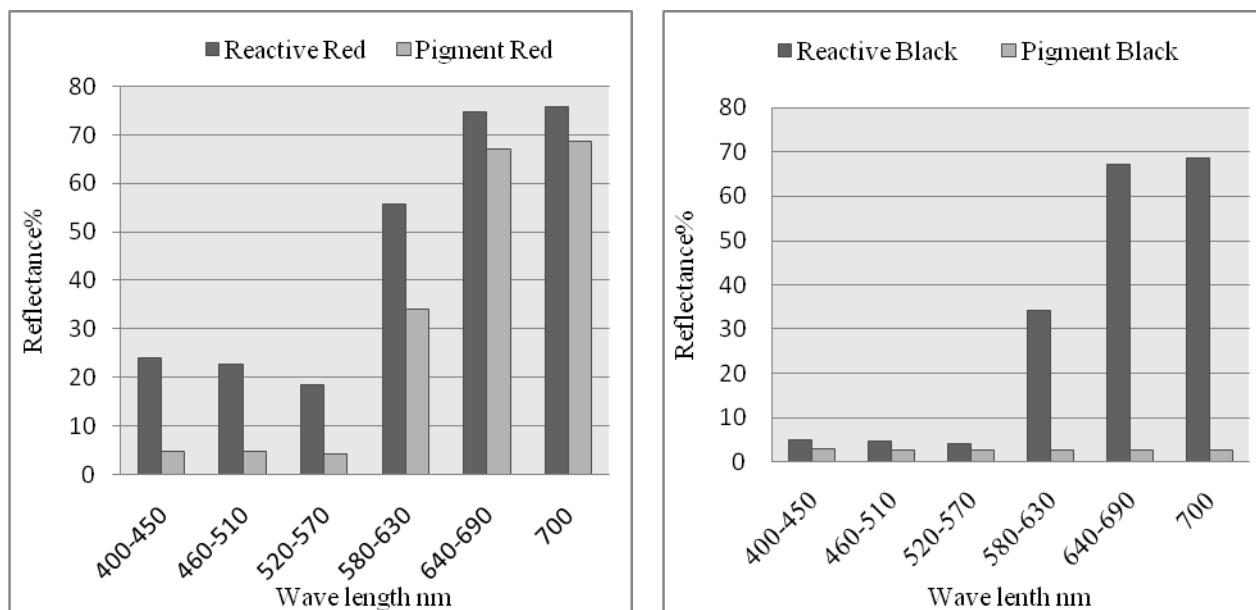


Figure 1: The bar diagram of the sample S-1 (left) which compares the reactive red and pigment red and the sample S-1 (right) shows the difference between reactive black and pigment black.

The Reflectance of the sample S-2 and S-3

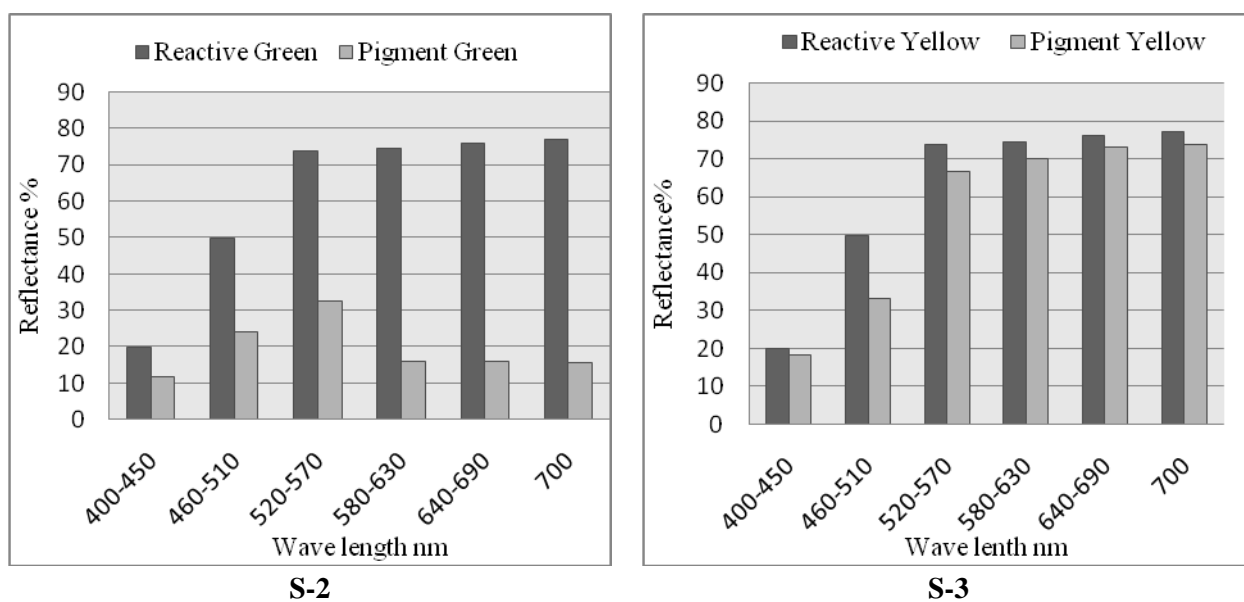


Figure 2: The bar diagram of Sample S-2 (left) compares the reactive green and pigment green and Sample S-3 (right) that shows the difference between reactive yellow and pigment yellow.

Color Fastness to Wash

Table 2: Report on Color fastness to Wash (Change in Color).

| Samples | Reactive printed sample | Pigment printed sample |
|---------|-------------------------|------------------------|
| S-1 | 4 | 3-4 |
| S-2 | 3-4 | 2 |
| S-3 | 3-4 | 3 |

Table 2 shows the color fastness results measured by grey scale rating. In case of sample S-1 the reactive printed sample was 4 which indicates very good and the pigment printed sample was 3-4 that indicates good fastness to change in color due to wash. Similarly, the results of the sample S-2 was 3-4 for reactive printed sample and rating was 2 for pigment printed sample which indicates poor fastness to wash. Lastly, the wash fastness rating of the sample S-3 was 3-4 of reactive printed sample and 3 of the pigment printed sample which indicates moderate to good to wash,

Color fastness to Rubbing

Table 3 shows the color fastness to rubbing of the samples S-1, S-2 and S-3. In all the cases, the dry rubbing fastness was very good with rating 4-5 for both reactive and pigment printed samples. In case of wet rubbing, the reactive and pigment printed samples show good rating with 4 and 3-4 for sample S-1, Likewise, the wet rubbing results of the samples S-2 were 3-4 and 2-3 for reactive and pigment printed sample respectively. Similarly, the sample S-3 shows the rating 4 that indicates very good results for both samples.

Table 3: Report on Color fastness to rubbing

| Samples | Reactive printed sample | Pigment printed sample | Reactive printed sample | Pigment printed sample |
|---------|-------------------------|------------------------|-------------------------|------------------------|
| | Dry | Dry | Wet | Wet |
| S-1 | 4-5 | 4-5 | 4 | 3-4 |
| S-2 | 4-5 | 4-5 | 3-4 | 2-3 |
| S-3 | 4-5 | 4-5 | 4 | 4 |

Color Fastness to Perspiration

Table 4: Report on Color fastness to Perspiration

| Samples | Reactive Printed sample | Pigment Printed sample | Reactive Printed sample | Pigment Printed sample |
|---------|-------------------------|------------------------|-------------------------|------------------------|
| | Acid | Acid | Alkali | Alkali |
| S-1 | 4 | 4 | 3 | 4-5 |
| S-2 | 3-4 | 2-3 | 3-4 | 3 |
| S-3 | 4-5 | 3-4 | 3 | 3-4 |

Table 4 shows the color fastness to perspiration of the samples S-1, S-2 and S-3. Both

acid and alkali perspiration tests were done. In all the cases, the fastness to acid perspiration of sample S-1 the results were very good with rating 4 both for reactive and pigment printed samples and for alkali perspiration, the rating was 3 for reactive printed and 4-5 for pigment printed samples respectively. The acid and alkali perspiration fastness results of the sample S-2 were 3-4, 2-3 and 3 for reactive and pigment printed sample. The sample S-3 shows very good and good results to acid perspiration with rating 4-5 and 3-4 for reactive and pigment printed sample. Similarly, the results of alkali perspiration fastness were 3 and 3-4 of the reactive and pigment printed sample.

IV. Conclusion

In comparison to pigment printed samples, the reflectance percentage of the reactive dyes printed samples were much greater than pigment printed samples. The color depth of pigment printed samples was superior to reactive dyes printed fabric as the colour content was higher on the fabric surface. In wash fastness, most of the Pigment printed samples show an intermediate rating between moderate to fair, the reactive printed samples were good when evaluated the change in color. The dry rubbing fastness of all the samples was very good but wet rubbing fastnesses were fair to good. The color fastness to perspiration of both printed samples was fair to good. At the end, it can be concluded that pigment printed samples are superior to reactive dyes printed samples as the reflectance values were lower on the contrary to the depth of color in pigment printed samples are more than reactive printed samples but the quality parameters are better in reactive printed samples.

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