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OPTIMIZING PRINTING CONDITIONS ON MULBERRY SILK/WOOL BLENDED FABRIC WITH VINYL SULPHONE REACTIVE DYES (REACTIVE ORANGE 7 DYE, REACTIVE ORANGE 12 DYE)

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ABSTRACT

The present study was conducted to investigate the conceivable outcomes of printing mulberry silk/wool blended fabric with vinyl sulphone reactive dyes. Sodium alginate concentration, steaming time and steaming temperature were optimized for the printing. Samples were assessed for CIE L*a*b* values and K/S value before and after washing and percent fixation was additionally recorded.Printed samples were also assessed for colour fastness to various agencies.

KEYWORDS: Blend, Printing, Reactive Orange 7 Dye, Reactive Orange 12 Dye, Silk, Vinyl Suphone Dyes, Wool

INTRODUCTION

The art of dyeing and printing is more than the application of dyestuffs to the yarn or fabric. Textile printing is the process of applying colour to fabric in definite patterns or design so it is also termed as localized dyeing. It is the art of taking impressions, from characters or figures, on paper, linen, silk, and other fabrics. Textile printing is related to dyeing, in plain dyeing the whole fabric is uniformly covered with one colour, and in printing one or more colours are applied to it in certain parts only, and in sharply defined patterns.The early societies of the India were familiar with resist dyeing and this may well have been the first form of textile printing. By 6th Century AD, the art of textile printing had reached Egypt. Remains of printed textiles including wooden blocks have been unearthed in a buried city of Egypt that belonged to the 6th Century. The art of textile printing gradually spread west ward thereafter. Examples of printed fabrics were known from Japan, Persia and Central Asia. Knowledge of this work was also brought to Central Asia by Buddhist monks who were active during 2nd Century in these areas (Ghosh & Ghose, 1995). The use of wooden blocks for printing either books or textiles is generally credited to the Chinese at sometime during the 8th century A.D. By the 17th century Augsburg in Germany was famous for its printed linens. Competitive industry sprang up in Holland, Switzerland, Spain, France and England.With the establishment of famous Oberkampf factory in Jouy (France) in 1759, the great era in textile printing really began (Mitra, 1988).

The textiles composed of wool or silk fiber is usually printed with acid dyes, basic dyes, premetalised dyes or chrome dyes. The aim of the present work was to explore the use of reactive dyes on mulberry silk/ wool blended fabric. Reactive dyes are coloured organic compounds that are capable of forming a covalent bond between reactive groups of the dye molecule and nucleophilic groups on the polymer chains within the fiber. Consequently the dyes become chemically part of the fiber by producing dye polymer linkages (Waring, 1990).

MATERIALS AND METHODOLOGY

MATERIALS

Hand woven blend of mulberry silk waste/wool in the proportion of 65:35 was used for the research work. Two vinyl sulphone hot reactive dye i.e. reactive orange 7 dyes, reactive orange 12 dyeswere chosen for the study.

METHODOLOGY

Optimization of Printing Variables for Reactive Dyes

Optimization of Thickener for Hot Reactive Dyes

Sodium alginate was used as the thickening agent. To optimize the quantity of sodium alginate three printing paste were prepared with varying concentration, i.e. 3%, 4%, and 5% separately for each of the hot reactive dye. Urea was used as anticracking agent, sodium bicarbonate as dye fixing agent, diethylene glycol as levelling agent and sodium tripolyphosphate was used to restrict build up of metallic salts. All the chemicals were blended thoroughly in the required amount of water to prepare the printing paste. After printing the fabric was tested for CIE L*a*b* values, K/S value and percent dye fixation. The percent of dye fixation (%F) was figured using an equation:

$$\%F = \frac{\text{K/S after dyeing}}{\text{K/S before dyeing}} \times 100$$

Where, K/S is the colour yield value. The sodium alginate concentration at which the samples gave the best result was considered optimized thickener concentration.

Optimization of Steaming Time for Hot Reactive Dyes

After optimizing the concentration of thickening agent printing paste was prepared separately for each of the hot reactive dye. Printing paste was applied to the fabric and the steaming was carried out for three different durations i.e. 10 minutes, 15 minutes and 20 minutes. Ater printing, the fabric was tested in CIE L*a*b*, K/S value and percent dye fixation. The time duration at which the samples gave the best result was considered optimized steaming time.

Optimization of Steaming Temperature for Hot Reactive Dyes

To optimize steaming temperature three printing paste were prepared separately with optimized thickener quantity. Printing paste was prepared similarly as for thickening agent and steaming was carried out for three different temperatures i.e. 90^{o}C, 95^{o}C, 100^{o}C . The samples were steamed for optimized time duration for each of the hot reactive dye. CIE L*a*b*, K/S value and percent dye fixation were measured after printing. The steaming temperature at which the samples gave the best result was considered optimimum steaming temperature.

Printing of Silk/Wool Blended Fabric Using Reactive Dyes

Recipe for Printing Paste

The printing paste for hot reactive dye was prepared using the following recipe:

Dye	:	2 %
Sodium alginate	:	3-5%
Urea	:	10%

Sodium bicarbonate	:	2%
Diethylene glycol	:	2%
Soda tripolyphosphate	:	2%
Water	:	x %
Temperature	:	90^{o}C-100^{o} C
Time	:	10-20 minutes

Printing Procedure

Printing paste was prepared using an optimized concentration of sodium alginate with required amount of dye. Fabric samples were printed with prepared printing paste using nylon printing screens. Steaming was carried out at optimized temperature for optimized time duration. After printing the samples were washed to remove excess dye and were shade dried.

RESULT AND DISCUSSIONS

Optimization Results

Printing conditions for two hot reactive dyes, i.e. reactive orange 7 dyes and reactive orange 12 dyes were optimized separately. Best printing results for reactive orange 7 dyes were obtained with 4% sodium alginate concentration at 100^{o}C steaming temperatures using 20 minutes steaming time. Whereas, for reactive orange 12 dye, sodium alginate concentration was optimized at 5% , at 100^{o}C steaming temperature for 20 minutes steaming time.

Colour Fastness Results

Fabric printed with hot reactive dyes has also shown good light fastness. The wash fastness grade for fabric printed with hot reactive dye in terms of colour change was found to be good and the printed fabric showed little staining on both wool and cotton fabrics. The grade for colour change for fabric printed using hot reactive dye ranged between fair to good and slight staining was observed for dry rubbing on adjacent fabric. In case of wet rubbing fair grade were observed for colour change and noticeable to slight staining was observed on the adjacent fabric. Observation for perspiration fastness for the fabric printed with hot reactive dye showed that the grade for colour change in acidic medium was good. Noticeable to slight staining was observed on wool fabric and noticeable staining was observed on cotton fabric. In alkaline medium the grade observed for change in colour was fair, slight staining was observed on wool fabrics and noticeable to slight staining was found on cotton fabric.

Printing on Fabric

Mulberry silk waste / wool blended fabric was printed using the screen printing method.

Figure 1: Screen Printing Using Reactive Orange 7 Dye

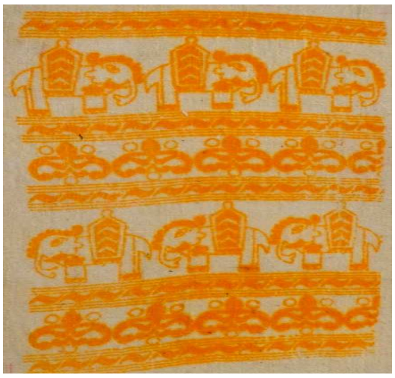

Figure 2:Screen Printing Using Reactive Orange 12 Dye

CONCLUSIONS

Outcomes of the present study affirmed that printing of mulberry silk/wool blended fabric with vinyl sulphone reactive dye is conceivable in addition with good fastness properties and bright colours.

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