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ORIGINAL ARTICLE

Dyeing of UV irradiated cotton and polyester fabrics with multifunctional reactive and disperse dyes

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Abstract The dyeing behaviour of UV irradiated cotton and polyester fabrics using multifunctional reactive and disperse dyes has been investigated. The plain, woven, mercerized, bleached, cotton and polyester fabrics were exposed to UV radiation (180 w, 254 nm) for 30, 60, 90 and 120 min. Dyeing was performed using irradiated fabric with a dye solution of un-irradiated reactive and disperse/azo dyes. The dyeing parameters such as, temperature, time, pH and salt concentration have been optimized. The colour strength values of dyed fabrics were evaluated by comparing irradiated and un-irradiated cotton and polyester fabrics in CIE Lab systems using spectra flash SF600. Finally ISO standard methods were employed to observe the effect of UV radiation on fastness properties. It was found that UV radiation has a potential to improve the colour strength values of cotton and polyester fabrics by using reactive and disperse dyes.
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1. Introduction

Love of colour is an instinct and every individual has his own choice and liking. The choice of beautiful fascinating colour reflects the aesthetic sense of humans that varies. Synthetic colours are used in the clothes we wear, in paints, plastic articles, in a wide range of multicoloured printed materials such as posters, magazines and newspapers, in photographs, cosmetics, ceramics and on television and film. Thus dyes are such coloured substances which are capable of imparting their colour to the matrix (Shukla, 1992).

Synthetic dyes are a class of highly coloured organic substances, primarily utilized for tinting textiles that attach themselves to the substances by forming a covalent bond during the application process. The use of natural dyes in textiles was eliminated since synthetic dyes give a variety of reproducible shades and colours (Deo and Desai, 1999).

Reactive dyes are the best choice for dyeing of cellulosic fibers and coloring at home or in the art studio. These dyes are coloured compounds that contain functional groups that react with OH, SH and NH_2 groups present in textile fibres. Fixation occurs in the fibre under alkaline conditions by forming

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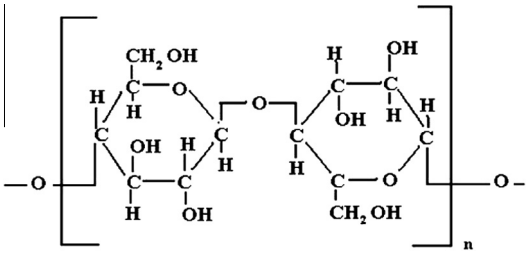
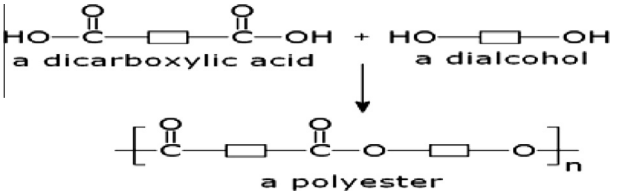
a covalent bond between carbon atom of a dye molecule and OH, NH, SH etc. groups present in the fibres (cotton, wool, silk, nylon, etc.) (Bahi et al., 1992).

Disperse dyes are synthetic chemical constituents which have a very low water solubility in their dispersed colloidal forms and are capable for dyeing and printing the hydrophobic fabrics. They are usually applied from a dye bath as dispersion by a direct colloidal absorption. Disperse dyes have low solubility in water, but they can interact with the polyester chains by forming dispersed particles. Their main use is the dyeing of polyesters, and they find minor use for dyeing cellulose acetates and polyamides (Broadbent, 2001).

Cotton cellulose is highly crystalline in nature and well oriented and has a long and rigid molecular structure. The β-1,4-D glucopyranoses are the principle building blocks of a cotton cellulose chain and are linked by 1,4-glucodic bonds. There are three hydroxyl groups attached to each anhydro glucose unit. The large number of hydroxyl groups readily forms hydrogen bonds with water and are therefore responsible for the hydrophilic nature of the cellulose fibre (Burkinshaw, 1990). Due to the presence of hydroxyl groups and the chain conformation, there are possibilities for the formation of many bonds of the dye and fabrics (intermolecular and intra molecular) (Hsieh, 2007).



The name polyester refers to the linkage of several monomers (esters) within the fibre. Polyester is a long chain polymer chemically composed of at least 85% by weight of an ester and a dihydric alcohol and a terephthalic acid.



Various treatments such as UV, ultrasonic and gamma radiation are being used to improve the colour strength and fastness properties of dyed fabric (Fazal et al., 2012; Bhatti et al., 2012a). Limited study has been performed on the effect of radiation treatment in order to evaluate the dyeing characteristics of fabric using natural as well as synthetic dyes. An alternative approach has recently been developed by using UV radiation to modify the fabric surface while leaving the bulk textile unaffected (Shao et al., 1997). Surface fibres must either absorb UV radiation directly or a suitable photo initiator must be applied to produce a large number of highly reactive radicals when the textile surface is exposed to UV (Hocker, 2002). Surface modification is particularly useful on natural fibres such as wool and cotton synthetic colourants (Millington, 2000; Adeel et al., 2013).

For the present study we have an aim to improve the colour strength and colourfastness properties of UV irradiated cotton and polyester fabrics dyed with multifunctional reactive and disperse dyes, respectively.

2. Materials and methods

2.1. Sample preparation and irradiation

Patches of grey cotton fabric (10 × 10 cm) were procured from "Lal Mill" Faisalabad and subjected for bleaching. H_2O_2 and sodium hydroxide were used each 2 ml for 10 g cotton fabric containing (1:50) M:L. Bleached cotton fabric and polyester fabrics were exposed to UV radiation source of 254 nm;

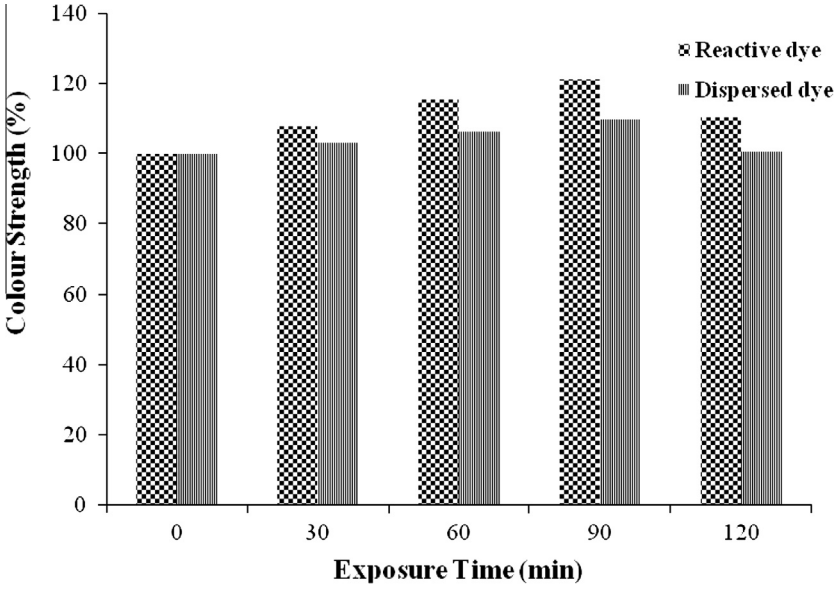


Figure 1 Effect of UV irradiation on the dyeing of irradiated cotton and polyester fabric using un-irradiated reactive and disperse dye.

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