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Dyeing of polyester/cotton fibers with reactive AZO disperse dyes in one batch processes dyeing

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ABSTRACT

Research into the process of dyeing polyester /cotton fabrics using Two disperse/Reactive dyes were synthesized by coupling diazotized N-Ethyle-N-B-Vinylsulphonylethylaniline dyestuffs one batch processes dyeing. In order to improve the different pH and temperature and concentration on the uptake cotton and polyester to dye batch in 90 c°. Cotton and polyester fabrics were dyed by reactive /disperse dye 1 and 2 in the dye batch various pH values. Both dyes were exhaustion and fixation over a pH range 6 to 8. The effect of dye concentration on the uptake of dye 1by cotton and polyester was examined and the result are shown in figures .Exhaustion and fixation increased slowly at lower dye concentration and increased somewhat at higher dye concentration.

Kay word: *cotton/polyester fibers, reactive/disperse dyes,*

Introduction

Cotton, Owing to its characteristic and excellent physical and chemical properties, has long found use as a textile fiber. Cotton can also be blended with synthetic fibers to produce a wide rang of materials. These blends are most economically dyed in one batch, in order to save water and energy. In practice, one batch dyeing is used for cotton/polyester, cotton/ silk, cotton/wool fibers. In the present study an attempt was made to overcome same of these problems by dyeing cotton/polyester with sulphatoethylsulphonyl reactive/disperse dyes.

Experimental

Material

Fabrics

Cotton/polyester fabric its 35/65 blends, enzymatic method with 2 g/l by Baylase AT (Bayer co.) at 70 c° 40 minute and then washing hat water add 0.5 g/l nonionic soap, Scoured and bleaching H2o2 35% ,4 g/l and NaoH 30% 2g/l and stabilizer 2g/l and wetting agents 1 g/l in 90c° at 45 minute and then washing hat water and cold water and air dried at room temperature when finishing in pretreatment dyeing with reactive disperse dyes.

Dyes

Two disperse/Reactive dyes were synthesized by coupling diazotized *P*-sulphatoethylsulphonyl aniline *NN*-disubstituted aniline. The chemical structures and the molecular weights of these dyes are listed in Table1.

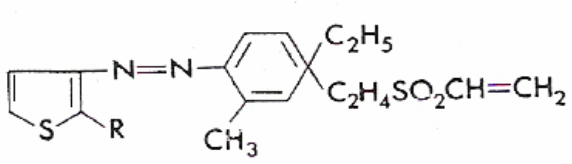

TABLE 1 Dyes used in present study

Dye	R	Subsistent	Molecular Weight
1	R_1	CH_3	414
	R_2	CH_3	
2	R_1	CH_2CH_2OH	488
	R_2	CH_2CH_2OH	

Dyeing of cotton/polyester fabric

For satisfactory dispersion in the dye batch, the dye were initially finished by mortar milling in the presence of a specially selected dispersing agent cotton/polyester fabric ere dyed in Atlas dyeing machine at a liquor ratio of 40:1 using distilled water. The dye batch were prepared with the dye at range of dye concentrations (0.5%,1%,1.5%, 2%, and 3% owf) and with 1.5 g/l anionic Carrier (Levegal PEW Bayer Co.). The pH was then adjusted to 4, 6,7,8,9 and 10 using 10% acetic acid and 0.2 mol sodium carbonate solution. Dyeing was started at 45 c for 15 minute, then the dye batch temperature was raised at a rate of 1.5-2 c/min to 90 c° and the dyeing continued at the desired temperature for a further 60 minute unless otherwise specified. Dyeing was commenced at 70c°. The dye batch temperature was raised by 1 c/min to 90 c°, maintained at this temperature for 60 min and cooled to 60c° .After 30 min at 60c°, 20g/l of alkali (Na_2Co_3) was added to effect fixation of the dye on cotton and maintained at 60c for further 30 min. The dyeing were rinsed and soaped at 95c° for 15 min with 1.5 g/l soaping agent. Figure1.

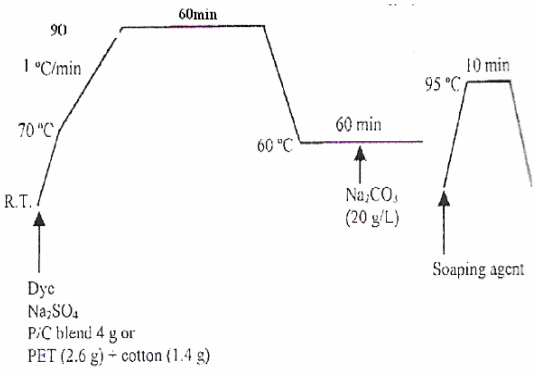

Figure1.One- batch dyeing profile of P/C blend with temporarily solubilized reactive disperse dyes

Effect of pH

Dye was introduced into the dyeing along with 200ml buffer solution at various pH values .After the dye batch temperature reached 90c°.Each 2 g cotton and polyester fiber was immersed in the liquor and kept there for 1 hr. After this the dyed sample was removed and the unreacted dye extracted with methanol. The dyed cotton and polyester were dissolved by calcium chloride/ water/ethanol mixture (1:7:2 molar ratio)and 90% formic acid respectively, cooled to room temperature and diluted to a total volume of 100ml.The concentration the solution was determined by colorimetry and the amount of dye fixed was calculated. The amount of dye removed from the batch determined by adding the amount of dye extracted to the amount of dye fixed on the fiber.

The reactive /disperse dyes used gave negligible fixation on polyester fiber and so only the unfixed dye was Determine by colorimetry of the residual solution.

Effect of temperature and total dye concentration.

A constant of dye was place in a dyeing vessel along with 200 ml buffer solution(0.01ml acetic acid 35%/sodium acetate of solution at pH6).After the dye batch temperature achieved a constant value(75,85or 90c°),both the cotton/polyester fabric were immersed in the dye batch where they remained for 0-4.5hr. The cotton and polyester fiber were also dyed in a dye batch (pH6) containing various amounts of reactive/disperse dye for 1 hr at 90c°.Exhaution and fixation of dye on the cotton and polyester fibers were determined as described previously.

Results and Discussion

Cotton and polyester fabrics were dyed by disperse/reactive dyes1 and 2 in the dye batch at various pH values. The effect of dye batch pH on the uptake of these dyes on cotton and polyester is shown in Figures 2 and 3 .Both dyes were exhaustion and fixed over a pH range6to8, but only a very small proportion of dye1 was exhaustion onto the polyester. Dye1 was taken, up more by cotton and polyester, and even less of dye 2. The more hydrophobic dye 1 was taken, up more by cotton and polyester than dye2.

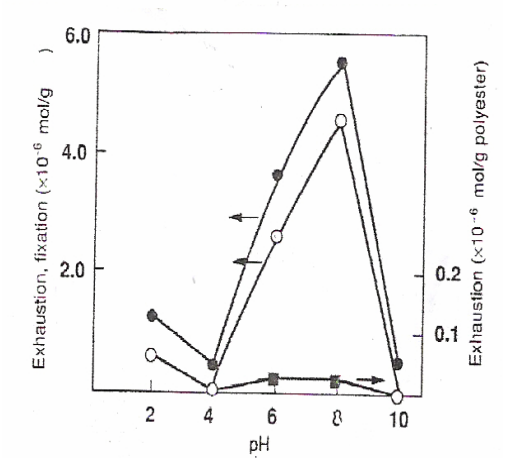

Figure 2- Effect of dye batch pH on the Uptake of dye 1 by cotton and polyester (1 hr.90c°)

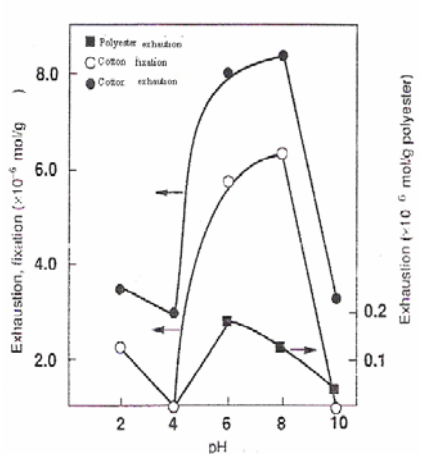

Figure3- Effect of dye batch pH on the uptake of dye 2 by cotton and polyester (1hr.90c°)

The effect of dye concentration on the uptake of dye 1 by cotton and polyester was examined and the result are shown in figure4.Exhaution (on cotton and polyester)and fixation (on cotton)increased slowly at lower dye concentration and increased some what at higher dye concentration. This is due to the low solubility of dye 1 in water. The extent of exhaustion of dye1 on cotton was over 20 times that on polyester at 10^{-4} ×1.5 mol/l total dye concentration.

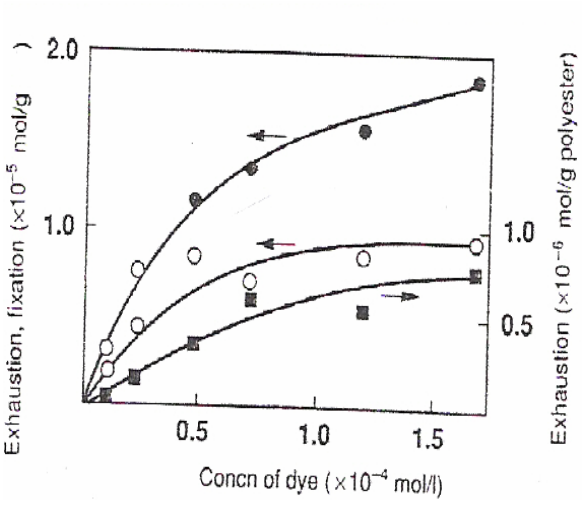

Figure4-Effect of dye batch concentration uptake of dye 2 by cotton and polyester (pH6, 1hr.90c°)

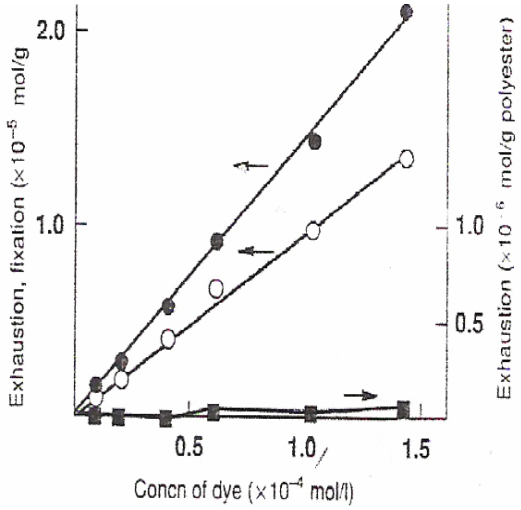

Figure5-Effect of de batch concentration on the uptake of dye 1 by cotton and polyester (pH6.1Hr. 90c°)

The relationship between the uptakes of dye 2 concentration is portrayed in Figure5.Exhaution and fixation of dye 2 on cotton increase linearly with dye Mol/both parameters were 10^{-4} ×1.5 Concentration. At a total dye concentration greater with dye 2 than with dye 1.Dye 2 dissolved the more readily in water and thus the reaction was promoted by an increase in dye concentration .Dye2 failed to be adsorbed onto polyester owing to its high hydrophilic character, even at higher concentrations.

Adsorption of reactive/disperse dyes on cotton/polyester

The effect of dye batch pH on the uptake of reactive/disperse dyes by cotton and polyester was examined and the result are shown in Figure. 6 and 7. The dye uptake of dye 1 on cotton reached a maximum at pH 8 and 6 - 8 respectively. The ratio of fixation to exhaustion was found to be very high. At pH 6 the uptake of both dyes on cotton was very similar to that on polyester. Dyeing experiments were thus carried out at pH 6 at constant dye concentration .Figures 8 and 9 indicate the variation in exhaustion and fixation with time respectively for dye 1. While Figures 10 and 11give similar information for dye 2.

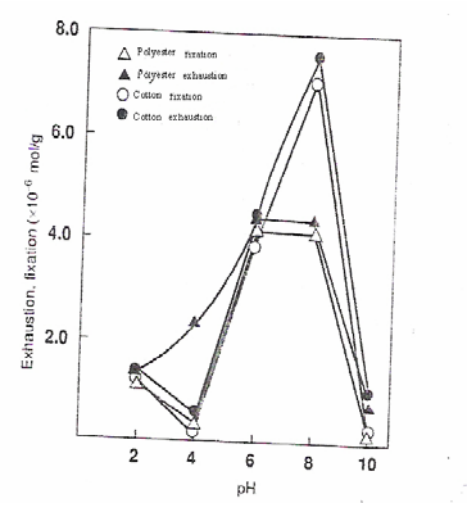

Figure 6-Effect of dye batch pH on the uptake of dye 1 by cotton and polyester

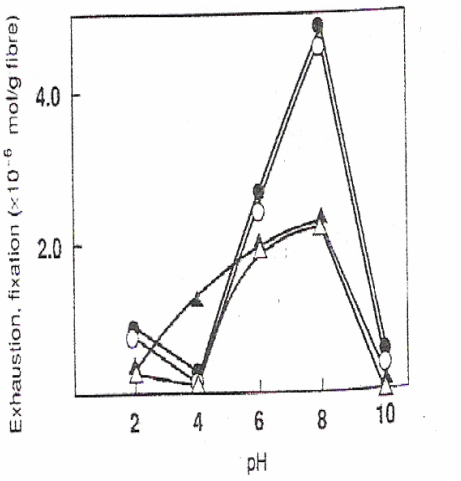

Figure 7-Effect of dye batch pH on the uptake of dye 2 by cotton and polyester (1hr.90c°)

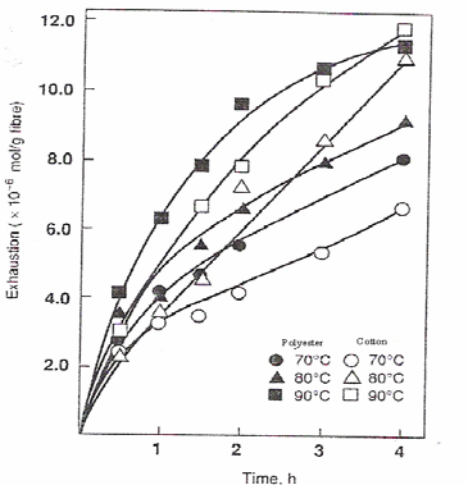

Figure8-Exhaution rate of dye 1 on the cotton and Polyester at pH6

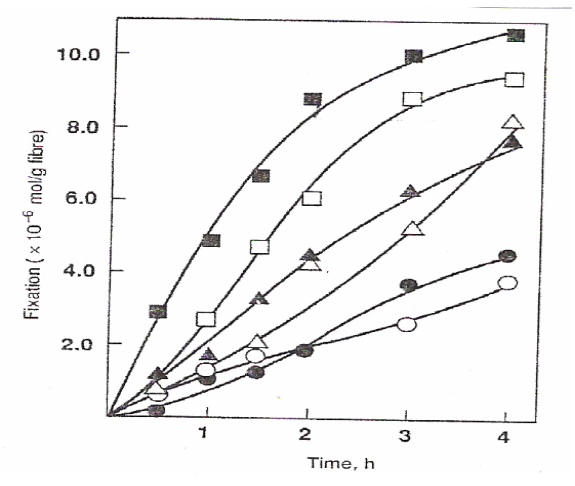

Figure 9- Rate of dye on cotton and polyester Fixation at pH 6

Exhaustion and fixation increase were noted with temperature and time in all cases. Increases were noted even after 4 hr.

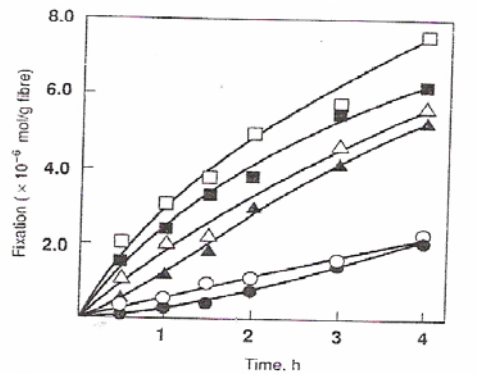

Figure10- Exhaustion rate of dye 2 on cotton And polyester at pH6

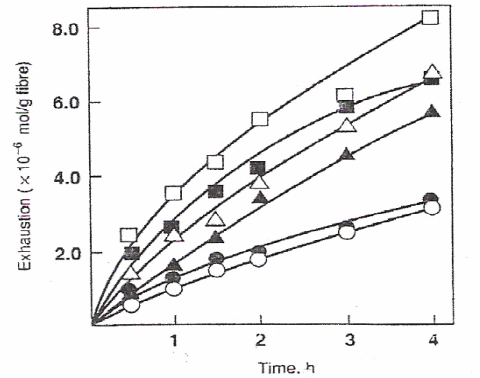

Figure11-Fixation rate of dye 2 on cotton And polyester at pH 6

The dyeing rates observed when using reactive /disperse dyes for cotton were essentially the same as those for polyester; this similarly was also found in the relationship between dye uptake and concentration (Figure 12 and13).The relationship between exhaustion or fixation and dye concentration in the dyeing of cotton with reactive / disperse dyes was virtually the same as in case of polyester.

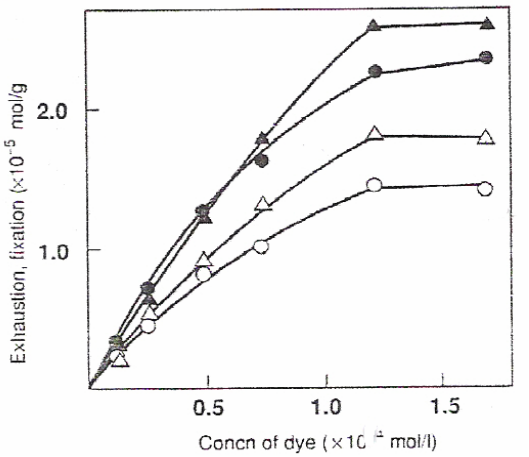

Figure12-Effect of dye concentration on the uptake of on the uptake of dye 2 by cotton and polyester (PH 6.1hr.90C°)

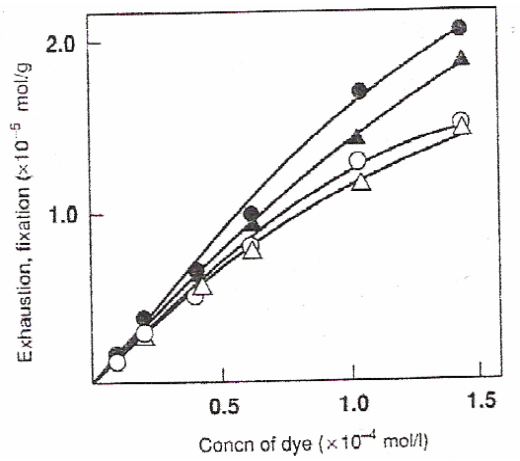

Figure 13-Effect of dye concentration Dye 1 by cotton polyester (Ph6.1hr.90c°)

The maximum degree of adsorption of dye 1 on polyester was about 2.6 Mol/g, this being less than the amount of groups in polyester .It is for this reason that polyester adsorbs dye 1 to the same degree as dose cotton.

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