The International Conference on Dyeing and Finishing
EXCO, Daegu, Korea, March 13, 2009

Application of Reactive Disperse Dye to Mixture Fabrics

Yeon Ji Choi, Jong Lyel Lee, and Sung Dong Kim

Department of Textile Engineering, Konkuk University
1 Hwayang-dong, Kwangjin-gu, Seoul, 143-701, Korea
E-mail: ssdokim@konkuk.ac.kr

1. INTRODUCTION

Properties of different fibers can be expressed in a fabric by blend of fibers or mixture weaving. Recently the production of mixture fabrics such as N/P, N/C and P/NP have increased due to their special handle and unique appearance. Dyeing of mixture fabric is required of careful treatments because the component fibers have different dyeing and physical properties. The two-bath dyeing method, even though the processing time is quite long, is frequently employed in dye-house to secure one-tone effect and acceptable color fastnesses of the mixture fabric. The one-bath dyeing, which can save considerable processing time and energy, often results in deteriorating quality of dyeing and color fastness, caused by the staining one fiber with a dye for the other fiber. One of the possible way to achieve efficient one-bath dyeing of blends or mixture fabrics is the development of a universal dye which alone is capable of dyeing component fibers in a blend or mixture fabric[1]. Disperse dyes with reactive group are considered to be the most appropriate to the dyeing of blend or mixture fabrics[2-4]

The purpose of this study is to investigate dyeing properties of four disperse dyes having sulphatoethyl-sulphone group on mixture fabrics.

2. EXPERIMENTAL

Four reactive disperse dyes, whose chemical structures are shown in Figure 1, were synthesized and purified by the standard procedures. HPLC(ACME 9000), FTIR(Jasco 300E), UV/Vis(UV Mini 1240) were used for characterization of synthesized dyes.

Dyeing was carried out in the sealed dyepot(Labomat), pH was adjusted with buffer solutions according to the substrate, and a liquor ratio was 30:1. Temperature was raised from 30℃ to the highest dyeing temperature(N/P 120℃; N/C 100℃; P/C 120℃), and dyeing was continued at the highest dyeing temperature for 60 min, then the temperature was lowered to 80℃. Dyed fabric was reduction cleared, rinsed and dried.

All chemicals used in the synthesis, analysis and dyeing were laboratory grade reagents. N/P mixture fabric(warp, nylon 70d/68f; weft, PET 150d/288f; N/P=53/47), N/C mixture fabric(warp, nylon 70d/24f; weft, CM 24's; N/C=35/65), P/C mixture fabric(warp, PET 150d/288f; weft, CM 30's; P/C=65/35) were used for dyeing.

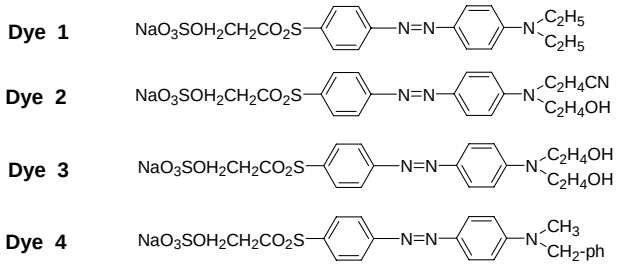

Figure 1. Chemical structure of four reactive disperse dyes.

3. RESULTS AND DISCUSSION

Reaction yield, purity, molecular weight, and molar extinction coefficient of the dyes are shown in Table 1.

Table 1. Physical properties of dyes synthesized

Dye	Purity (%)	Yield (%)	M.W (g/mol)	λ_{max} (mm)	ε (l/molcm)
1	96.30	59.21	463.50	488	25,400
2	97.13	64.30	504.51	457	24,600
3	95.70	61.19	495.50	472	29,400
4	96.81	83.40	511.55	473	30,100

Distribution of Dyes 1 and 4 between nylon and PET at 1%owf dyeing were measured and shown in Figure 2. Dyes were mainly absorbed by nylon fiber at the early stage of dyeing and started to be absorbed by PET at 100~120℃. The final color strength(K/S) of nylon was higher than that of PET. Both dyes showed similar behavior. Univadine PB is an auxiliary to accelerate the diffusion of dyes into hydrophobic fibers, and it was used in order to enhance the dye uptake of PET side. As shown in

Figure 3, Univadine increased the dye uptake of PET to a smaller extent than expected.

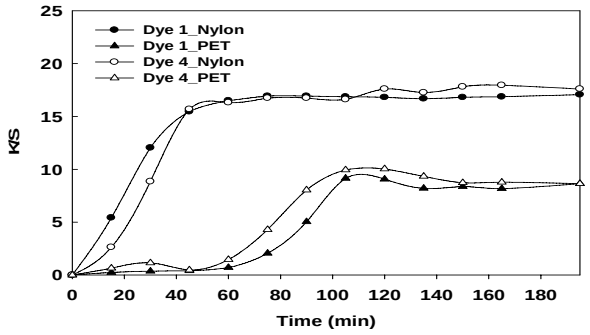

Figure 2. Distribution of Dyes 1 and 4 between nylon and PET.

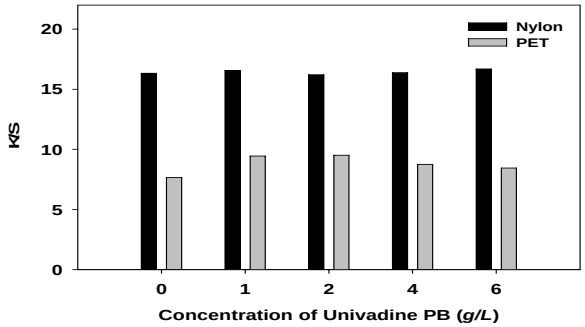

Figure 3. Effect of auxiliary to color yield of Dye 1.

Distribution of Dyes 2 and 3 between nylon and cotton were measured and shown in Figure 4. Cotton fiber absorbed dyes from the start of dyeing and reach the apparent equilibrium at 90℃ (40min). Nylon fiber started to absorb dyes after 30 min, but continued to absorb dye molecules to the final stage of dyeing. Dye 3 which had two hydroxyl groups was expected to be absorbed onto cotton fibers more easily than Dye 2, but the result showed the color strength of both dyes was quite similar.

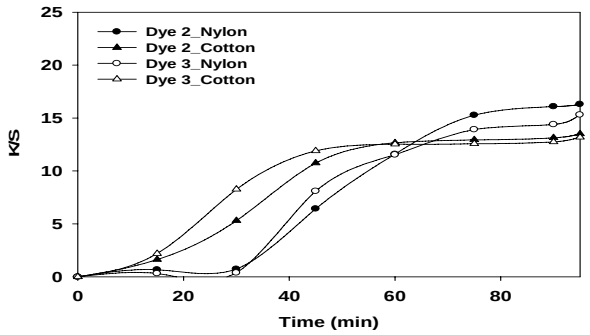

Figure 4. Distribution of Dyes 2 and 3 between nylon and cotton.

Distribution of Dye 4 which was the most hydrophobic among dyes between cotton and PET were examined and shown in Figure 5. PET fiber absorbed Dye 4 dominantly, but cotton fiber did absorb very small amount of Dye 4.

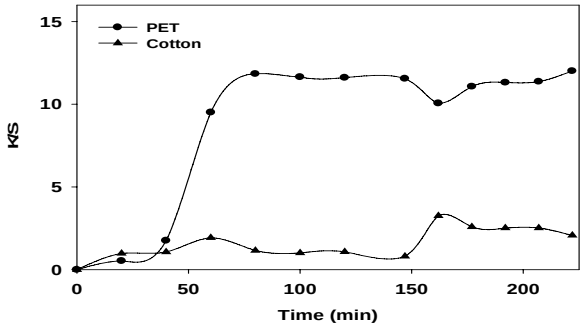

Figure 5. Distribution of Dye 4 between PET and cotton.

4. CONCLUSIONS

Dyes 1 and 4 which did not have hydrophilic group were suitable to the dyeing of N/P blend fabric. N/C blend fabric could be dyed with Dyes 2 and 3 which had hydrophilic hydroxy group. When Dye 4 was applied to P/C blend fabric, it was absorbed much more onto PET than cotton.

5. REFERENCES

[1] H. S. Freeman and J. Sokolowska, *Rev. Prog.Coloration*, 29(1), 8-22(1999).
[2] K. S. Kim et al, *J. Korean Fiber Soc.*, 38(2), 683-692(2001).
[3] S. D. Kim et al, *J. Korean Fiber Soc.*, 39(6), 723-730(2002).
[4] S. D. Kim et al, ; *J. Korean Soc. Dyers Finishers*, 16(1), 26-33(2004).