Disperse Dyeing of Synthetic Fiber using Cotelomer Type Surfactants as Auxiliaries

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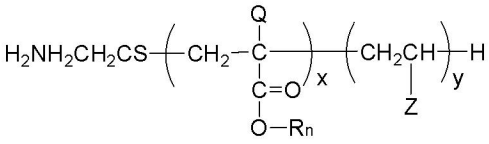
1. Introduction

Recentlyextensive investigations have been undertaken on dyeing with double tailed natural and synthetic amphiphiles as auxiliaries[1]. We have reported the application of Calix[4]resorcinarenes, having alkyl chains and phosphate functions as auxiliaries for the disperse dyeing of synthetic fibers[2]. We have synthesized telomer type anionic surfactantsof alkyl acrylate and acrylic acid (xR_nA-yAA) and alkyl metacrylate and acrylic acid (xR_nMA-yAA) having multi-hydrophilic function[3,4], and used them as auxiliaries for disperse dyeing[5].

In"@this work we prepared nonionic surfactants of a cotelomer type having alkyl methacrylate and vinyl alcohol (xR_nMA-yVA) and investigated their properties as auxiliaries for the disperse dyeing of cellulose acetate, nylon-6 and polyester fibers.



xR_nA-yAA	Q=H, R_n=$(CH_2)_nH$, Z=COO^-Na^+
xR_nMA-yAA	Q=CH_3, R_n=$(CH_2)_nH$, Z=COO^-Na^+
xR_nMA-yVA	Q=CH_3, R_n=$(CH_2)_nH$, Z=OH

2. Experimental

Cotelomers xR_nMA-yVA were prepared by the radical cotelomerization of vinyl acetate (VAc) with alkyl methacrylate (R_nMA) in presence of 2-aminoethanthiol followed by hydrolyses in alkaline solution. The disperse dyes used were 1,4-diaminoanthraquinone (DAA) and Disperse Blue 14 (DB14). To measure degree of dispersion, aqueous solutions containing 0.1 g/L of the dyes and 0.1-2.0 g/Lof the cotelomers were stirred at 95 °C for 120 min at pH 8. The mixtures were kept standing for 30 min at 95 °C, filtered with No. 2 filter paper, and the filtrates were diluted with acetone to measure the concentration of

the dyes using a spectrophotometer. Centrifugation of the filtrate revealed that it contained about 70 and 30 % of dispersed and dissolved dye, respectively. Mixed solutions of the dye (0.1 g/L) and the cotelomers (0.1-2.0 g/L) were applied to cellulose acetate, nylon-6 and polyester fabrics for 120 min at 95, 95 and 120 °C, respectively. The absorbed dyes were extracted from fiber with solvents to estimate the dye uptake spectroscopically.

3. Results and Discussion

The abilities of the cotelomer type surfactants with carbon number of alkyl chain (n) of 6 and degree of polymerization degree of 10 to disperse the dyes were examined. The dispersibility of disperse dyes after shaking reached a maximum value at auxiliary concentration of 0.2 g/L. Figure 1 shows plots of dispersion of DB14 against monomer unit ratio (x/y) of cotelomer with carbon number of alkyl chain (n) of 6 and degree of polymerization of 10. The cotelomer with the monomer unit ratio (x/y) of 0.35 gave the highest dispersion of the dye.

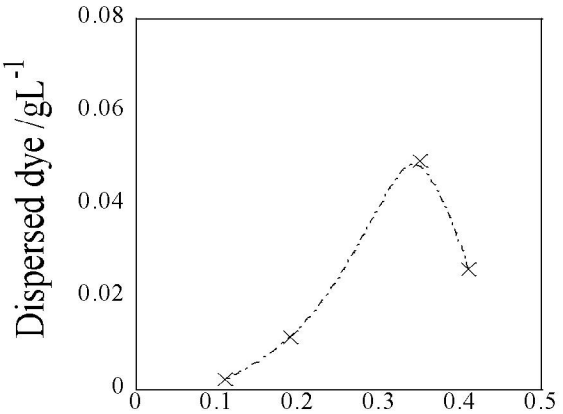


Fig. 1. Plot of dispersion against the structural parameter (x/y) using **DB14**. [Dye]=0.1 gL-1; [Auxiliary]=0.2 gL-1; pH 8; after filtering.

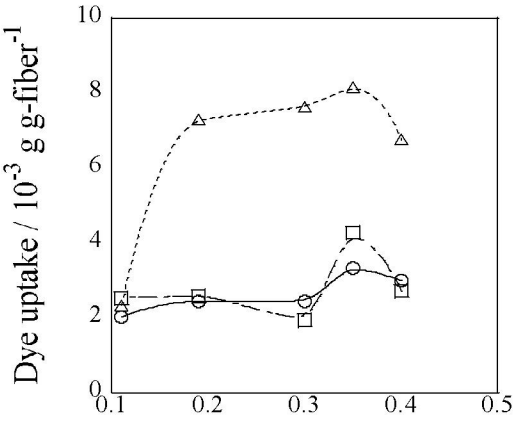


Fig. 2. Plot of dispersion and dye uptake against the structural parameter (x/y) using DB14. [Dye]=0.1 gL-1; [Auxiliary]=0.2 gL-1; pH 8.○, Cellulose acetate; □, Nylon-6; △, Polyester.

In the disperse dyeing of each fiber using cotelomer type surfactants as auxiliaries, the dye uptake increased with increasing concentration of the auxiliary until reaching a maximum around the concentration of 0.2 g/L. Further increase of the concentration resulted in the reductionof the dye uptake. Cotelomer gave the highest degree of dispersionand dye uptake at the same concentration. The dependence of dye uptake on the structural parameters resembled those of dispersion of the dye in aqueous solution. The cotelomer with the monomer unit ratio (x/y) of 0.35 gave the highest dye uptake for each fiber (Fig.2) and the highest dispersion of the dye. The dispersibility of dye plays an important role in properties of

surfactants as auxiliaries for disperse dyeing.

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