The Application of Syntan to Improve the Solid Shades of Wool/Silk Blends

Ren-Cheng Tang, Fang Yao

College of Textile and Clothing Engineering, Soochow University
178 East Ganjiang Road, Suzhou 215021, China
E-mail: tangrencheng@suda.edu.cn

1. INTRODUCTION

syntans are mainly used as the fixing agents to improve the wet fastness properties of acid dyes on nylon fibers [1,2], and as the dye-resist agents to protect the nylon component from cross-staining during the dyeing of wool/nylon and cellulosic/nylon fiber blends [2-4]. To our best knowledge, there has been no work reported on the application of syntan to the dyeing of wool/silk blends. When wool/silk blends are dyed in one dyebath, wool has higher apparent color strength than silk, and the solid shades must be improved by means of the selection of dyes employed as well as the control of pH and temperature [5]. In this work, the new application of syntan to improve the solid shades of wool/silk blends dyed with acid milling dyes was investigated.

2. EXPERIMENTAL

Wool and silk adjacent fabrics for color fastness tests were used for dyeing experiments. A commercial syntan of Mesitol NBS was from LanXess Co.; it is a methylene-bonded condensation product of aryl-sulfonic acids and hydroxyaryl sulfone. Everacid A and N acid dyes were supplied by Everlight Chemical Industrial Co.

In order to imitate the one-bath acid dyeing of wool/silk blends, wool and silk fabrics with the same weight were dyed together in the dyebath composed of 2%omf dye, 2.5%omf syntan and buffer (pH 5, HAc/NaAc) using a 50:1 liquor ratio. The dyeing was performed as follows: the dyebath was raised from 40 to 85°C over 45 minutes (1°C/min), and held for 60 minutes. The samples were then rinsed and dried at room temperature. The experiments of the sorption rates and istherms of syntan on wool and silk as well as the measurements concerned were carried out as described earlier [4].

3. RESULTS AND DISCUSSION

The sorption rates and isotherms of syntan on wool and silk are shown in Figs. 1 and 2, respectively. The sorption of syntan on silk was obviously faster and higher than that on wool. Therefore it may be postulated that when wool/silk blends are treated in syntan solution a competition of synan sorption on wool and silk will occur and the syntan will be primarily and rapidly absorbed by silk.

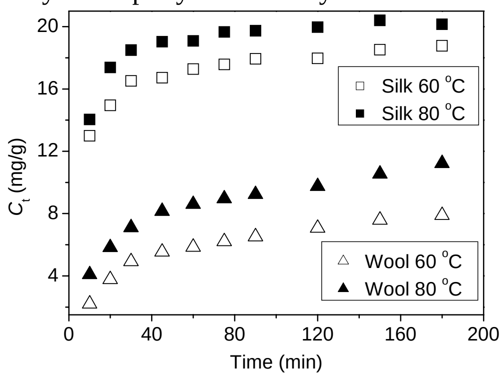

Fig. 1. Sorption rates of syntan on wool and silk at pH 4 using a 50:1 liquor ratio. Initial syntan concentration: 3%omf.

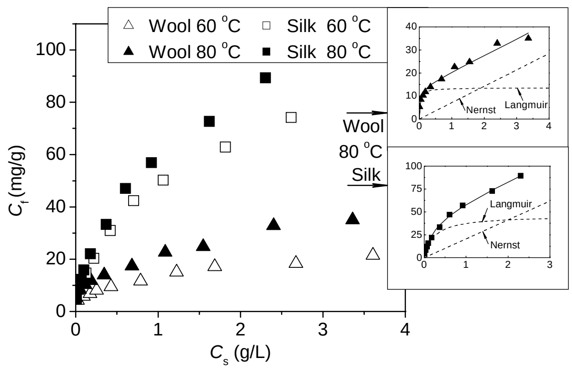

Fig. 2. Sorption isotherms of syntan on wool and silk at pH 4 for 5h using a 50:1 liquor ratio.

The isotherms were analyzed by the dual sorption mechanism of Langmuir plus Nernst-type partitioning which was previously proposed for the sorption of syntan on nylon [4]. The results fitted by nonlinear least squares fitting procedure shows that the proposed sorption mechanism is applicable to wool and silk, due to the exact superposing of all of the experimental points with the fitted curves and the very high correlation coefficients. This suggests that under acidic conditions, the sorption of syntan occurs on the protonated amino groups in protein fibers by

Langmuir mechanism, and by virtue of hydrogen bonding between the uncharged polar groups in syntan and protein fibers and hydrophobic interaction between the non-polar moieties in syntan and protein fibers by partitioning mechanism.

The sorption of anionic syntan on protein fibers had certain influence on the uptake of acid dyes. Although syntan exhibited the higher extent of uptake by silk than by wool, the great influence of syntan on the dyeing rates and the apparent color depth was observed for wool and not for silk in the two cases of the respective dyeing of wool and silk with C.I. Acid Red 249 (Fig.3), and the dyeing of imitated wool/silk blends (Fig.4).

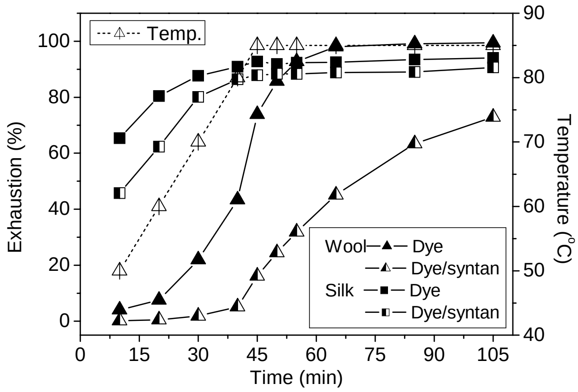

Fig.3. Uptake rates of Red 249 by wool and silk in the absence and presence of syntan.

As shown in Fig.4, wool exhibited extremely higher color depth than silk for all of acid dyes used and two fibers had poor solid shades when dyed in the absence of syntan. For the application of the dyes with two sulfonate groups except Blue 113, the color depth of wool decreased markedly and that of silk had small changes in the presence of syntan, and as a result the union dyeing properties were clearly improved. However the similar phenomenon was not found for the dyes with one sulfonate group. This indicated that syntan exerted the good reserving effect on the uptake of the dyes with two sulfonate groups by wool.

Taking into consideration the lower sorption of syntan on wool than on silk, the higher content of amino groups in wool, the higher resist effectiveness of syntan towards wool dyeing and the mechanism of the dye-resist action of syntan reported previously [2, 4], it is suggested that the ability of syntan to resist the uptake of the acid dyes with two sulfonate groups and large molecular weight by wool is primarily attributed to a decrease in the coefficient of dye diffusion within fiber interior caused by the existence of the large molecular size syntan in the scale layer of wool, although the ion-ion repulsion effects operating between the anionic syntan and anionic dye molecules occur.

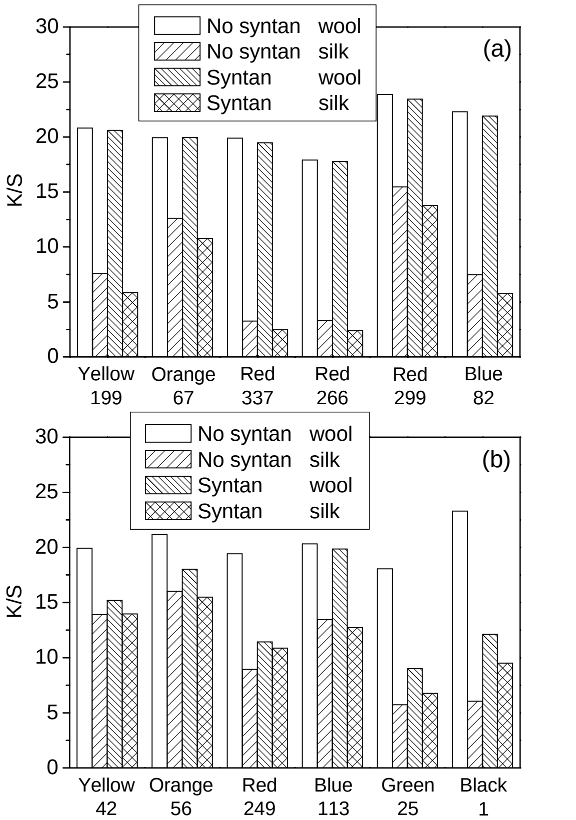

Fig.4. Effect of syntan on the color depth of imitated wool/silk blends dyed by acid dyes with one (a) and two (b) sulfonate groups.

According to the results obtained in the effect of initial syntan concentration on the color depth of imitated wool/silk blends, it is found that for the good solid shades to be obtained the optimum syntan concentration varied greatly with the dyes used. In order to verify the foregoing dyeing results obtained for imitated wool/silk blends, the actual wool/silk blends were dyed with acid dyes with two sulfonate groups and large molecular weights (600-750). The visual estimation showed that the good solid effects were obtained for the dyeing in the presence of syntan. In addition, the good fastness to washing was also reached according to the testing results.

4. REFERENCES

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