THE AFTERTREATMENT OF ACID DYEINGS TO IMPROVE WASH FASTNESS ON NYLON FIBERS

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Introduction

Nylon, one of the most widely used synthetic materials, has enjoyed great success in many areas due to its excellent physical properties, good dyeability and pleasant aesthetic. Of the many types of anionic dye that are substantive to nylon substrates, acid dyes are most widely used. Although nylon fiber is dyed predominantly with acid dyes, the level of wash fastness properties displayed by members of this class on nylon fiber often leaves much to be desired. As a consequence, an aftertreatment is usually required to secure satisfactory wash fastness properties. In addition, the fastness of dyeings to repeated washing has become increasingly important in recent years in response to increased consumer and retailer demands [1-4]. In this context, the work herein comprises an investigation of an aftertreatment process for acid dyed nylon fibers in terms of their wash fastness properties.

Experimental

Dyeings

Scoured, knitted nylon 6.6 (78f/68) was dyed with the following chosen acid dyes: C.I. Acid Red 182, C.I. Acid Orange 144 and C.I. Acid Violet 90. All acid dyeings were carried out in a laboratory scale dyeing machine. Levelling agents were not used. A buffer was used to insure a pH of 6 for the acid dye baths. Samples were placed in a 40°C solution of 25:1 liquor ratio. After 10min, the temperature was raised at a rate of

2°C/min until reaching 98°C. Dyeing continued for one hour at this temperature.

Aftertreatment

Syntan aftertreatment

Samples that had been dyed with acid dyes were aftertreated using commercial syntan employing a liquor ratio 20:1. The 3% omf syntan solution was adjusted to a pH of 3.5 by acetic acid. The temperature was raised to 80°C and sustained for 30min.

Cationic agent aftertreatment

The dyed and syntanned nylon fibers were consequently placed with cationic agent using liquor ratio 20:1. Samples was treated with solution of 2% omf cationic agent at pH 6. The treatment was carried out for 20min at 40°C.

Fullbacktan aftertreatment

The dyed nylon was backtanned using the single-bath and two-stage process. The treatment was conducted at 70°C for 20min. In the first stage, 2% omf tannic acid was applied at pH 3.5 and then 2% omf fixing agent was employed in the subsequent stage.

Color measurement

All measurement was carried out using an *X-rite* spectrophotometer interfaced to a PC using D65 illumination, 10° standard observer with specular component excluded and UV component included. Each fabric was folded once to give two thickness and an average of four readings was taken each time.

Wash fastness test

The ISO 105:C06/C02 wash test method [5] using SDC multifiber strip fabric as an adjacent material was used; the samples were sequentially washed five times. The reduction in depth of shade that occurred as a result of washing was calculated.

Results and Discussion

The Figure 1 shows the reduction in color strength that occurred for dyeing of acid dyes, as a result of the five consecutive wash tests. It is apparent that the reduction in colour strength achieved for the non-aftertreated dyeings increased with increasing number of washes thus showing that dye loss occurred in a progressive manner. Cleary, each of the three aftertreatments reduced the extent of dye loss that occurred during repeated washing. In addition, the Figure 1 represents the difference between the three types of 1:2 pre-metallised acid dyes in terms of their wash fastness behavior on nylon fibers. The extent of shade change that occurred during extended washing generally increased with increasing degree of sulfonation of the dyes.

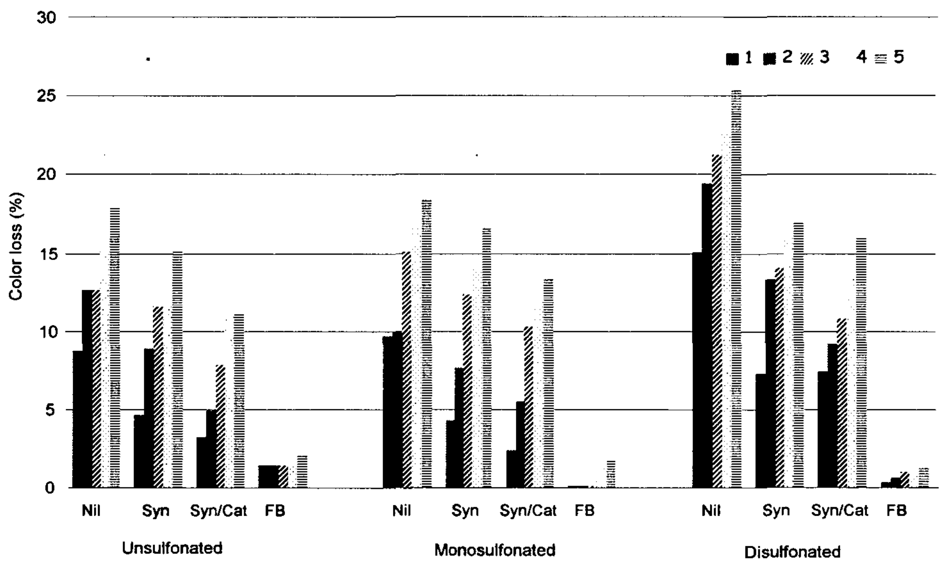

Figure 1. Color loss for acid dyeings over 5 repeated wash tests

In contrast, the extent of staining of the nylon component in the adjacent multifiber strip during washing decreased with increasing sulfonation of the dyes (Figure 2). This observation in washing can be explained in terms of the difference in the aqueous solubility of the three types of dye. The disulfonated types of dye are easily removed during washing because these members are the most water-soluble but the removed dyes display little tendency to stain adjacent materials due to their high water-solubility. In addition, Figure 2 shows that the corresponding assessments of staining of the multifiber strip achieved for the dyeings after one and five washes also support the findings displayed in Figure 1 in terms of the effectiveness of the aftertreatments.

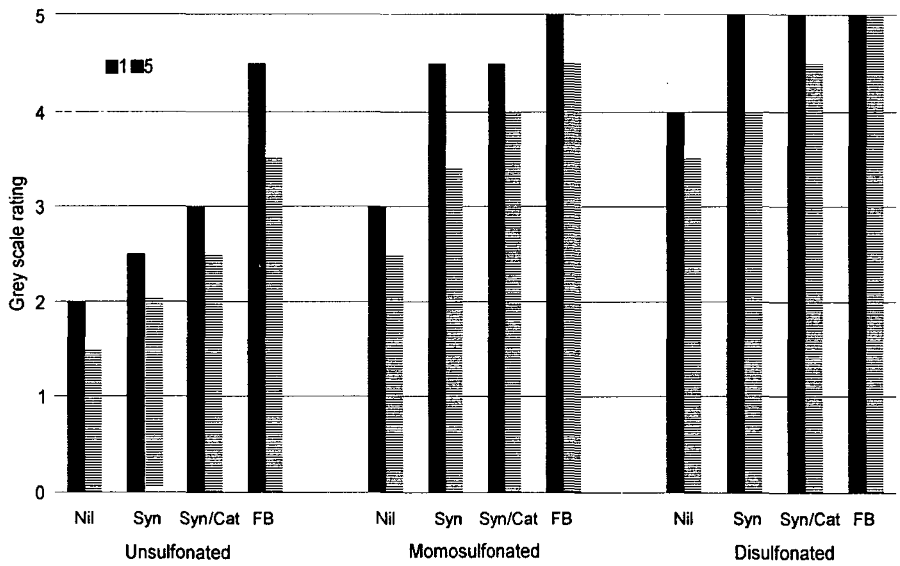

Figure 2. Effect of wash tests on the grey scale rating to the nylon component

Conclusions

The results show that the extent of dye loss that occurred during washing generally increased with increasing degree of sulfonation of the dyes. In the case of staining, it decreased with increasing sulfonation of the dyes. The treatment using three systems was considerably effective to improve wash fastness properties in terms of both reduction in color strength and staining.

References

1. S.M. Burkinshaw, "*Chemical Principles of Synthetic Fiber Dyeing*", Chapman & Hall, London (1995).

2. T.M. Baldwinson & ed. J. Shore, "*Colorants and Auxiliaries*", Society of Dyers and Colourists, Bradford (1990).

3. D.P. Bishop & ed. C.M. Carr, "*Chemistry of the Textiles Industry*", Chapman & Hall, London (1995).

4. Young-A Son & S.N. Chevli, "*1999 AATCC IC&E*", Charlotte (1999).

5. *Method of Test for Color Fastness of Textiles and Leather*, 5th edition, Society of Dyers and Colourists, Bradford (1990).