

EFFECTS OF WATER HARDNESS ON COLOR OBTAINED IN DYEING OF POLYESTER MICROFIBER

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Abstract

Polyester fibres can be dyed to dye classes that have low solubility in water. Water is the most important processing for dyeing. The quality of textile fabrics is affected by the water quality. In this paper, azo disperse dye was used to dye polyester microfibers under changing dye bath and anionic sequestering agent concentrations. The effects of some treatment variables on L^ , a^* , b^* and K/S between absence and presence of a anionic sequestering agent are examined.*

Keywords: water hardness, polyester microfiber, colour values.

INTRODUCTION

Polyester microfibres are a new generation of polyester fibres which are characterized with their low fibre fineness.[1] Dyeing of microfibres is different from normal-denier fibres due to the increased surface area of microfibres. [2] Disperse dyes are the most important class of dye used in dyeing of polyester fibres and provide a range of hues with good built-up.[3] The quality of textile products is affected by the water quality. Chlorine, iron and treatment chemicals have a major effect on dyeing process. Shade variation can be caused by chlorine contamination of water. This can cause color loss for many classes of dyestuff. Shade variation can also be caused by metal such as iron, copper and other metals. These metals are known to affect many dyes, especially disperse dyes. Traces metals can change the shade of disperse colors, for example, the colors of azo dyes are reduced by metallic salts. The most common metals affecting shade variation of textile goods in water are aluminium, copper, manganese and iron. [4]

EXPOSITION

The disperse dyeings were performed on polyester microfibre plain weave fabric. The fabric was scoured under controlled mill conditions and prepared for dyeing in the laboratory.

Three different water hardness qualities were used in dyeing experiments.(in Table 1).

Table 1. Properties of the water hardness

Water No	Water Hardness(°Fr)
I	1.2
II	2.6
III	4.3

Dyeing Conditions

Dyeings were carried out under the following conditions in Table 2.

Table2. Dyeing conditions

Dyes used	C.I.Disperse Red 73(medium energy dye)
Auxiliary	1g/L non-ionic leveling agent, 4 different concentration of anionic sequestering agent.
pH	5.5 (adjusted with acetic acid)
Dyeing temperature	start at 50°C and heat to 70°C at 2°C/min and 130°C at 1°C/min
Dyeing time	45 minutes
Liquor-to-good ratio	40:1

Dyeings were carried out at three different dye bath concentrations and four different sequestering agent concentrations. The dyed samples weighed 2.000(±0.005) grams and

dyeing liquor was 80 ml. All the chemical additions were made according to the instructions of the dyestuff manufacturer. After the dyeing, the samples were washed with cold water and a reduction clearing was made with sodium dithionite (2g/L) and soda (1g/L). Solution at 70°C for 30 minutes. Later, the samples were rewashed with cold water and were left to dry under laboratory conditions.

In this paper, colour values (L^* , a^* , b^* and K/S) of disperse dye was obtained on polyester microfiber under changing three different dye bath concentrations and four sequestering agents concentrations. L^* , a^* , b^* color values, expressed as the K/S value, of the dyed fabrics was measured at the wavelength of maximum absorbance and calculated by the Kubelka-Munk equation:

$$K/S = \frac{(1-R)^2}{2R} \quad (1)$$

where K is the light-absorption coefficient, S , the light-scattering coefficient, and R , the reflectance measured at wavelength of minimum reflectance 520nm for C.I. Disperse Red 73.

The color measurements were performed on a X-rite CFS57CA reflectance spectrophotometer connected to a PC between 400-700 nm under D65/10° illuminant.

In CIELAB color space, L^* values represent the lightness/darkness axis, a^* values represent the red-green axis and b^* values represent the yellow-blue axis.

L^* values are presented in Figure 1. L^* results under the all dye concentrations showed the same tendency. L^* values decrease as the dyeing concentration and water hardness increase. In this situation, the increase in lightness of samples was obtained.

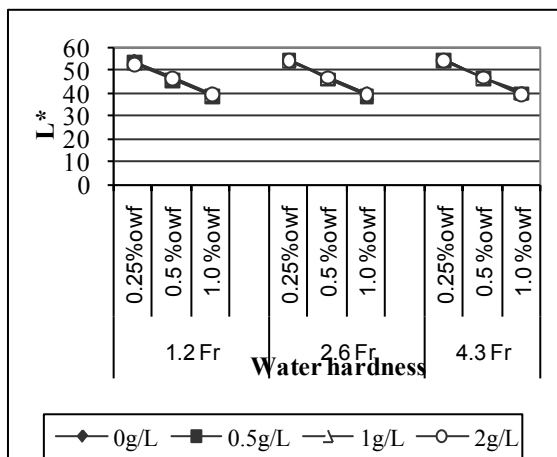


Figure 1. L^* values

a^* values are presented in Figure 2. a^* values increase as the dyeing concentrations increase. As shown in the graph in a^* values, the color shifts from red to white as the water hardness increases.

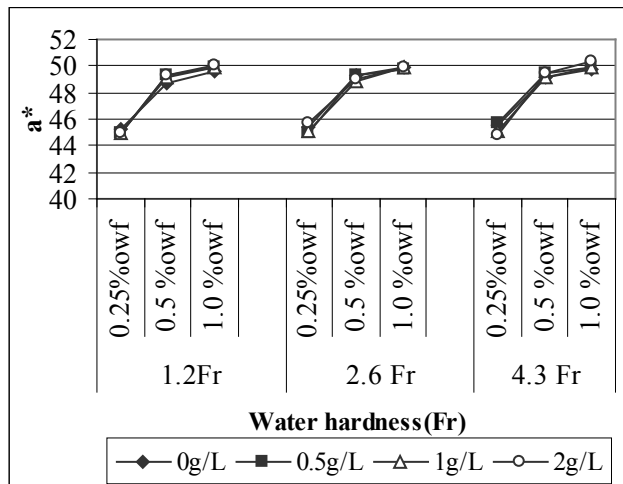


Figure 2. a^* values

b^* values are presented in Figure 3. b^* values of 1.2 °Fr are more sensitive to dye concentration changes. b^* values show different changes for 1 g/L sequestering agent concentration. For all water hardness, the color of the samples shift to yellower on a^* - b^* plane.

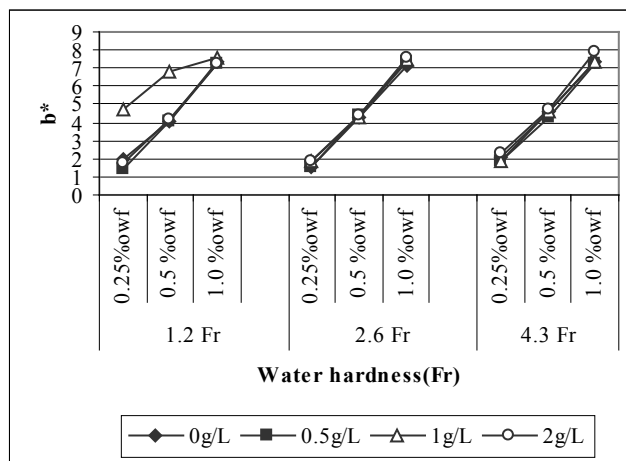


Figure 3. b^* values

K/S values are presented in Figure 3. K/S values of azo red dye are sensitive to dyeing concentration changes when dyeing with three different water hardness.

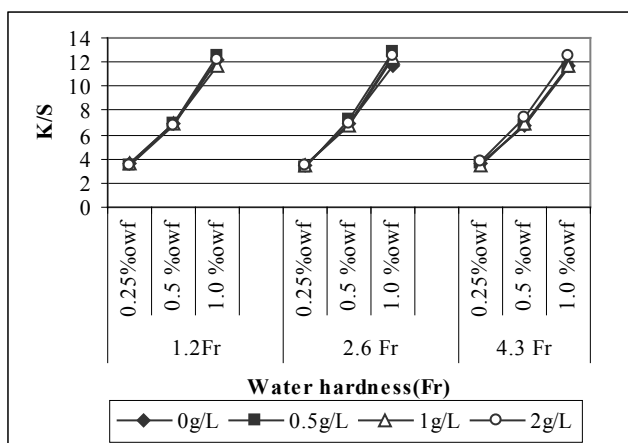


Figure 3. K/S values

CONCLUSION

Colour values of azo red disperse dyes on polyester microfiber under changing dye concentration and water hardness is presented in this paper.

The quality of water, in particular hardness, can have a significant effect on disperse dyeing.

It is important to use a sequestering agent that is stable to high temperatures and is effective within the pH range of the dyeing process.

Dyeing of different water hardness and different concentration sequestering agents show regularly changes. K/S values increased when water hardness increases color efficiency is increased with water hardness. The results obtained with L* values. Therefore, water hardness has effect on polyester microfibre.

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