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Synthesis of Novel Disperse Dyes based on Arylazophenols: Part 5. A Comparison between Dyeing Methods at Low and High Temperatures for Polyester Fabrics

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Abstract

In this work, a comparison of dyeing with the two methods of using high and low temperatures was studied. It has also been shown that dyeing using high temperature is better than using low temperature

***Keywords*:** Disperse dyes, Arylazophenols, .Low and High temperature dyeing *methods*

1. Introduction

Since the invention of synthetic fabrics, the use of dispersion dyes in textiles has steadily increased thanks to easy-to-use manufacturing methods. Reconstituting the dye bath with the necessary quantity of dyes and agents to prevent and reduce contamination is one way to reuse the dye bath [1-3]. Reusing dye baths is a well-known method for cutting costs and reducing pollution. Polyester fibres are dyed at low temperatures, and carriers are utilized to increase dye adsorption and speed up color dispersion, spread throughout the fibres. However, the majority of carriers poisonous to aquatic life and humans, and during dyeing and rinsing, many carriers are negatively impacts the wastewater discharged damages the environment as well.[4-9]. In contrast, when dyeing polyester fibres at high temperatures, these carriers are not used to enhance adsorption and speed up the dispersion of the dyes in the fibres; rather, when the two dyeing techniques are contrasted, the temperature at 130 °C and the subsequent high pressure play a role in achieving a deeper color [10-15]. Additionally, the dyeing bath contains nearly no dye leftovers, which reduces the amount of leaving materials in the wastewater and benefits the environment.In this study, polyester fibers were dyed with separate dyes in two different ways, namely, dyeing at low temperatures and high temperatures, and comparing them to find out the best.

2. Materials and Methods

The disperse dyes were prepared according to the method that we published in our previous study [3].

Dyeing at 130 °C

The disperse dyes 5a-f were created by dissolving the appropriate amount of dyes (3% shades) in 2 ml DMF and then adding dropwise with stirring to the dye bath (liquor ration 1:30) containing a (3%) of levegal MDL as dispersing agent (TANATEX chemicals). With aqueous acetic acid, the pH of the dye bath was adjusted to 5.5, and the wetted out polyester fibers (3 gm) were added. We dyed the dye bath by raising its temperature to 130°C at 3°C/min and keeping it at this temperature for one hour. After being cooled to 50 °C, the dyed fibers were rinsed with cold water and reduction-cleared (1 g/L sodium hydroxide, 1 g/L sodium hydrosulfite), for 10 minutes, 80°C). The samples were rinsed with hot and cold water and, finally, air-dried

Dyeing at 100 °C

Disperse dyes 5a-f were created by dissolving the necessary amount of dye (3% colours) in 2 mL of DMF, adding drops at a time, and agitating the dye solution . In the event of dyeing at 100°C, solution ratio 1:30 contains (1.5%) MDL levegal as an anionic

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dispersion (TANATEX Chemical) and (1.0%) Tanavol EP 2007 as an anionic eco-carrier (TANATEX Chemical). A moist polyester fabric (3 g) was added after the PH value of the dye solution was changed using acetic acid in water to 5.5. The temperature of the dye bath solution is raised to 100°C and kept there for an hour in order to begin dyeing. After washing the colored fabrics in fresh water and cleaning them with a decontamination clearing solution (1 g/L caustic soda, 1 g/L sodium hydrosulphite, 10 min. and 80°C), the dyeing path is cooled to 50 °C. After being washed in both hot and cold water and neutralised with acetic acid, the samples were dried by air.

Color Measurements

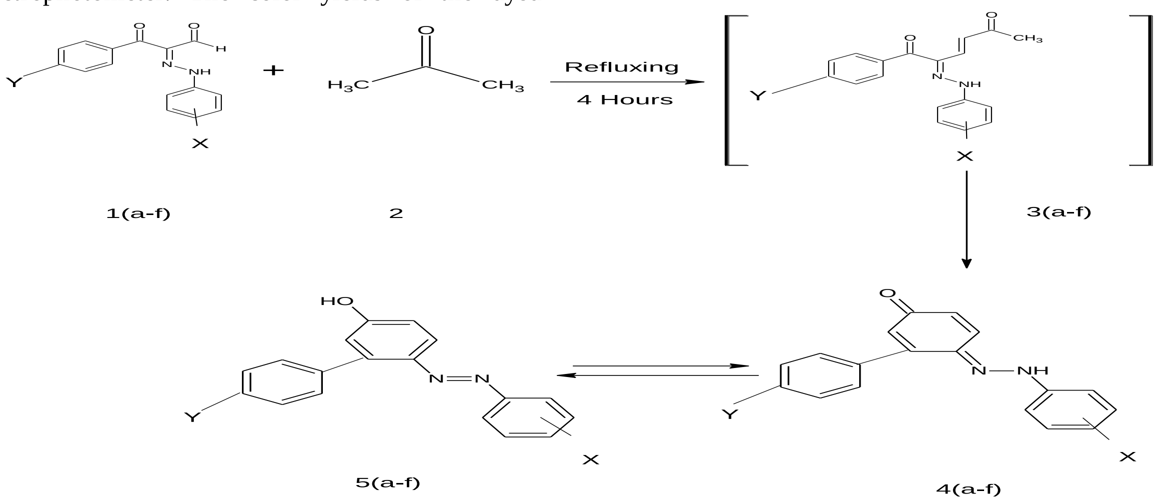
The colorimetric parameters of the dyed polyester fabrics were determined on areflectance spectrophotometer. The color yields of the dyed samples were determined by using the lightreflectance technique performed on an UltraScan PRO D65 UV/VIS Spectrophotometer. The colorstrengths, expressed as K/S values, were determined by applying the Kubelka-Mink equation.

$K/S = (1- R)^2 / 2R$

Where, R is the reflectance of colored samples and K and S are the absorption and scattering coefficients, respectively

3. Result and discussion

In this investigation, polyester fabrics were dyed using these new disperse dyes based on 3-oxo-3-phenyl-2-(2-phenylhydrazono)propanals at a low and high temperature (Figure 1).



5 (a) X,Y= CL, H
5 (b) X,Y=CL,CH_3
5 (c) X,Y=CL, Br
5 (d) X,Y=No_2,H
5 (e) X,Y=No2,CH_3
5 (f) X,Y=No_2,Br

Scheme 1: Structures of new disperse dyes

Table (1) Colour Strength of the new dyes 5(a-f) at low temperature 100°C.

DYE	L*	a*	b*	C*	h*	k/S
5(a)	81.08	-0.91	4.12	4.22	102.43	5.41
5(b)	82.12	-0.22	0.20	0.29	137.75	3.54
5(c)	81.07	-0.70	3.12	3.20	102.67	4.02

5(d)	80.84	-0.26	3.50	3.51	94.21	4.26
5(e)	79.44	-0.25	6.42	6.43	92.27	3.74
5(f)	81.58	-0.46	2.41	2.45	100.87	5.66

Table (2) Colour Strength of the new dyes 5(a-f) at high temperature 130°C.

Dye No	*L**	*a**	*b**	*C**	*h**	K/S
5(a)	79.98	-0.66	4.75	4.80	97.97	14.92
5(b)	82.71	-0.19	10.83	10.83	90.98	8.65
5(c)	80.56	-0.55	6.80	6.82	94.60	10.31
5(d)	81.48	-0.73	4.06	4.13	100.21	8.46
5(e)	82.80	-0.22	0.58	0.62	100.73	11.94
5(f)	82.45	-0.69	1.01	1.22	124.50	10.40

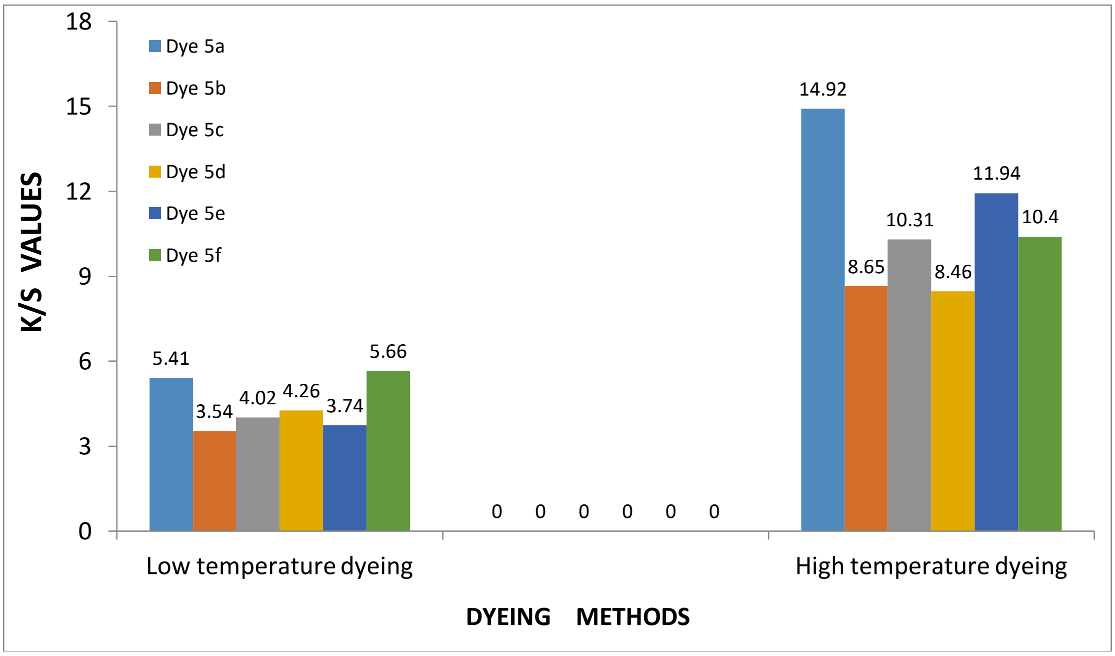


Figure 1.Relation between *K/S* and dyeing temperatures

From data obtained from tables 1 and 2 , that represented the dyeing process at 100 °C and 130 °C this prove that the high temperature dyeing process is more effective than low temperature process as the amount of up taken dyes increase at high temperature dyeing than low temperature dyeing. Tables 1 and 2 and Figure 1 showed that, for all dyes used, the color strength K/S for high temperature dyeing at 130 degrees was higher than the color strength K/S for low temperature dyeing at 100 degrees, with rates 276%, 244%, 256%, 199%, 319% and 184%. This relationship between color strength K/S and temperature used in the dyeing process was the subject of our investigation

4. Conclusions

In this study, we created disperse dyes that were used to dye polyester fabrics at both low and high temperatures. High temperature dyeing produces colours with greater colour strength and saturation than low temperature dyeing.

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