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Synthesis of Novel Disperse Dyes based on Arylazophenols: Part 3. High Temperature Dyeing of Polyester Fabrics

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Abstract

New dispersion dyes were created for our prior study. In this investigation, polyester fabrics were dyed using these disperse dyes at a temperature of 130 °C. Studying the fastness characteristics of the materials colored with these dyes revealed that polyester fabrics coloured with erratic dyes have excellent fastness against washing, perspiration, rubbing, and light fastness capabilities.
***Keywords*:** Disperse dyes, Arylazophenols, . High temperature dyeing

1. Introduction

Over the past 10 years, 3-oxo-3-phenyl-2-(2-phenylhydrazono)propanals have proliferated due to their effectiveness in the production of various essential organic compounds. The polydentate reactants known as 3-oxo-3-phenyl-2-(2-phenyl hydrazono)propanals are acknowledged to have important roles in organic chemistry [1–11].

One way to use the dye solution once more is to refill it with the required amount of dye and chemicals to prevent and minimise contamination. Various naturally dynamic compounds have been created using 3-oxo-3-phenyl-2-(2-phenylhydrazono) propanals as intermediates. In earlier research, we discussed the usage of 3-oxo-3-phenyl-2-(2-phenylhydrazono) propanals as precursors to poly functional organic chemistry [1,2].

In this study, we used dispersion dyes in dyeing polyester fabrics using high temperature and pressure.

2. Materials and Methods

General Procedure for the Synthesis of Disperse Dyes 5a-f

The disperse dyes were prepared according to the method that we published in our previous study [2].

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

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were rinsed with hot and cold water and, finally, air-dried

Color Measurements

The colorimetric parameters of the dyed polyester fabrics were determined on a reflectance spectrophotometer. The color yields of the dyed samples were determined by using the light reflectance technique performed on an UltraScan PRO D65 UV/VIS Spectrophotometer. The color strengths, 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

Color fastness to washing

The color fastness to wash was measured using the method ISO 105-C02:1989. Two pieces of bleached cotton and wool fabrics were sewed between the composite specimens. Then, they were mixed into an aqueous solution containing 5 g/L of nonionic detergents at a liquor ratio of 1:50. For 30 minutes, the bath was thermostatically set to 60 °C.

Samples were removed after the desired time, rinsed twice with occasional hand squeezing, and then dried. The grey scale for color change was used to evaluate the wash fastness.

Color fastness to rubbing

Color fastness to rubbing was determined according to the ISO 105-X12:1987 test method. The test is designed for determining the degree of color that may transfer from the surface of the colored fabrics to another surface by rubbing. The current test can be carried out on dry and wet fabrics.

Dry crocking test

The test specimen was placed flat on the base of the crockmeter. A white testing cloth was mounted. The covered finger was lowered onto the test specimen and caused to slide back and forth 20 times. The white test sample was then removed for evaluation using the grey scale for staining.

Wet crocking test

The white test sample was thoroughly (65%) wetted with water. The procedure was run as before. The white test samples were air dried before evaluation.

Color fastness to perspiration

According to the ISO 105-E04:1989 test technique, two artificial sweat solutions (acidic and alkaline) were created. L-histidine monohydrochloride monohydrate (0.5 g), sodium chloride (5 g), and sodium dihydrogen orthophosphate dihydrate (2.2 g) were dissolved in one litre of distilled water to create the acidic solution. Finally, 0.1 N NaOH was used to raise the pH to 5.5. L-histidine monohydrochloride monohydrate, sodium chloride, and disodium hydrogen orthophosphate dehydrate were all dissolved in one litre of distilled water to create the alkaline solution. 0.1 N NaOH was used to bring the pH down to 8. This is how the fastness test was carried out. To create a composite specimen, the coloured specimen measuring 5 cm by 4 cm was stitched between two sections of the uncolored specimens. The composite samples were submerged in both solutions for 15–30 min, thoroughly mixed, then squeezed to achieve thorough soaking.

Under a force of around 4-5 kg, the test specimens were positioned between two glass or plastic plates. The composite specimen-containing plates were then kept vertically in an oven set at 37 2 °C for four hours. The grey scale for colour change was used to represent and define the effect on the tested specimens' colour.

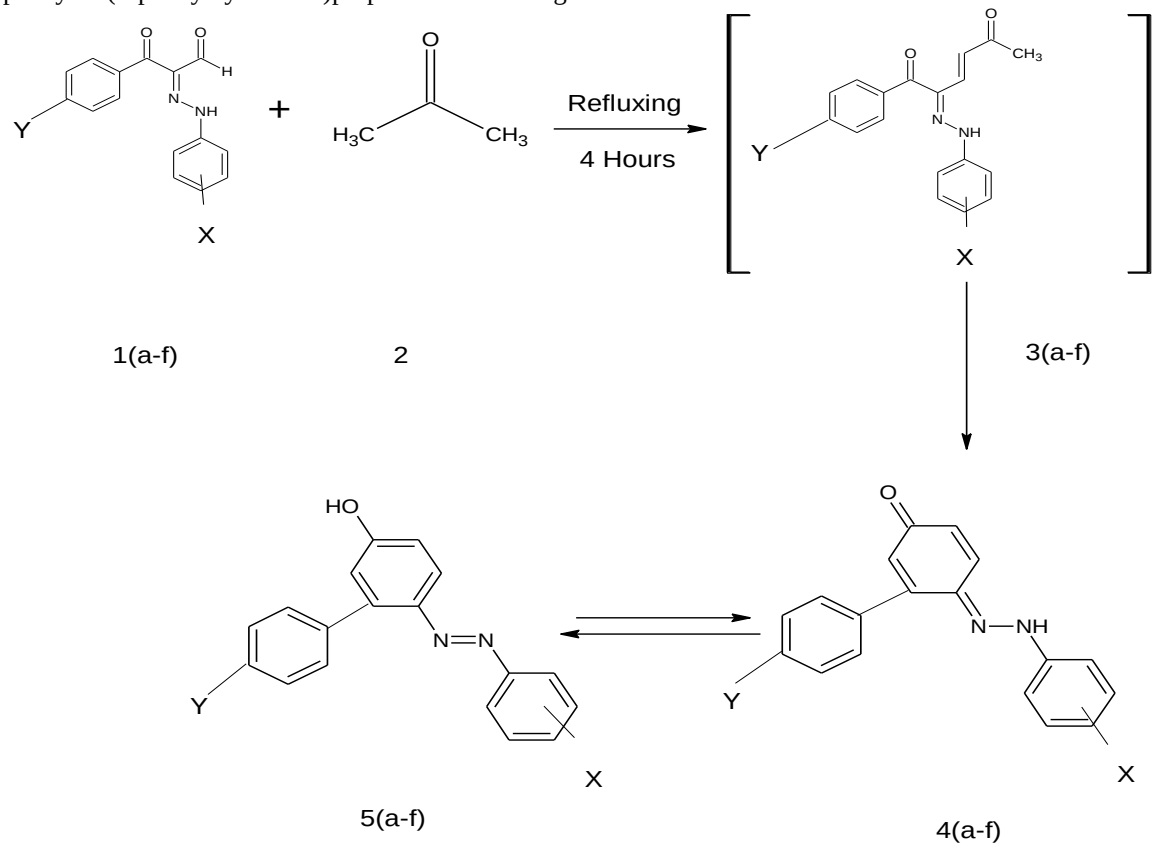
Color fastness to light

Using a carbon arc lamp and continuous illumination for 35 hours, the ISO 105-B02:1988 test technique was used to conduct the light fastness test. The blue scale for colour change was used to measure the impact on the samples that were evaluated.

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 high temperature of 130 °C (Figure 1) while the dispersing agent was present.

From data obtained from table 1 , that represented the dyeing process at 130 °C this prove that the high temperature dyeing process is more effective than low temperature process that we published before as the amount of up taken dyes increase at high temperature dyeing than low temperature dyeing



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).

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

Table (2) Fastness properties of the new dyes 5(a-f) shade 3% at 130 °C dyeing process:

Dye NO	washing			rubbing		Perspiration acidic			Perspiration alkaline			Light fastness
	SC	SP	ALT	dry	wet	SC	SP	ALT	SC	SP	ALT	
5(a)	4	4	4–5	4–5	4	5	5	5	5	5	5	3
5(b)	4–5	4	4–5	4–5	4	5	5	5	5	5	5	3-4
5(c)	4–5	4	4–5	4–5	4	5	5	5	5	5	5	3-4
5(d)	5	4	4–5	4	4	5	5	5	5	5	5	4
5(e)	5	4	4–5	4–5	4	5	5	5	5	5	5	3
5(f)	5	4	4–5	4–5	4	5	5	5	5	5	5	4-5

From the data obtained about the fastness properties of the disperse dyes in tables (2) at concentration of dye shades (3%) and by using of the dyeing process 130 °C, we observed that, the six dyes **5(a-f)** showed from good to excellent washing, perspiration and rubbing fastness properties according to grey scale, while showed moderate light fastness properties according to the blue scale. We can say that, the better washing fastness of these disperse dyes are come back to the partly insolubility of the disperse dyes and partly to the hydrophobic nature of the textile fibers**.**

4. Conclusions

In this study, the high temperature dyeing of these dyes was studded and these dyes gave a good dye uptake. Also the fastness properties of the dyed fabrics gave very good results.

References

[1] El-Apasery, M. A.; Abdellatif, M. E. A.; Yassin, F. A.; Ahmed, S. M. Synthesis of novel disperse dyes based on arylazophenols: Part 2. Anticancer Activities. *Egyptian Journal of Chemistry*, **2023**, 66 (4), 49-53.

[2] El-Apasery, M. A.; Abdellatif, M. E. A.; Yassin, F. A.; Ahmed, S. M. Synthesis of novel disperse dyes based on arylazophenols: Synthesis, Characterizations and applications. *Bull. Chem. Soc. Ethiop.* **2023**, 37(4), 993-1002.

[3] Iskender, M. A.; Becerir, B.; Koruyucu, A.Carrier Dyeing of Different Energy Level Disperse Dyes on Polyester Fabric, Textile Res .J. 2005, 75(6), 462-465.

[4] Alnajjar, A., Abdelkhalik, M. M., Al-Enezi, A., Elnagdi, M. H. Enaminones as building blocks in heterocyclic syntheses: Reinvestigating the product structures of enaminones with malononitrile. A novel route to 6-substituted-3-oxo-2, 3- dihydropyridazine-4-carboxylic acids. Molecules, 2009, 14(1), 68-77.

[5] Saleh, M. O.; El-Apasery, M. A.; Hussein, A.M.; El-Adasy, A.B.A.; Kamel. M. M. Micro wave assisted synthesis of some azo disperse dyes part 2: Eco-friendly dyeing of polyester fabrics by using microwave irradiation, European Journal of Chemistry, 2021, 12 (1), 64-68.

[6] Al-Mousawi, S. M, El-Apasery, M. A, Elnagdi. H. Green methodologies in organic synthesis: Microwave assisted solvent-and catalyst-free synthesis of enaminones and their conversion into 1, 3, 5-trisubstituted benzenes as well as 3-aroyl6-substituted pyridines .European Journal of Chemistry, 2011, 2(2), 168-
172.

[7] Simunek, P.; Machacek, V. The structure and tautomerism of azo coupled b -
Enaminones .Dyes and Pigments, 2010, 86(3), 197-205.

[8] El-Apasery, M. A., Al-Mousawi, S. M., Mahmoud, H., Elnagdi, M. H. Novel Routes to Biologically Active Enaminones, Dienoic Acid Amides, Aryl azo nicotinates and Di hydro pyridazines under Micro wave Irradiation. International Research Journal of Pure & Applied Chemistry, 2011, 1(3), 69-83.

[9]Hidayet Tutun,Anti-Proliferative effect of melamine on human colonaden carcinoma cells.Kocatepe Veterinary Journal,12(2019), 264 – 267.

[10] Mosmann, T,Rapid colorimetric assay for cellular growth and survival, application to proliferation and cytotoxicity assays. J. Immunol. Methods; 65 (1983), 55-63.

[11] El-Apasery, M. A.; Yassin, F. A.; Abd El-Azim, M. H. M.; Abdellatif, M. E. A.Synthesis and Characterization of some Disperse Dyes based on Enaminones Journal of Textiles, Coloration and Polymer Science. 2020.