Synthesis of novel disperse dyes derived from phthalimide containning diester groups and their dyeing properties

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ABSTRACT

In this study, 12 azo disperse dyes based on phthalimide were synthesized including their precursors. The chemical structures of the dyes and the corresponding precursors were analyzed by the GC-MASS, ^{1}H NMR spectra and elemental analysis. The dyeability on PET, such as step dyeing and build-up properties and color fastness were examined using conventional exhaust dyeing procedures.

1. INTRODUCTION

In recent, wash fastness has been becoming as an important requirement of disperse dyes, international test standards have been also changed more and more strictly. Therefore the improved wash fastness of disperse dye should be of interest. In this study, 12 phthalimidyl azo dyes were synthesized including their intermediates, followed by dyeing and color fastness tests.

2. EXPERIMENTAL

Twelve phthalimidyl azo disperse dyes and corresponding precursors were synthesized through 5 steps. Their chemical structure were analyzed by the GC-MASS, ^{1}H NMR spectra and elemental analysis.[1)2)3)]

Both regular PET and micro fiber PET were dyed using synthesized dyes by the dyeing program, as shown in Figure 1. After R/C and heat setting, color fastness, such as wash, rubbing, light, were evaluated. Exhaustion yields were calculated from UV-Vis absorbance data of the initial and the residual dye concentrations in the dyebath. M&S C4A and AATCC 16 methods were used for wash and light fastness test, respectively

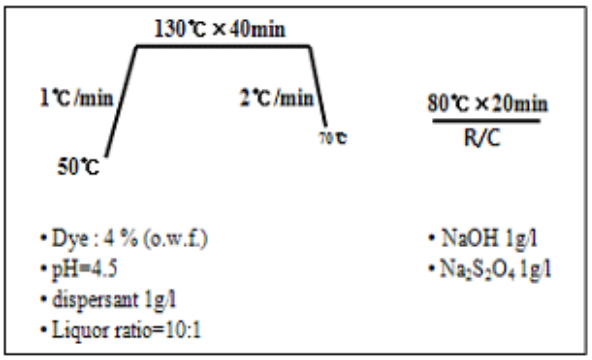
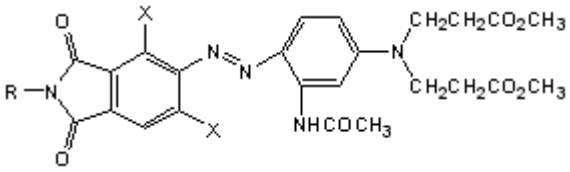


Figure 2) Dyeing program of PET fabric

3. RESULTS AND DISCUSSION

The structure of synthesized dyes and their absorption maxima are shown in Table 1. Exhaustion yields and fastness results of 12 disperse dyes on regular PET and micro fiber PET are given in Table 2 and Table 3, respectively. Dye 9, 10 and 12 showed comparatively higher exhaustion yields above 70%. All samples show excellent wash and rubbing fastness over 4 grade. The light fastness of dye 3 and dye 9 showed higher grade than other dyes.

Table 1 The structure of synthesized dyes and their UV-VIS spectra



Dye	R	X	λ_{max} (nm)	ε_{max}
D1	CH_3CH_2-	H	494	33,210
D2	CH_3CH_2-	Br	420	22,000
D3	CH_3CH_2-	CN	567	32,310
D4	$CH_3CH_2CH_2$-	H	496	22,040
D5	$CH_3CH_2CH_2$-	Br	454	23,230
D6	$CH_3CH_2CH_2$-	CN	573	34,020
D7	$CH_3(CH)CH_3$	H	476	23,160
D8	$CH_3(CH)CH_3$	Br	444	29,300
D9	$CH_3(CH)CH_3$	CN	569	32,860
D10	$CH_3CH_2CH_2CH_2$-	H	497	25,930
D11	$CH_3CH_2CH_2CH_2$-	Br	459	24,550
D12	$CH_3CH_2CH_2CH_2$-	CN	577	44,520

Table 2 Exhaustion yields on regular PETand micro fiber PET

Dye	Exhaustion yield(%)		Dye	Exhaustion yield(%)	
	Regular PET	Micro fiber PET		Regular PET	Micro fiber PET
D1	48.9	39.6	D7	32.1	27.9
D2	50.5	27.3	D8	45.7	34.8
D3	49.8	46.3	D9	85.0	42.1
D4	67.1	45.0	D10	71.0	45.9
D5	24.5	38.1	D11	47.3	56.2
D6	23.5	7.9	D12	74.0	77.8

Table 3 fastness results on regular PET and micro fiber PET

Dye	Wash fastness (Regular PET/ microfiber PET)		Rubbing fastness (Regular PET/ microfiber PET)		Light fastness (Regular PET/ microfiber PET)
	Stain on nylon	Stain on acetate	Dry	Wet	
D1	4-5/4	4-5/4-5	4-5/4-5	4-5/4-5	3-4/3
D2	5/5	5/5	4-5/4-5	4/4-5	3-4/3
D3	5/5	5/5	4-5/4-5	4-5/5	4-5/3
D4	4-5/4-5	5/5	4-5/4-5	4/4	3-4/3-4
D5	5/4-5	5/5	5/4-5	4-5/4-5	3-4/3
D6	5/5	5/5	4-5/4-5	4-5/4-5	3-4/3
D7	4-5/4-5	4-5/4-5	5/5	4-5/4-5	3/3
D8	5/4-5	5/5	5/4-5	4/4-5	4/3
D9	4-5/4-5	5/5	4-5/4-5	4/4-5	4-5/3-4
D10	4/4	4/4	4-5/5	4-5/4-5	4/3-4
D11	5/5	5/5	5/5	4-5/4-5	3-4/3
D12	4-5/4-5	5/5	5/4-5	4-5/4-5	3-4/2-3

4. CONCLUSIONS

Exhaustion yields of 12 synthesized dyes on regular PET fiber ranged in 23% and 85% which were lower than those of commercial disperse dyes. However wash and rubbing fastness showed over 4 due to the alkali clearability of dye structure, especially both phthalimidyl ring and diester groups. Dye 3 and dye 9 showed comparatively higher light fastness.

5. REFERENCES

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