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RESEARCH ARTICLE



Dyeing Polyester, Cotton and Wool with Some Schiff Bases Derived from 4-chloroaminophenol and Various Benzaldehydes

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Abstract: Dyeability of ten Schiff bases obtained from 4-chloroaminophenol and various benzaldehydes including methyl, chloro, bromo, nitro, methoxy, and hydroxy groups were investigated on polyester, cotton and wool fibers. The dry/wet rubbing and washing fastness of the compounds were measured. It is observed that the rubbing and washing fastness values are varying at the 4 – 5 range (1: weak, 5: excellent). The lightness (L), red-greenness (a), and yellow-blueness (b) properties of the compounds were also investigated. It was observed that the dyeing properties of the compounds change depending on the substituent positions, and the substituent effect is observed on wool mostly. Especially, 3- and 5-methyl derivatives (**VIII** and **IX**) exhibit similar behavior toward polyester and cotton while they behave differently on wool in point of the L, a, and b values. On the other hand, it can be claimed that chlorine substituent increases the L value on wool.

Keywords: Schiff bases, dyeability, polyester, cotton, wool.

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INTRODUCTION

Schiff bases have considerable interest due to a large number of biological activities, including anticancer (1-3), antibacterial (4-6), antiviral (7-9), antifungal (10-12), antimalarial (13), urease inhibition (14-15), antioxidant agents (16-17) and DNA binding ability (18-19). The presence of C=N functional group in Schiff bases is responsible for biological activities (20). Intramolecular the hydrogen bonding between the phenolic group and the azomethine nitrogen atoms of Schiff bases derived from aromatic o-hydroxy aldehydes impacts the properties of various molecular systems and plays an essential role in many biochemical reactions (21).

Besides, the synthesis of Schiff bases has been increasing attention in synthetic organic chemistry, because of their potential applications in biological modeling, catalysis, design of molecular magnets and materials chemistry (22-24) and also widely used as chelating agents (25-27), as corrosion inhibitors (28-29), as an herbicide (30), as textile dyes (31), as stabilizers in polymer chemistry (32).

Polyester is a synthetic fiber which is the most widely used in the textile industry due to their advantageous properties, including high tenacity, good resistance to chemicals, and deformation. Polyester fiber is preferred because of its hydrophobic nature and has a highly compact structure that permits efficient dyeing at high temperatures with disperse dyes.

The present study reports the investigation of the dyeability of some Schiff bases synthesized from 4chloroaminophenol and various benzaldehydes. Polyester, cotton, and wool fabrics dyeing with conventional aqueous dyeing (batch dyeing) methods are studied in this context.

EXPERIMENTAL SECTION

General

All reagents were commercially available and used as received without further purification. Elemental analysis data were recorded on a Thermo Finnigan Flash EA 1112 analyzer. The FTIR spectra were obtained with a Bruker Optics Vertex 70 spectrometer (ATR). UV-Visible spectra were measured using a Perkin Elmer Lambda 25 UV/Visible Spectrophotometer. The Electron Sprav Ionization-Mass Spectroscopy (ESI-MS) analyses recorded on a Thermo Finnigan LCQ were Advantage MAX LC/MS/MS. Dyeing was performed



at a TERMAL Dyeing Lab. Machine. The used polyester (110 g/m²), wool (120 g/m²), and cotton (110 g/m²) fabrics for dyeing procedure are 100% woven. Decacid Sab was used as a dispersing agent.

General Procedure for the Preparation of Schiff Bases

The Schiff bases were synthesized by condensation of 4-chloro-2-aminophenol (1.44 g; 10 mmol) with an appropriate aldehyde (*e.g.*, 2,4dihydroxybenzaldehyde for **V**, 1.38 g; 10 mmol) in 20 mL of EtOH. This mixture was stirring under reflux for 3h. After the heading, the mixture was allowed to cool to room temperature. The solid product was separated by filtration and then crystallized from CH₃OH (33-34).

Scheme 1. The chemic	al structures of Schiff bas	uses $\mathbf{I} - \mathbf{X}$ used in this study.
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I: Yellow-orange solid. Yield: 90%, m.p.: 201 °C. Elemental analysis: Calculated for $C_{13}H_9BrCINO_2$: C, 47.82; H, 3.28; N, 4.56; Found : C, 47.81; H, 2.78; N, 4.29. FT-IR (ATR, v/cm⁻¹): 3071 m,br, 2925 m,br, 2854 m,br, 2587 m, 1628 m, 1607 w, 1504 s, 1288 m, 1231 m, 1177 m, 1123 m, 816 m, 656 m, 525 w. UV (10⁻⁴ M, in methanol): 456 sh, 364 m,br, 262 m, 214 s. MS (ESI), m/z (%) (MA: 326.57 g/mol): 324.6 (38.0, [M-2]⁺), 325.4, 326.7, 327.5, 328.6, 329.7.

II: Orange solid. Yield: 96%, m.p.: 203 °C. Elemental analysis: Calculated for $C_{13}H_9Cl_2NO_2$: C, 54.17; H, 3.41; N, 5.08; Found : C, 55.34; H, 3.22; N, 4.96. FT-IR (ATR, v/cm⁻¹): 3072 m,br, 2926 m,br, 2542 m,br, 1628 s, 1452 m, 1208 m, 1154 m, 1093 m, 1018 m, 910 m, 831 s, 698 w. UV (10⁻⁴ M, in methanol): 452 w,br, 364 m,br, 269 m, 234 sh, 215 s. MS (ESI), m/z (%) (MA: 282.12 g/mol): 280.6 (100, [M-2]⁺), 281.7 (11.7, [M-1]⁺), 282.5 (65.6, [M]⁺), 283.6 (8.1, [M+1]⁺), 284.5 (9.6, [M+2]⁺).

III: Orange solid. Yield: 93%, m.p.: 271 °C. Elemental analysis: Calculated for $C_{13}H_8BrCl_2NO_2$: C, 43.40; H, 2.19; N, 3.70; Found : C, 43.25; H, 2.32; N, 3.88. FT-IR (ATR, v/cm⁻¹): 3214 m,br, 3059 m,br, 2925 m,br, 1628 s, 1499 s, 1438 m, 1305 m, 1226 s, 1145 m, 1021 m, 915 m, 845 m, 739 m, 664 m. UV (10⁻⁴ M, in methanol): 462 w,br, 440 sh, 367 m,br, 269 m, 211 s. MS (ESI), m/z (%) (MA: 361.02 g/mol): 358.8 (41.4, [M-2]⁺), 359.9 (6.0, [M-1]⁺), 360.8 (100, [M]⁺), 361.7 (15.9, [M+1]⁺), 362.5 (49.7, [M+1]⁺), 363.2 (43.0, [M+2]⁺), 364.1 (9.8; [M+3]⁺), 364.8 (11.7, [M+4]⁺), 365.7 (5.0, [M+5]⁺).

IV: Orange solid. Yield: 95%, m.p.: 279 °C. Elemental analysis: Calculated for $C_{13}H_8Cl_3NO_2$: C, 49.18; H, 2.74; N, 4.56; Found : C, 49.32; H, 2.55; N, 4.42. FT-IR (ATR, v/cm⁻¹): 3164 m,br, 3063 m,br, 2921 m, 1628 s, 1508 s, 1438 m, 1217 s, 1149 m, 1034 m, 854 m, 761 m, 660 w. UV (10⁻⁴ M, in methanol): 463 m,br, 437 sh, 365 m,br, 269 m, 213 s. MS (ESI), m/z (%) (MA: 316.57 g/mol): 314.7 (87.2, M-2), 316.6 (100, [M]⁺), 317.7 (14.6, [M+1]⁺), 318.6 (31.5, [M+2]⁺), 319.5 (5.4, M+3), 320.5 (4.4, M+4).

V: Dark yellow solid. Yield: 73%, m.p.: 221 °C. Elemental analysis: Calculated for C₁₃H₁₀ClNO₂: C, 58.89; H, 3.84; N, 5.50; Found : C, 59.22; H, 3.82; N, 5.31. FT-IR (ATR, v/cm⁻¹): 3178 m,br ●(OH), 3072 m,br, 2926 m, 2553 m,br, 1637 s, 1592 m, 1269 s, 1228 s, 1131 m, 989 m, 915 m, 849 m, 790 m, 662 w. UV (10^{-4} M, in methanol): 422 m,br, 352 m,br, 269 m, 228 sh, 212 s. MS (ESI), m/z (%) (MA: 263.67 g/mol): 264.5 (38.0, [M+1]⁺), 265.8 (17.2, [M+2]⁺), 509.3 (100, [2M-OH]), 511.3 (71.9), 525.5 (56.7), 526.5 (20.8), 527.5 (22.0).

VI: Bright yellow solid. Yield: 85%, m.p.: 219 °C. Elemental analysis: Calculated for $C_{14}H_{12}CINO_3$: C, 60.82; H, 4.46; N, 5.01; Found : C, 60.55; H, 4.36; N, 5.04. FT-IR (ATR, v/cm⁻¹): 3071 m,br, 2970 m,br, 2909 m,br, 1649 s, 1621 s, 1592 m, 1525 m, 1504 s, 1479 s, 1429 s, 1278 m, 1226 s, 903 m, 831 m, 800 m, 772 m, 656 m. UV (10⁻⁴ M, in methanol): 446 sh, 426 m,br, 351 s,br, 304 m,br, 285 sh, 242 s,br, 215 sh. MS (ESI), m/z (%) (MA: 277.50 g/mol): 276.67 (77.6, [M-1]⁺), 278.69 (100, [M+1]⁺), 280.16 (30.4, [M+3]⁺).

VII: Red solid. Yield: 50%, m.p.: 145 °C. Elemental analysis: Calculated for $C_{14}H_{12}CINO_3$: C, 60.75; H, 4.48; N, 5.00; Found : C, 60.55; H, 4.36; N, 5.04. FT-IR (ATR, v/cm⁻¹): 3054 m,br, 3002 m,br, 2930 m,br, 1623 s, 1594 m, 1504 s, 1443 m, 1251 m, 1140 m, 906 m, 827 m, 799 m, 646 m. UV (10^{-4} M, in methanol): 482 w,br, 373 m,br, 354 sh, 273 s, 252 sh, 236 s,br, 219 sh. MS (ESI), m/z (%) (MA: 277.50 g/mol): 276.72 (100, $[M-1]^+$), 278.71 (71.3, $[M+1]^+$), 280.37 (24.4, $[M+3]^+$).

VIII: Light orange solid. Yield: 97%, m.p.: 220 °C. Elemental analysis: Calculated for $C_{14}H_{12}CINO_2$: C, 64.20; H, 4.83; N, 5.42; Found : C, 64.25; H, 4.62; N, 5.35. FT-IR (ATR, v/cm⁻¹): 3071 m,br, 2920 m, 2673 m,br, 2562 m,br, 1624 s, 1595 sh, 1441 m, 1232 s, 1162 m, 1036 m, 817 m, 762 m, 662 w. UV (nm, 10⁻⁴ M, in methanol): 452 w,br, 352 m,br, 269 m,br, 215 s. MS (ESI), m/z (%) (MA: 261.70 g/mol): 262.6 (100, [M+1]⁺), 263.5 (30.7, [M+2]⁺).

IX: Orange solid. Yield: 85%, m.p.: 173 °C. Elemental analysis: Calculated for $C_{14}H_{12}CINO_2$: C, 64.34; H, 4.51; N, 5.11; Found : C, 64.25; H, 4.62; N, 5.35. FT-IR (ATR, v/cm⁻¹): 3428 m, 2925 m, 1631 s, 1585 m, 1508 s, 1438 m, 1294 m, 1240 m, 1162 m, 922 m, 822 m, 656 w. UV (nm, 10⁻⁴ M, in methanol): 451 w,br, 359 m,br, 269 m, 237 sh, 214 s. MS (ESI), m/z (%) (MA: 261.70 g/mol): 262.5 (31.6, [M+1]⁺), 261.6 (10.5, [M]⁺), 260.6 (100, [M-1]⁺).

X: Yellowish orange solid. Yield: 74%, m.p.: 268 °C. Elemental analysis: Calculated for $C_{13}H_9ClN_2O_4$: C, 53.44; H, 3.26; N, 9.74; Found : C, 53.35; H, 3.10; N, 9.57. FT-IR (ATR, v/cm⁻¹): 3066 m, 2925 m,br, 2774 m,br, 2557 m,br, 1649 s, 1623 s, 1446 m, 1391 m, 1296 s, 1238 m, 1192 m, 1151 m, 1100 m, 1038 m, 901 m, 837 m, 755 m, 639 m. UV (nm, 10⁻⁴ M, in methanol): 461 sh, 426 m,br, 350 m,br, 269 m, 262 m, 211 s. MS (ESI), m/z (%) (MA: 292.67 g/mol): 290.3 (100, [M-2]⁺), 292.4 (65.7, [M]⁺), 293.5 (29.3, [M+1]⁺) 294.5 (28.6, [M+2]⁺).

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Dyeing Polyester Fabrics

The polyester samples were dyed with an HT sample dyeing machine. Dyebath was prepared with dye, which was synthesized, nonionic dispersant (0.5 g/L), and CH₃COOH (pH~5) with a liquor ratio of 1:20. The temperature was raised to 130 °C at a rate of 3 °C/min. Within 30 min. and the dyeing continued for 60 min. After completion of dyeing, reduction cleaning of the samples were rinsed with warm water and were subjected to neutralization with a solution containing Na₂S₂O₄ and NaOH (2 g/L each) at 70 °C for 10 min. To remove the superficial dye, the polyester was rinsed with water and air-dried.

Dyeing Cotton Fabrics

The cotton samples were dyed with an HT sample dyeing machine. Dyebath was prepared with dye, which was synthesized, nonionic dispersant (0.5 g/L), and Na₂CO₃ (pH~10) with a liquor ratio of 1:20. The temperature was raised to 90 °C at a rate of 6 °C/min within 30 min, and the dyeing continued for 90 min. After completion of dyeing, the samples were rinsed two times for 10 min. with water at 60 °C and air-dried.

Dyeing Wool Fabrics

The wool samples were dyed with an HT sample dyeing machine. Dyebath was prepared with dye, which was synthesized, nonionic dispersant (0.5 g/L), and CH₃COOH (pH~5) with a liquor ratio of 1:20. The temperature was raised to 80 °C at a rate of 8 °C/min and then held at this temperature for 90 min. and the dyeing continued for 60 min. After completion of dyeing, the samples were removed, thoroughly rinsed with water for 10 min. at 40 °C and air-dried.

Color Fastness Tests

The reduction cleaning of the dyed samples was measured using the ISO 105 C06 standard method, and ECE was used as washing detergent for this test. The Greyscale was used for evaluating the change in shade and staining of adjacent multifiber test fabrics. Color fastness to rubbing test was evaluated according to the ISO105–X122002 standard method. The color of the dyed fabrics was measured using ISO7724/1 standard method

RESULTS AND DISCUSSIONS

The Schiff bases used in this study were reported previously (33- 34). The physicochemical and spectroscopic data of the Schiff bases are given at Experimental Section.

Tables 1, 3, and 5 show the washing and rubbing fastness test results of dyes on polyester, cotton, and wool fabrics. Washing and rubbing fastness values of the compounds for polyester, cotton, and wool are detected as 4 or 5, which considered that these values are specified at the 1 - 5 range (1:

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weak, 4: good, 5: excellent). It can be said that the compounds give good fastness properties for washing and rubbing levels as well.

The lightness (**L**), red-greenness (**a**), and yellowblueness (**b**) properties of the compounds, containing different substituents on polyester, wool, and cotton fibers are shown in Tables 2, 4, and 6.

The following points are found by examining the lightness (L), red-greenness (a) and yellowblueness (b) values of the compounds for polyester fabric (Table 2): The L value of the compound VI (3-methoxy derivative) is highest, that of III (3-Br,5-Cl derivative) is lowest although all L values are close to each other (between 68.11 and 53.61). Similarly, all the **a** and **b** values are close to each other, also. The highest **a** and **b** values are belonging to 3-Me (VIII) and 5-Br (I) derivatives, 14.52 and 43.34; the lowest ones are 10.27 (VII: and 30.01 3-Br,5-Cl), 4-methoxy) (**III**: respectively.

It is seen that the **L** and **b** values of 5-Br derivative (**I**) are higher than those of 5-Cl derivative (**II**),

whereas the a value is lower (Table 2). The bromo substituent at the ortho position (III: 3-Br,5-Cl) decreases the L, a, and b values comparing to the chloro derivative (IV: 3-Cl,5-Cl) on polyester fabric. It is observed that the **L** value of the 5-Br derivative (I) is highest among the compounds having chloro and bromo substituents, namely I, II, III, and IV. The L and a values of the 4-methoxy derivative (meta position, VII) are lower (66.73 and 10.27, respectively) than those of 3-methoxy derivative (VI; L: 68.11, a: 13.41) whereas the b value is higher (42.43) than that of VI (36.39) towards to polyester fabric (Table 2). The L value of the 3-Me derivative (VIII: methyl group at ortho position) is lower than that of 5-Me derivative (IX: methyl group at the para position) whereas the values of **a** and **b** are higher than that of 3-Me derivative.

It is seen that the highest **L** value is belonging to 5-Br derivative (**I**) for cotton fabrics (Table 4), whereas the nitro derivative (**X**) shows the lowest **L** value. The highest **a** and **b** values are shown by the compound **VIII** (3-Me derivative); the lowest **a** and **b** values are exhibited by **I** and **II** (5-Br and 5-Cl derivatives), respectively.

	Table 1.	Color	fastness	of tl	he con	npounds	on	poly	vester	fabric.	(1)
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Comment			Washi	ng fastr	ness			Rub fasti	bing ness
Compound	Color			Stai	ning ⁽²⁾			Dry	Wet
	Change	AC	CO	PA	PES	PAN	WO		
I	4-5	4-5	4	4-5	4-5	4-5	4-5	4-5	4
II	4	4-5	4	4	5	5	4	4-5	5
III	4	5	4	4	5	5	4	4-5	5
IV	4	4-5	4	4	5	5	4	4-5	5
v	4	4-5	4	4-5	5	4-5	4	5	4
VI	5	5	4	5	5	5	5	5	4-5
VII	5	5	4	4-5	5	5	4-5	5	5
VIII	4	4	4	4	4	4	4	4	4
IX	4	4	4	4	4	4	4	4	4
Х	4-5	5	4	4	5	5	4	4-5	5

¹ The changes are graded with marks 1 - 5 (1: weak, 5: excellent)

² AC: Acetate cellulose, CO: Cotton, PA: Polyamide, PES: Polyester, PAN: Polyacrylonitrile, WO:wool

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Table 2. Lightness (L), red-greenness (a) and yellow-blueness (b) values for polyester (D65).⁽¹⁾

Compound	L ⁽²⁾	a ⁽²⁾	b ⁽²⁾	Compound	L ⁽²⁾	a ⁽²⁾	b ⁽²⁾
I	64.01	10.59	43.34	VI	68.11	13.41	36.39
II	55.52	14.00	37.55	VII	66.73	10.27	42.43
III	53.61	11.74	30.01	VIII	64.64	14.52	39.08
IV	60.84	12.18	36.51	IX	63.78	12.63	33.42
ν	56.32	14.37	43.04	X	59.75	12.68	37.54

¹: D65: daylight lamp.

² L: Lightness (low or negative value: darkness, high or positive value: lightness); **a**: Red-greenness (low or negative value: green, high or positive value: red); **b**: Yellow-blueness (low or negative value: blue, high or positive value: yellow).

	Table 3. C	olor fas	tness o	f the co	mpound	s on cott	on fabri	C. ⁽¹⁾	
			Washi	ng fastr	ness			Rub fast	bing ness
Compound	Color			Stai	ning ⁽²⁾			Dry	Wet
	Change	AC	CO	PA	PES	PAN	WO	•	
I	5	4-5	4	4	4-5	5	4	4-5	4
11	5	4-5	4	4-5	4-5	4-5	4	4-5	4
III	4-5	4	4	4	5	5	4	4-5	4
IV	4-5	4	4	4	4	3-4	4	4-5	4
v	4	4-5	4	4	4-5	5	4	5	4
VI	4	4-5	4	4	4-5	5	4	5	4
VII	4	4-5	4	4	4-5	5	4	5	4
VIII	4	4	4	4	4	5	4	5	4
IX	4	4	4	4	4	4	4	4	4
X	4	4	4	4	5	5	4	4	4

Compound	L ⁽²⁾	a ⁽²⁾	b ⁽²⁾	Compound	L ⁽²⁾	a (2)	b ⁽²⁾
I	85.20	2.68	11.45	VI	82.66	4.39	16.96
II	82.24	5.03	10.04	VII	82.04	4.08	18.66
III	77.16	6.47	25.64	VIII	74.28	7.86	26.53
IV	81.53	4.96	15.73	IX	84.30	2.78	16.26
v	77.96	6.16	14.65	x	71.22	4.95	13.47

	Tuble 5. C	0101 103	01035 0		npounds		i iubiic.		
			Washi	ng fastr	iess			Rub fast	bing ness
Compound	Color Change			Stai	ning ⁽²⁾			. Drv	Wet
	change	AC	CO	PA	PES	PAN	WO	Bry	mee
I	4	4	4	4	4	4	4	5	4
II	4	4	4	4	4	4	4	5	4
III	4	4	4	4	5	5	4	5	4
IV	4	4	4	4	4	4	4	5	4
V	4-5	4-5	4	4-5	4-5	5	4-5	4-5	4
VI	4-5	4-5	4	4	4-5	5	4	4-5	4
VII	4	4-5	4	4	4-5	5	4	4-5	4
VIII	4	4	4	4	4	5	4	4	4
IX	4	4	4	4	4	4	4	4	4
x	4	4	4	4	5	5	4	4	4

Table 5. Color fastness of the compounds on wool fabric.⁽¹⁾

Table 0. Lightness, rea-greenness and yenow-blueness values for woor (D05)	Table 6. Lightness,	red-greenness and	vellow-blueness	values for wool	(D65)	.(1)
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Compound	L ⁽²⁾	a ⁽²⁾	b ⁽²⁾	Compound	L ⁽²⁾	a ⁽²⁾	b ⁽²⁾
I	54.83	12.20	41.08	VI	52.70	14.71	39.60
II	90.46	2.02	-6.25	VII	49.83	15.05	40.31
111	64.86	8.37	10.52	VIII	46.34	14.41	35.83
IV	90.94	1.73	-5.10	IX	90.58	0.38	-2.07
V	37.48	18.01	38.86	X	38.16	14.93	33.15

It is observed that the L and b values of 5-Br derivative (I) are higher than those of 5-Cl derivative (II), whereas the a value is lower for cotton fabric (Table 4). On the other hand, the chloro substituent at ortho position (IV: 3-Cl,5-Cl) increases L value whereas decreases the a and b values compared to those of the bromo derivative (III: 3-Br,5-Cl). The L value of the 5-Br derivative (I) is highest among the compounds having chloro and bromo substituents, namely I, II, III, and IV (similarity to the polyester fabric). In the compounds VI (3-methoxy, ortho position) and VII (4-methoxy, meta position), the L and a values are close to each other, whereas the methoxy group at the meta position (VII) increases the b value according to the ortho position. It is seen that the methyl group at the para position (IX) increases the L value according to the ortho position methyl group (VIII) (84.30 and 74.28 respectively) whereas decreases **a** and **b** values (Table 4).

The L, a, and b values for wool fabrics (Table 6) are in a wide range according to the polyester and cotton. These ranges are 90.94 - 37.48, 18.01 - 0.38, and 41.08 - (-6.25) for L, a, and b, respectively. The highest L, a, and b values belong to IV, V, and I, respectively, whereas the lowest L, **a**, and **b** values are exhibited by the compounds **V**, **IX**, and **II**, respectively. Interestingly, compound **V** (4-OH derivative) has the highest **a** and lowest **L** values.

By comparing **I** and **II** for wool fabric (Table 6), it is seen that the L value of II (5-Cl derivative) is relatively high than that of \mathbf{I} (5-Br derivative) (90.46 and 54.83, respectively). The **a** and **b** values of **II** (2.02, -6.25) are relatively low, according to those of I (12.20 and 41.08). There is a similar situation for III (3-Br,5-Cl) and IV (3-Cl,5-Cl): The L value of IV is considerably high (64.86 and 90.94 for III and IV, respectively) and the a and b values (1.73 and -5.10 for **IV**, respectively) are considerably low according to those of **III** (8.37 and 10.52). From these results, it can be claimed that chloro substituent increases L value whereas decreases the **a** and **b** values in case of wool. The L, a, and b values are close to each other for 3methoxy and 4-methoxy derivatives (VI and VII) on wool. The L values are 90.58 and 46.34 for IX and VIII, respectively: The methyl group at para position (IX) increases the L value whereas decreases the **a** and **b** (0.38 and -2.07) values considerably according to the methyl group at ortho position (VIII: 14.41 and 35.83).

Tables 2, 4, and 6 reveal that the **a** and **b** values are higher for polyester and wool fabrics according to that of cotton fabric. In addition, it is interesting that the **b** values of the compounds **III**, **IV**, and **IX** are negative. It is considered that the **b** value of **IX** (5-Me derivative) is negative (-2.07) for wool, although that of the **VIII** (3-Me derivative) is a reasonably positive value such as 35.83. These two compounds (**VIII** and **IX**) show similar behavior toward polyester and cotton while behaving differently on wool in point of the **L**, **a**, and **b** values. Contrarily for wool, there is no significant difference in the polyester and cotton fabrics comparing their **L**, **a**, and **b** values.

As a conclusion, it is observed that the compounds have **L**, **a**, and **b** values at a wide range of wool fabric. It means that the substituent effect is seen more clearly in wool fabrics. Besides, it can be concluded that the position of the substituents is significant on dyeing properties even if slightly, comparing the **VI** with **VII** and **VIII** with **IX**, the derivatives including the methyl and methoxy groups.

It is possible to say that comparing Tables 2, 4, and 6, the **L** values are inversely proportional to **a** and **b** values, generally: If the **L** values are high, **a** and **b** values are low.

CONCLUSIONS

In this study, dry/wet rubbing and washing fastnesses of some Schiff bases derived from 4chloroaminophenol and various benzaldehydes including methyl, chloro, bromo, nitro, methoxy, and hydroxy groups were investigated on polyester, wool and cotton fibers. The compounds exhibit good excellent rubbing and washing fastness or characteristics. Also, the lightness (L), redgreenness (a), and yellow-blueness (b) properties of the compounds were investigated. Dyeing properties of the compounds depend on the substituent positions, and the change in dyeing properties resulted from substituent effect is observed on wool mostly. Interestingly, the L, a, and **b** values of 3-Me and 5-Me derivatives (VIII and IX) are close to each other on polyester and cotton; however, they show significant differences in wool fabric (substituent position effect).

On the other hand, it can be claimed that chlorine substituent increases L value on wool. Schiff base substituents cause various effects on the fabrics. These result from interactions between the functional groups on the molecule and the fabrics depending on their structure.

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