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Synthesis, characterization and dyeing assessment of novel acid azo dyes and mordent acid azo dyes based on 2-hydroxy-4-methoxybenzophenone on wool and silk fabrics

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Abstract: Novel acid mono azo and mordent acid mono azo dyes were synthesised by the coupling of diazonium salt solution of different aromatic amines with 2-hydroxy-4-methoxybenzophenone. The resulting dyes were characterized by spectral techniques, *i.e.*, elemental analysis, IR, ^{1}H-NMR and UV––visible spectroscopy. The dyeing performance of all the dyes was evaluated on wool and silk fabrics. The dyeing of chrome pre-treated wool and silk fabrics showed better hues on mordented fabrics. Dyeing of wool and silk fabrics resulted in pinkish blue to red shades with very good depth and levelness. The dyed fabrics showed excellent to very good light, washing, perspiration, sublimation and rubbing fastness. The results of antibacterial studies of chrome pre-treated fabrics revealed that the toxicity of mordented dyes against *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi*, *Bacillus subtilis* bacteria was fairly good.

Keywords: acid azo dye; mordent acid azo dye; light fastness; washing fastness.

INTRODUCTION

Traditionally, azo dyes are the most important class of commercial dyes, occupying more than half of the dye chemistry, which contain phenols as intermediates.[1–6] If they contain sodium salts of a sulphonic acid group in addition to a phenolic group, they are referred as an acid azo dye. All such dyes having phenolic and sulphonic acid moieties, contain hydroxyl (–OH) and sulphonic (–SO_3H) groups as auxochromic groups. Such an auxochromic (–OH) and chromophoric (C=O) groups-containing compound, *i.e.*, 2-hydroxy-4-methoxybenzophenone, has shown wide applications as a polymer additive.[7–9] It is also known for its ex-

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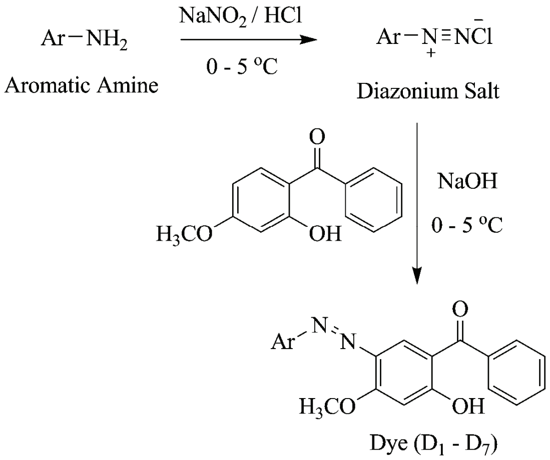
cellent UV absorbing capacity, as it prevents the photo-degradability of most vinyl polymers.[10–12] The acid mono azo dyes and mordent mono azo dyes formation based on this compound has not been developed except in a few patents.[13–16] Considering the above-mentioned importance of 2-hydroxy-4-methoxybenzophenone, it was planned to explore the field of acid azo dyes based on this compound, which may yield dyes with good hue properties.

Hence, in continuation of earlier work,[17,18] the present communication comprises the synthesis, characterization and dyeing assessment of novel acid mono azo and mordent acid mono azo dyes based on 2-hydroxy-4-methoxybenzophenone. The proposed synthetic route is shown in Scheme 1.



Scheme 1. Proposed synthetic route for the 2-hydroxy-4-methoxybenzophenone based dyes (**D_1–D_7**).

EXPERIMENTAL

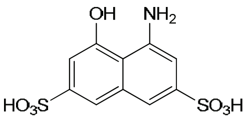
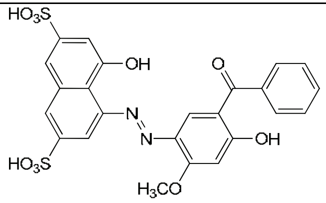
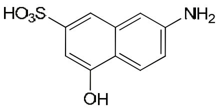
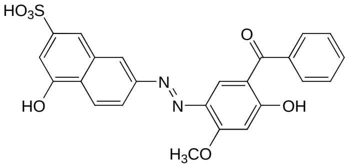
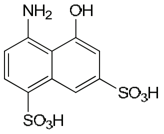
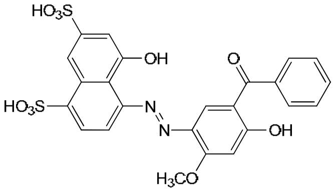
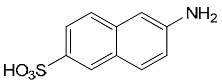
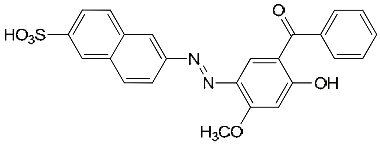
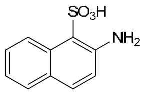
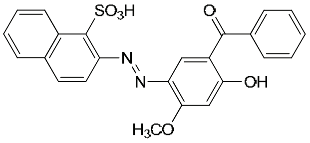
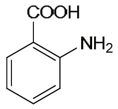
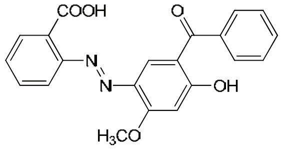
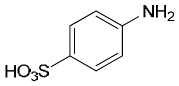
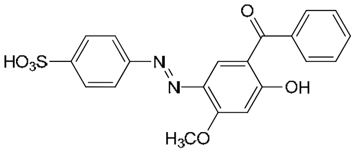
All the employed chemicals were of analytical reagent grade. The aromatic amines shown in Table I were used for diazotization. Wool and silk fabrics were gifted by Color Tax (Pvt) Ltd., Surat, India. Melting points were determined by the open capillary method and are given uncorrected. The UV–visible absorption spectra were measured on a Carl Zeiss UV/Vis Specord spectrometer, and the elemental analysis was realized using a Perkin Elmer CHNS/O Analyzer 2400 Series II. The infrared spectra were recorded in KBr pellets on a Perkin–Elmer Spectrum GX FT-IR model. The ^{1}H-NMR spectra were recorded on Hitachi R-1500 (400 MHz) in DMSO-d_6 solvent and thin layer chromatography (TLC) was run on aluminium sheets pre-coated with silica gel 60 F_{254} (Merck, Germany) using a methanol–water–acetic acid (12:3:7) solvent system. The colour spots were visualized by a UV cabinet. A HTHP dyeing machine (model LL) was used for dyeing.

Synthesis of acid mono azo dyes

Diazotization. Diazotization of various aromatic amines (shown in Table I) was performed by a reported method.[19,20]

Accordingly, each of the aromatic amines (3.19 g, 0.010 mol) was mixed with HCl (25 mL, 37 %) in a mortar, transferred to a 3-neck round bottom flask, and additional HCl (20 mL, 37 %) was added. To the resultant suspension, crushed ice (25 g) and $NaNO_2$ (2.5 mL, 4 M) were added. Diazotization was realized over 0.5 h at 0–5 °C under continuous stirring. The complete synthetic route is shown in Scheme 1 and the structures of the various aromatic amines and the corresponding dyes are shown in Table I.

TABLE I. Structures of the aromatic amines and corresponding acid azo dyes

Dye	Aromatic amine	Acid azo dye structure
D_1		
D_2		
D_3		
D_4		
D_5		
D_6		
D_7		

Coupling procedure. The coupling of above mentioned diazotized aromatic amines (as shown in Table I) was performed by a method reported in the literature.[19,20] The general procedure followed is given below: 2-hydroxy-4-methoxybenzophenone (2.15 g, 0.010 mol) was dissolved in aqueous sodium hydroxide (100 mL, 0.10 M) solution. The clear solution was cooled in an ice–salt bath and the diazonium salt solution of an aromatic amine was added dropwise over a period of 30 min under vigorous stirring. The pH was maintained between 2.0 to 3.0 by the simultaneous addition of 10 % w/v sodium carbonate solution. Stirring was continued for 2 h, allowing the temperature to rise to ambient. The dye was then filtered off and dissolved in distilled water. Then the acid azo dye was obtained by the evaporation procedure and subsequently dried at room temperature. The dyes were designated as acid mono azo dyes ($\mathbf{D_1}$–$\mathbf{D_7}$).

Acid mono azo dyeing method

Wool and silk fabrics are conveniently dyed in the laboratory at 90–130 °C and at a high pressure (166–207 kPa). A model glycerine-bath, high-temperature beaker and HTHP (model LL) dyeing machine were used. For this purpose, a paste of finely powdered acid azo dye (0.060 g) was prepared with a dispersing agent dodamol (0.090 g), wetting agent Tween-80 (0.0060 g) and water (2.0 mL) in a ball mill. Water (10 mL) was added to this paste under stirring and the pH was adjusted to 2.0–4.0 using acetic acid. This dye suspension (100 mL) was added to a beaker provided with a lid and a screw cap. A wetted pattern of wool or silk fabric was rolled into the beaker and the lid was placed on the beaker the metal cap tightened. The beaker was then placed vertically on the rotatory carrier inside the tank and the clamp plate was firmly tightened.

The rotatory carrier was then allowed to rotate in the glycerine-bath and the temperature was raised to 90 °C at a rate of 2 °C/min. The dyeing was continued for 1 h under pressure. After cooling for 1 h, the beaker was removed from the bath and washed with distilled water. The dyed pattern was thoroughly washed with cold water and dried at room temperature.

Mordent dyeing method

The wool and silk fabric dye pattern obtained from the above-mentioned process was treated with potassium dichromate solution equal to half of the weight of the dye and it was allowed to roll into the beaker and again the beaker was then placed vertically on the rotatory carrier inside the tank and the dyeing was continued for 1 h under pressure. After cooling for 1 h, the beaker was removed from the bath and washed with cold distilled water. The dyed pattern was thoroughly washed with warm water and air dried at room temperature.

Determination of the percentage exhaustion and fixation

The percentage exhaustion and fixation of the dyed fabrics were determined according to the reported methods.[21]

Fastness property

All the fastness properties of the synthesized dyes were assessed, *i.e.*, the light, sublimation and perspiration fastnesses according to the British standard: 1006-1978, the wash fastness according to the Indian standard: IS: 765-1979 and the rubbing fastness using a Crock meter (Atlas) AATCC-1961.

Antimicrobial activity

The *in vitro* antimicrobial activities of the acid azo chrome dyes were tested against *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi* and *Bacillus subtilis* bacteria using agar nutrient as the medium. A stock solution of 250 ppm was prepared by dissolving the compounds in 20 % DMSO solution. The antimicrobial activity was performed at a concentration 100 μg/ml, using the agar-cup method in which the well diameter was 4 mm,[22] with DMSO as the control.

RESULTS AND DISCUSSION

Physical properties of dyes

All the dyes obtained upon recrystallization from acetone were crystalline powders ranging in colour from pinkish blue to red. The purity of the dyes was checked by TLC using methanol–water–acetic acid (12:3:7) solvent system. A single spot was observed for each dye.

Analytical and spectral data of the dyes

*4-(5-Benzoyl-4-hydroxy-2-methoxyphenylazo)-5-hydroxy-2,7-naphthalenedisulphonic acid (**D$_1$**)*. Yield: 78 %; m.p.: 146–150 °C; Rf. value: 0.78. Anal. Calcd. for $C_{24}H_{18}O_{10}N_2S_2$ (FW 558): C, 51.61; H, 3.32; N, 5.01; S, 11.46 %. Found: C, 51.59; H, 3.21; N, 5.00; S, 11.38 %. IR (KBr, cm^{-1}): 3463 (–OH), 3072 (=CH, aromatic), 1628 (C=O, diaryl), 1521 (N=N), 1520 (for naphthalene substitution), 1481 (C=C, aromatic), 1333 (C–N), 1101 (C–O), 1030, 650 (for sulphonic acid), 732, 584, 481 (for substituted benzene). ^{1}H-NMR (400 MHz, DMSO-d_6, δ / ppm): 3.82 (3H, *s*, Ar–OCH_3), 5.4 (2H, *s*, Ar–OH), 7.2–7.4 (11H, *m*, Ar–H), 8.0 (1H, *s*, –SO_3H), 8.2 (1H, *s*, –SO_3H).

*7-(5-Benzoyl-4-hydroxy-2-methoxyphenylazo)-4-hydroxy-2-naphthalenesulphonic acid (**D2**)*. Yield: 80 %; m.p.: 138–142 °C; Rf. value: 0.82. Anal. Calcd. for $C_{24}H_{18}O_7N_2S$ (FW 478): C, 60.25; H, 3.76; N, 5.85; S, 6.69 %. Found: C, 60.20; H, 3.72; N, 5.83; S, 6.61 %. IR (KBr, cm^{-1}): 3450 (–OH), 3082 (=CH, aromatic), 1624 (C=O, diaryl), 1540 (for naphthalene substitution), 1522 (N=N), 1490 (C=C, aromatic), 1345 (C–N), 1101 (C–O), 1032, 653 (for sulphonic acid), 744, 564, 478 (for substituted benzene). ^{1}H-NMR (400 MHz, DMSO--d_6, δ / ppm): 3.81 (3H, *s*, Ar–OCH_3), 7.2–7.5 (12H, *m*, Ar–H), 5.42 (1H, *s*, Ar––OH), 6.3 (1H, *s*, Ar–OH), 8.2 (1H, *s*, –SO_3H).

*4-(5-Benzoyl-4-hydroxy-2-methoxyphenylazo)-5-hydroxy-1,7-naphthalenedisulphonic acid (**D$_3$**)*. Yield: 79 %; m.p.: 142–146 °C; Rf. value: 0.77. Anal. Calcd. for $C_{24}H_{18}O_{10}N_2S_2$ (FW 558): C, 51.61; H, 3.32; N, 5.01; S, 11.46 %. Found: C, 51.58; H, 3.19; N, 4.97; S, 11.34 %. IR (KBr, cm^{-1}): 3481 (–OH), 3070 (=CH, aromatic), 1632 (C=O, diaryl), 1542 (N=N), 1525 (for naphthalene substitution), 1483 (C=C, aromatic), 1337 (C–N), 1103 (C–O), 1029, 650 (for sulphonic acid), 737, 562, 472 (for substituted benzene). ^{1}H-NMR (400 MHz, DMSO-d_6, δ / ppm): 3.82 (3H, *s*, Ar–OCH_3), 7.1–7.3 (11H, *m*, Ar–H), 5.5 (2H, *s*, Ar–OH), 7.9 (1H, *s*, –SO_3H), 8.35 (1H, s, –SO_3H).

*6-(5-Benzoyl-4-hydroxy-2-methoxyphenylazo)-2-naphthalenesulphonic acid (**D$_4$**)*. Yield: 81 %; m.p.: 131–135 °C; Rf. value: 0.84. Anal. Calcd. for $C_{24}H_{18}O_6N_2S$ (FW 462): C, 62.33; H, 3.89; N, 6.06; S, 6.92 %. Found: C, 62.27;

H, 3.83; N, 6.00; S, 6.89 %. IR (KBr, cm^{-1}): 3633 (–OH), 3080 (=CH, aromatic), 1652 (C=O, diaryl), 1560 (for naphthalene substitution), 1532 (N=N), 1473 (C=C, aromatic), 1338 (C–N), 1104 (C–O), 1032, 653 (for sulphonic acid), 782, 741, 583, 485 (for substituted benzene). ^{1}H-NMR (400 MHz, DMSO-*d*$_6$, δ / / ppm): 3.83 (3H, *s*, Ar–OCH$_3$), 7.2–7.4 (13H, *m*, Ar–H), 6.10 (1H, *s*, Ar–OH), 8.1 (1H, *s*, –SO$_3$H).

*2-(5-Benzoyl-4-hydroxy-2-methoxyphenylazo)-1-naphthalenesulphonic acid (**D$_5$**)*. Yield: 79 %; m.p.: 136–141 °C; Rf. value: 0.82. Anal. Calcd. for $C_{24}H_{18}O_6N_2S$ (FW 462): C, 62.33; H, 3.89; N, 6.06; S, 6.92 %. Found: C, 62.26; H, 3.84; N, 6.01; S, 6.88 %. IR (KBr, cm^{-1}): 3580 (–OH, phenolic), 3070 (=CH, aromatic), 1621 (C=O, diaryl), 1575 (for naphthalene substitution), 1531 (N=N), 1482 (C=C, aromatic), 1463 (C–N), 1338 (C–O), 1034, 650 (for sulphonic acid), 1103, 732, 574, 473 (for substituted benzene). ^{1}H-NMR (400 MHz, DMSO-*d*$_6$, δ / ppm): 3.82 (3H, Ar–OCH$_3$), 7.1–7.5 (13H, *m*, Ar–H), 6.3 (1H, *s*, Ar–OH), 8.2 (1H, s, –SO$_3$H).

*2-(5-Benzoyl-4-hydroxy-2-methoxyphenylazo)benzoic acid (**D$_6$**)*. Yield: 78 %; m.p.: 145–148 °C; Rf. value: 0.83. Anal. Calcd. for $C_{21}H_{16}O_5N_2$ (FW 376): C, 67.02; H, 4.25; N, 7.44 %. Found: C, 67.01; H, 4.18; N, 7.39 %. IR (KBr, cm^{-1}): 3430 (–OH, phenolic), 3540 (–OH, acidic), 3062 (=CH, aromatic), 1634 (C=O, diaryl), 1678 (C=O, carboxylic acid), 1581 (N=N), 1483 (C=C, aromatic), 1352 (C–N), 1103 (C–O), 1100, 850 (for carboxylic acid), 783, 741, 583, 482 (for substituted benzene). ^{1}H-NMR (400 MHz, DMSO-*d*$_6$, δ / ppm): 3.82 (3H, *s*, Ar–OCH$_3$), 7.1–7.5 (11H, *m*, Ar–H), 5.5 (1H, *s*, Ar–OH), 10.9 (1H, *s*, –COOH).

*4-(5-Benzoyl-4-hydroxy-2-methoxyphenylazo)benzenesulphonic acid (**D$_7$**)*. Yield: 83 %; m.p.: 150–154 °C; Rf. value: 0.85. Anal. Calcd. for $C_{20}H_{16}O_6N_2S$ (FW 412): C, 58.25; H, 3.88; N, 6.79; S, 7.76 %. Found: C, 58.18; H, 3.82; N, 6.71; S, 7.70 %. IR (KBr, cm^{-1}): 3590 (–OH), 3063 (=CH, aromatic), 1632 (C=O, diaryl), 1533 (N=N), 1471 (C=C, aromatic), 1324 (C–N), 1103 (C–O), 1031, 652 (for sulphonic acid), 780, 744, 586, 475 (for substituted benzene). ^{1}H-NMR (400 MHz, DMSO-*d*$_6$, δ / ppm): 3.82 (3H, *s*, Ar–OCH$_3$), 7.2–7.4 (11H, *m*, Ar–H), 6.1 (1H, *s*, Ar–OH), 7.9 (1H, *s*, –SO$_3$H).

The results of elemental analyses of each acid azo dye were consistent with the predicted structure, as shown in Table I. The number of azo group was almost one for each dye. The nitrogen content and number of azo group for each dye are co-related with each other. The IR spectrum of each dye comprised the important features of aromatic, azo, hydroxyl, keto and carboxylic acid groups.

The ^{1}H-NMR spectra of all the dye compounds based on 2-hydroxy-4-methoxybenzophenone shows important signals at their respective positions, confirming the structures of various acid azo dyes, as shown in Table I. One of the –OH protons in the **D$_1$** and **D$_3$** dyes might be merged with the aromatic protons, while the other –OH protons in the other dyes resonated as a singlet between 5.4

to 6.3 δ. In the $\mathbf{D_6}$ dye, the –COOH proton gave a singlet at 10.9 δ. The singlet of the $–SO_3H$ proton resonated between 7.9 to 8.35 δ and $–OCH_3$ protons resonated as a singlet around 3.8 δ in all the acid azo dyes.

The visible absorption spectroscopic properties of the dyes were recorded in DMF. The absorption maxima (λ_{max}) of all the dyes falls in the range 422–465 nm in DMF, and the values are given in Table II. The values of the logarithm of molar extinction coefficient (log ε) of all the dyes were in the range of 4.21–4.60, consistent with their high absorption intensity. Moreover, the presence of electron donating or electron attracting groups did not bring about any marked increase or decrease in λ_{max} in the visible region and log ε remained nearly constant. However, an electron attracting substituent, such as $–SO_3H$, in the structure of the coupler increases the polarizability and will results in bathochromic shifts. This leads to a decrease in the energy between the highest occupied molecular orbital and lowest unoccupied molecular orbital and thus the $\pi \rightarrow \pi^*$ electronic transition occurs with a lower frequency photon, resulting in a bathochromic shift of the visible absorption band.

TABLE II. Absorption maxima in DMF (λ_{max}), intensities (log ε), exhaustion (E) and fixation (F) of acid mono azo dyes on wool and silk fabrics

Dye	λ_{max} / nm	log ε	Acid azo dyeing on wool		Acid azo dyeing on silk	
			E / %	F / %	E / %	F / %
$\mathbf{D_1}$	465	4.60	80	89	72	90
$\mathbf{D_2}$	445	4.36	75	94	75	87
$\mathbf{D_3}$	450	4.45	72	90	80	92
$\mathbf{D_4}$	435	4.27	85	89	76	88
$\mathbf{D_5}$	430	4.20	74	86	82	91
$\mathbf{D_6}$	420	4.18	71	88	75	89
$\mathbf{D_7}$	422	4.21	85	92	78	90

Dyeing properties of dyes

The acid mono azo dyes were applied at a 2 % depth on wool and silk fabrics. Their dyeing properties are shown in Tables III–VI. These dyes gave a wide range of colours varying from pinkish blue to red shades with good levelness, brightness and depth on the fabrics. The variation in the shades of the dye fabric results from both the nature and position of the substituent present on the diazotized compound. The dyeing showed excellent fastness to light, with a very good to excellent washing, perspiration, rubbing and sublimation fastnesses.

A remarkable degree of smoothness after washing was observed. This may be attributed to the good penetration into and affinity of the dye molecule for the structure of the fabrics. The most prominent feature of these dyes is that the dye patterns treated with Cr(III) salt solution afforded an excellent shining shade of the dyes. This might be due to chrome complex formation on the fabric matrix.

TABLE III. Results of acid mono azo dyeing and various fastness properties of dyes on wool fabrics (grading: 5 – excellent, 4 – very good, 3 – good, 2 – fair, 1 – poor)

Dye	Colour shades on wool	Light fastness	Washing fastness	Perspiration fastness		Sublimation fastness	Rubbing fastness	
				Acid	Alkaline		Dry	Wet
$\mathbf{D}_1$	Pinkish blue	5	5	4	5	4	4	4
$\mathbf{D}_2$	Pinkish blue	5	4	5	4	4	4	4
$\mathbf{D}_3$	Reddish brown	5	5	5	5	5	5	4
$\mathbf{D}_4$	Yellowish pink	4	5	4	5	4	4	3
$\mathbf{D}_5$	Chocolate brown	4	4	5	5	4	5	4
$\mathbf{D}_6$	Red	5	5	5	5	5	4	3
$\mathbf{D}_7$	Red	5	4	5	5	4	5	4

TABLE IV. Results of acid mono azo dyeing and various fastness properties of dyes on silk fabrics (grading: 5 – excellent, 4 – very good, 3 – good, 2 – fair, 1 – poor)

Dye	Colour shades on silk	Light fastness	Wash fastness	Perspiration fastness		Sublimation fastness	Rubbing fastness	
				Acid	Alkaline		Dry	Wet
$\mathbf{D}_1$	Pinkish blue	5	4	4	5	5	4	3–4
$\mathbf{D}_2$	Pinkish blue	5	4	5	4	4	4	3
$\mathbf{D}_3$	Reddish brown	4	4	4	5	5	4	4
$\mathbf{D}_4$	Yellowish pink	4	4	4	4	4	4	3–4
$\mathbf{D}_5$	Chocolate brown	5	5	4	4	4	5	4
$\mathbf{D}_6$	Red	5	4	4	4	5	4	4
$\mathbf{D}_7$	Red	5	4	4	4	5	5	3–4

TABLE V. Results of mordent acid azo dyeing and various fastness properties of dyes on wool fabrics (grading: 5 – excellent, 4 – very good, 3 – good, 2 – fair, 1 – poor)

Dye	Colour shades on wool	Light fastness	Washing fastness	Perspiration fastness		Sublimation fastness	Rubbing fastness	
				Acid	Alkaline		Dry	Wet
$\mathbf{D}_1$	Pinkish blue	5	5	4	5	5	5	4
$\mathbf{D}_2$	Pinkish blue	5	5	5	4	5	4	4
$\mathbf{D}_3$	Reddish brown	5	5	5	5	5	5	4
$\mathbf{D}_4$	Yellowish pink	5	5	5	5	5	5	4
$\mathbf{D}_5$	Chocolate brown	5	4	5	5	4	5	4
$\mathbf{D}_6$	Red	5	5	5	5	5	4	4
$\mathbf{D}_7$	Red	5	5	5	5	5	5	4

The antibacterial activities of the chrome complexes of the dyes ($\mathbf{D}_1$–$\mathbf{D}_7$) were monitored against the various pathogens. The results (Table VII) showed that the $\mathbf{D}_1$, $\mathbf{D}_3$ and $\mathbf{D}_7$ dyes had moderate to high, $\mathbf{D}_6$ weak to moderate and the other dyes weak activity against all the tested microorganisms. The dye pattern of the chrome-treated dye may be tolerable for the human body.

TABLE VI. Results of mordent acid azo dyeing and various fastness properties of dyes on silk (grading: 5 – excellent, 4 – very good, 3 – good, 2 – fair, 1 – poor)

Dye	Colour shades on silk	Light fastness	Wash fastness	Perspiration fastness		Sublimation fastness	Rubbing fastness	
				Acid	Alkaline		Dry	Wet
D₁	Pinkish blue	5	5	5	5	5	5	4
D₂	Pinkish blue	5	5	5	5	5	4	4
D₃	Reddish brown	5	4	5	5	5	4	4
D₄	Yellowish pink	5	5	5	5	4	5	5
D₅	Chocolate brown	5	5	5	5	4	5	4
D₆	Red	5	5	5	5	5	4	4
D₇	Red	5	5	5	4	5	5	4

TABLE VII. Antibacterial activity of the acid azo chrome dyes (100 μg/mL)

Dye	Zone of inhibition, mm			
	E. coli	*S. aureus*	*S. typhi*	*B. subtilis*
D_1	>21	16–20	16–20	16–20
D_2	11–15	11–15	11–15	11–15
D_3	>21	16–20	16–20	16–20
D_4	11–15	11–15	11–15	11–15
D_5	11–15	11–15	11–15	11–15
D_6	16–20	16–20	11–15	16–20
D_7	>21	>21	16–20	16–20

CONCLUSIONS

All newly synthesized acid mono azo dyes and mordent acid mono azo dyes exhibited very good to excellent fastness to light, sublimation, perspiration and rubbing. The remarkable degree of levelness after dyeing indicates good penetration into, and affinity of these dyes for the fabric matrix. They give deep and bright hues with levelling dyeing. The nature of the substituent in the coupling component has little influence on the UV–visible absorption and shade of the dyeing. A comparison of the acid mono azo and the mordent acid azo dyes revealed that the mordent acid mono azo dyes have better shades than the acid azo dyes. Of the acid azo chrome dyes (**D_1**–**D_7**), the dyes **D_1**, **D_3** and **D_7** showed moderate to high antibacterial activity against all the tested microorganisms.

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ИЗВОД

СИНТЕЗА, КАРАКТЕРИЗАЦИЈА И ИСПИТИВАЊЕ БОЈЕЊА ВУНЕНИХ И СВИЛЕНИХ ТКАНИНА НОВИМ КИСЕЛИМ И МОЧИЛСКИМ АЗО БОЈАМА НА БАЗИ 2-ХИДРОКСИ-4-МЕТОКСИБЕНЗОФЕНОНА

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Нове киселе и мочилске моноазо боје су синтетизоване купловањем диазонијумових соли различитих ароматичних амина са 2-хидрокси-4-метоксибензофеноном. Добијене боје су окарактерисане елементарном анализом, ИЦ, ^{1}H-NMR и UV–Vis техникама. Својства бојења су испитана на вуненим и свиленим тканинама. Бојење вунених и свилених тканина претходно третираних хромом дало је боље обојење. Обојеност бојених вунених и свилених тканина се кретала од плавичасто розе до црвене нијансе. Обојене тканине су показале веома добру постојаност на светлост, прање, зној, сублимацију и трење. Резултати антибактеријских испитивања својстава тканина претходно третираних хромом указала су на релативно добру токсичност мочилских боја према *Escherichia coli, Staphylococcus aureus, Salmonella typhi* и *Bacillus subtilis*.

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