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Synthesis, Characterization and application of some novel disperse azo dyes based on 1-(4-N-acetyl amino) 2-methyl phenyl 2-chloro ethanone

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ABSTRACT

Some novel azo disperse dyes synthesis by the coupling component of diazonium salt with 1-(4-N-acetyl amino) 2-methyl phenyl 2-chloro ethanone Thus a series of azo disperse dyes has been prepared. After syntheses compounds were characterized by chemical as well as instrumental methods. like Melting point, elemental analysis and UV-Visible spectral studies.The dyeing assessment of all the disperse dyes was evaluated on nylon and polyester fabrics and studies of fastness properties.

Key-words : Disperse dyes, UV-Visible spectra, dyeing assessment, fastness properties.

INTRODUCTION

Disperse dyes are organic colours having less water solubility, these are applied in colloidal aqueous dispersions to hydrophobic textile fibers in which the dyes literally dissolve and produce desired coloration. The development of disperse dyes is due to significant increase in the world production of polyester fibers [1] as compared to other fibers. Over 90% of disperse dyes usage is for the coloration of polyester and its blends.

The first member of the group of disperse dyes were introduced in 1924 by Baddiley and sheperdon of the british dye stuffs corporation (Duranol dyes) and by Ellis of the british celanese company(SRA dyes)[2] for dyeing it.

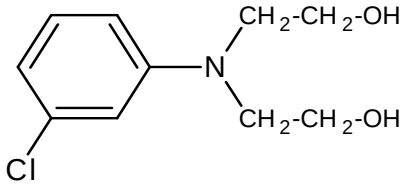
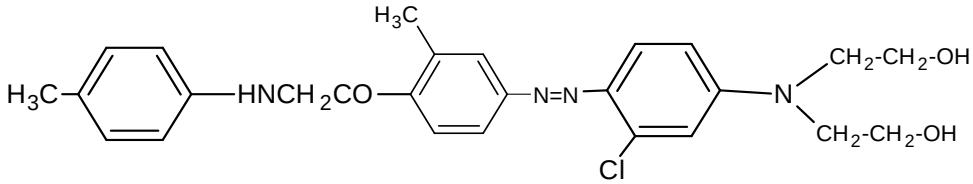
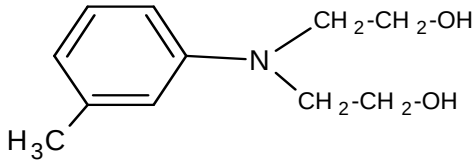
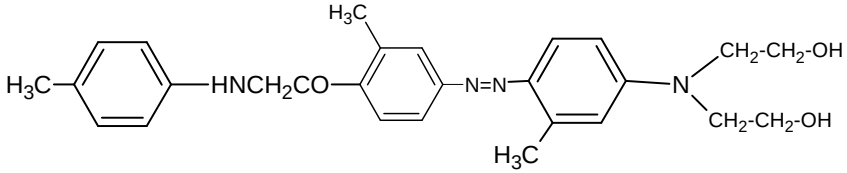
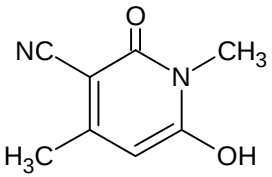
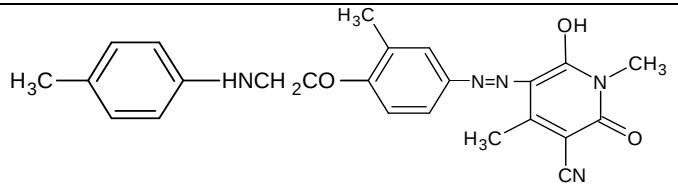
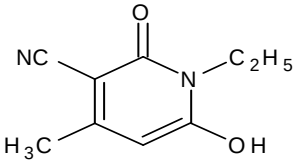
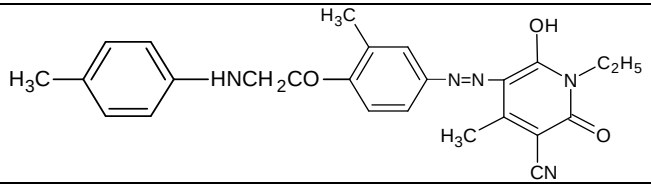
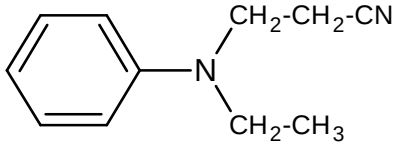
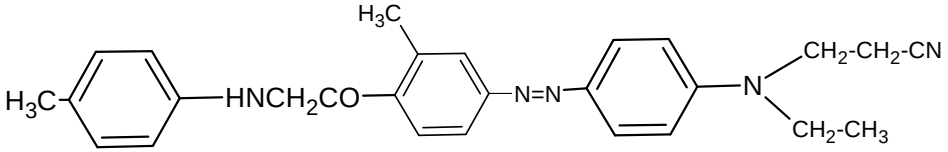
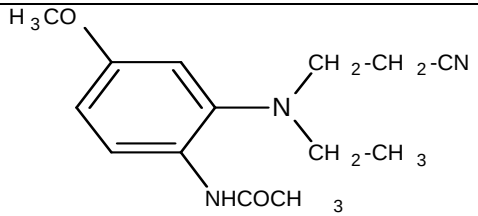
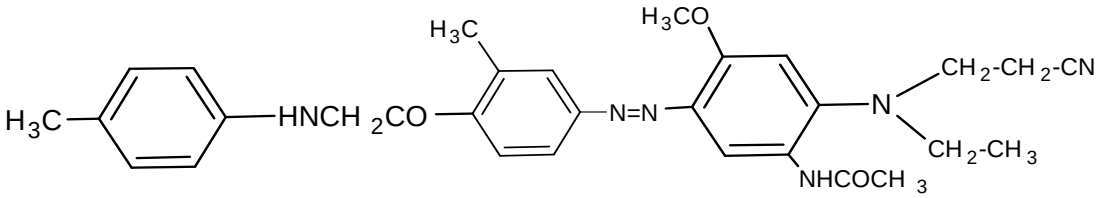
Traditionally, azo dyes are the most important class of commercial dyes, occupying more than half of the dye chemistry, which contain phenols as intermediates.[3-6] Hence ,in continuation of earlier work,[7-9] the present communication comprises the synthesis, characterization of some novel disperse azo dyes based on 1-(4-N-acetyl amino) 2-methyl phenyl 2-chloro ethanone,

MATERIALS AND METHODS

All the chemicals used were of analytical reagent grade and were used without further purification, All the product were synthesized and characterized by their spectral analysis, All Chemicals and solvents like acetone, ethanol, $NaNO_2$, sodium acetate were purchased from S.D.fine chemicals (india).

Melting points were taken by open capillary tube and are uncorrected.. The UV-Visible spectra were recorded in DMF using Shimadzu A-200 Spectrophotometer and C,H,N of all disperse dyes were estimated by the means of a carlo Erba elemental analyzer (Italy) The characteristic data of different molecules were studied their light, wash fastness properties [10-11] and further study applied on polyester fibers [12] and nylon fibers.

Table : I Structure of the Coulping component and corresponding of novel azo disperse dyes

Dye No	Coulping component	Disperse Dyes
D-1		
D-2		
D-3		
D-4		
D-5		
D-6		

Experimental

Synthesis of azo disperse dyes

1-(4-N-acetyl amino) 2-methyl phenyl 2-chloro ethanone (0.01 mole) (A). was dissolved in HCl (0.03 mole) with stirring and the solution was cooled to 0-5˚c in an ice-bath.A solution of sodium nitrite (0.01 mole) in 5ml water cooled to 0˚c then was added The excess nitrous acid was neutralized with sulfamic acid/urea (1.0 gm) and the mixture was filtered to get the clear diazonium salt solution. Diazotization of various aromatic amine was performed by a reported method.[13-14] D1-D6 coupling component was dissolved in HCl (15 ml) and then solution cooled 0-5˚c To this well stirred solution the above diazonium salt solution was added slowly so that temperature did not rise above 0-5˚c while maintaining the pH 4-5 by the action of sodium acetate solution (10% w/v) the mixture was stirred for 3 hrs. at 0-5˚c. After completion of the reaction the solid material was filtered, washed and dried it. So D1-D6 azo disperse dyes were prepared.

RESULTS AND DISCUSSION

The azo disperse dyes obtained from this compounds are shown in Scheme-I The Structure of the Coulping component and corresponding of novel azo disperse dyes in Table-I,

The observed bands in the IR spectra for each dye are shown in Table-II, IR spectra of all six series of disperse azo dyes contain aromatic nuclei, azo group and hydroxyl group. The band appeared from 1050 to 1350 cm^{-1} due to primary –OH group, The bands at 1500, 1200 and 1050 cm^{-1} appeared in the double bond region due to aromatic stretching. The strong band at 1575 to 1630 cm^{-1} appeared in the spectra are considered for the presence of azo (-N=N-) group. The band of 1725 to 1730 cm^{-1} might be responsible to –CO of $–COCH_2$ group. In the spectra of dyes obtained from methyl aniline derivatives side chain attached to the tertiary nitrogen The weak bands observed 2890-and 2950 cm^{-1} which is attributed to the $-CH_2$ stretching vibration.

The IR spectra of all dyes comprise the important bands due to initial diazo component. The bends due to –CH3 stretching 2825-2850 and 1320-1475 cm^{-1} and -CO of $-COCH_2$ dimethyl aniline(-CH3) . The other bands due to presence of coupling component are their respective positions. The elemental of C,H,N confirmed by Table: III.

The visible absorption spectroscopic properties of the all dyes were recorded in DMF. Absorption maximam (λmax), Intensites (log ε), dyeing assessment of disperse azo dyes on Polyester and Nylon fabrics are shown in Table-IV, The absorption maximam (λmax) of all the dyes falls in the range 392-540 nm in DMF. The values of the logarithm of molar extinction coefficient (log ε) of all the dyes were in the range of 3.953-4.894 , consistent with their medium absorption intensity The disperse azo dyes were applied at a 2% dye bath on nylon and polyester fabrics and gave various shade implied in Table-IV.

Table : II Position of selected bands in IR spectra of Disperse Azo dyes

Dye No.	C-H Stretching of aromatic cm^{-1}	CH_3 Stretching cm^{-1}	CN Stretching cm^{-1}	C=O (CH_2OCOCH_3) $COCH_2$ Stretching cm^{-1}	N=N Stretching cm^{-1}	1,2,4-Tri Sustituted cm^{-1}	Tritiary amine cm^{-1}	Primary alcohol cm^{-1}
D-1	3030, 1590,1480	-------	----------	----------	1590 1610	1590,1620 1475,1520	1240,1290 3350,1590	1050,1100 1350
D-2	2930,1610 1475,1470	2850,1475, 1320,1350	----------	----------	1600 1610	3100,1615, 1465	1240,1355 3410	1070,1350 1100
D-3	3030,1560 1630,1480	2830,1475, 1360	2240	1725	1630	1575 1640,1475	1350,1550 3450	1050,1100 1320,1350
D-4	2950,2990 1610,1480	2825,1480, 1350,1355	2220	1730	1630	3000,1550,1640,1475	1280,1240 3350,1350	1050,1100 1275,1320
D-5	2950,1575 1610,1480	----------	2230	----------	1575 1610	3000,1575 1475,1520	1240,1280 3450,1520	1050,1100 1260,1300
D-6	2930,1610 1480,1510	----------	----------	1725	1610	3100,1610 1480,1510	1250,1520 3420	1050.1100 1260,1300

All these spectra comprised the bands around 2890 and 2950 cm^{-1} presented of $-CH_2$ of $-COCH_2$ group

Table : III Characterization of novel azo disperse dyes

Dye No	Molecular Formula	Mol. Wt (gm/mole)	Melting Point ˚C	% C		% H		% N	
				Found	Cal	Found	Cal	Found	Cal
D-1	$C_{26}H_{29}N_4O_3Cl$	480.5	210	64.90	64.93	5.40	5.41	9.90	9.98
D-2	$C_{27}H_{32}N_4O_3$	460	240	70.40	70.43	6.93	6.95	12.07	12.17
D-3	$C_{23}H_{23}N_4O_3$	403	212	68.40	68.48	5.68	5.70	11.90	11.91
D-4	$C_{25}H_{25}N_4O_3$	429	180	69.90	69.93	5.80	5.82	13.00	13.05
D-5	$C_{27}H_{29}N_4O$	425	240	76.10	76.23	6.80	6.82	13.12	13.17
D-6	$C_{30}H_{34}N_6O_3$	526	215	68.40	68.44	6.42	6.46	15.90	15.96

Reaction scheme-I

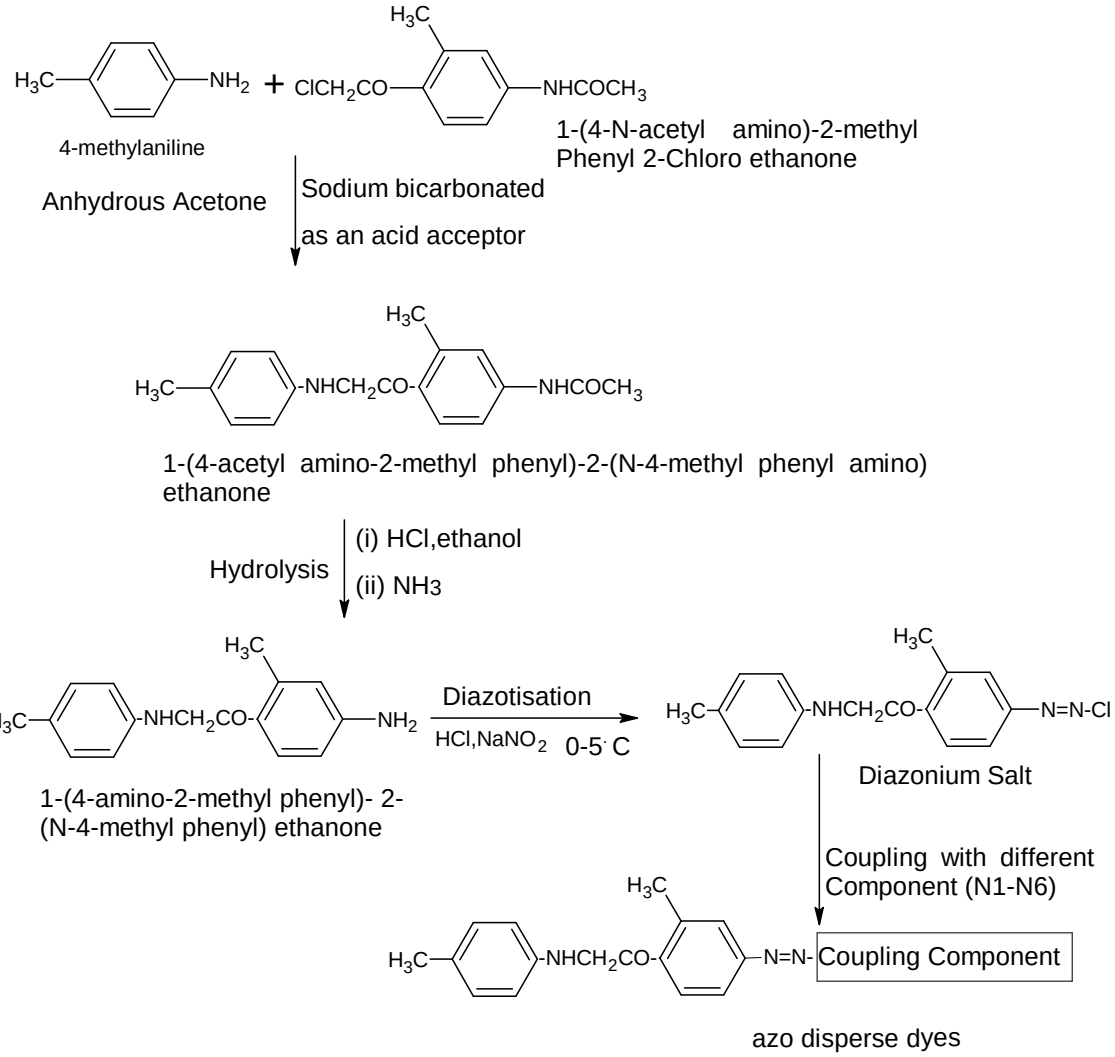


Table :IV Absorption maximam (λmax), Intensites (log ε), Dyeing assessment of disperse azo dyes on Polyester and Nylon fabrics

Dye	λmax (nm)	Log ε	Shade	Dyeing properties			
				Dyeing on polyester		Dyeing on nylon	
				Light	Wash	Light	Wash
D-1	467.0	4.208	Orange	5	4	5	4
D-2	508.0	4.653	Sunrise	4-5	4	4-5	4
D-3	427.0	4.290	Peogen blue	4	3	4-5	4
D-4	445.0	4.138	Light green	5	5	5	5
D-5	392.2	3.953	Ivory	5	4	5	4
D-6	540.0	4.894	Sandy	5-6	5	5-6	5

CONCLUSION

The azo disperse dyes have been prepared using based on 1-(4-N-acetyl amino) 2-methyl phenyl , 2-chloro ethanone. The present study revealed that prepared azo disperse dyes showed wide range of shades.They showed good dyeing performance on polyester and nylon fiber and The light fastness values of the azo disperse dyes are more consistent. The dyeing showed an excellent fastness to light, with very good to excellent fastness to washing.

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