Journal of Saudi Chemical Society (2013) **17**, 203–209

King Saud University

Journal of Saudi Chemical Society

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ORIGINAL ARTICLE

Synthesis, characterization and dyeing performance of new bisazo–bisazomethine disperse dyes

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Received 6 February 2011; accepted 11 March 2011
Available online 17 March 2011

KEYWORDS

Bisazo–bisazomethine;
Schiff base;
Polyester;
Disperse dyes

Abstract New bisazo–bisazomethine disperse dyes were prepared by the coupling of diazotized solutions of various aromatic amines with 2,2′-{methylenebis[4,1-phenylenenitrilomethylylidene]}diphenol (Schiff base). Schiff base (SB) was prepared by the condensation of 2-hydroxybenzaldehyde with 4,4′-diaminodiphenylmethane (DDM). The resultant dyes were characterized by elemental analysis, IR and ^{1}H NMR spectral studies. The UV–visible absorption spectral data were investigated in dimethylformamide (DMF) and are discussed in terms of structure property relationship. The dyes when applied on polyester fabric, gave golden yellow to reddish brown shades having fairly good to good light fastness, very good to excellent washing, perspiration and sublimation fastness and good to very good rubbing fastness properties.

1. Introduction

Azo disperse dyes are marketed as commercial dyes since long back for the dyeing of cellulose acetate as well as for the synthetic fabrics. They have phenolic moiety bearing hydroxyl group(s) as an auxochrome (Mohamed and Nour El-Din, 1999; Peters and Walker, 1956; Naik et al., 2000; Gordon and Gregory, 1983; Vashi and Desai, 1996; Maradiya, 2010; Patel and Pandya, 2003; Dixit et al., 2007). Much attention has also been given towards bisazo and polyazo dyes as dyeing materials in the recent years to increase their dye ability on fabrics (Vashi et al., 2003; Joshi and Mehta, 2004; Patel and Mehta, 2004; Dayananda and Revanasiddappa, 2007; Egli, 2005; Mali et al., 2000; Vashi and Mehta, 2004; Khurtsilaya et al., 2003; Wang et al., 2003). In addition to that there are several reports regarding bisazomethine (bisanil) dyes in which imine group formed by Schiff reaction of aromatic aldehyde with aromatic amine (Hosokai et al., 2010; Arun et al., 2009; Son et al., 2008). The crystal structures and properties of some bisazomethine dyes have been studied (Schmidt et al., 2007; Matsumoto et al., 2004; Kinashi et al., 2009; Kobayashi et al., 2005). However, there are no reports regarding bisazo–bisazomethine disperse dyes based on 2,2′-{methylenebis[4,1-phenylenenitrilomethylylidene]}diphenol Schiff base and the dyes in which both bisazo and bisazomethine chromophoric groups lie in a single molecular framework.

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Peer review under responsibility of King Saud University.
doi:10.1016/j.jscs.2011.03.009

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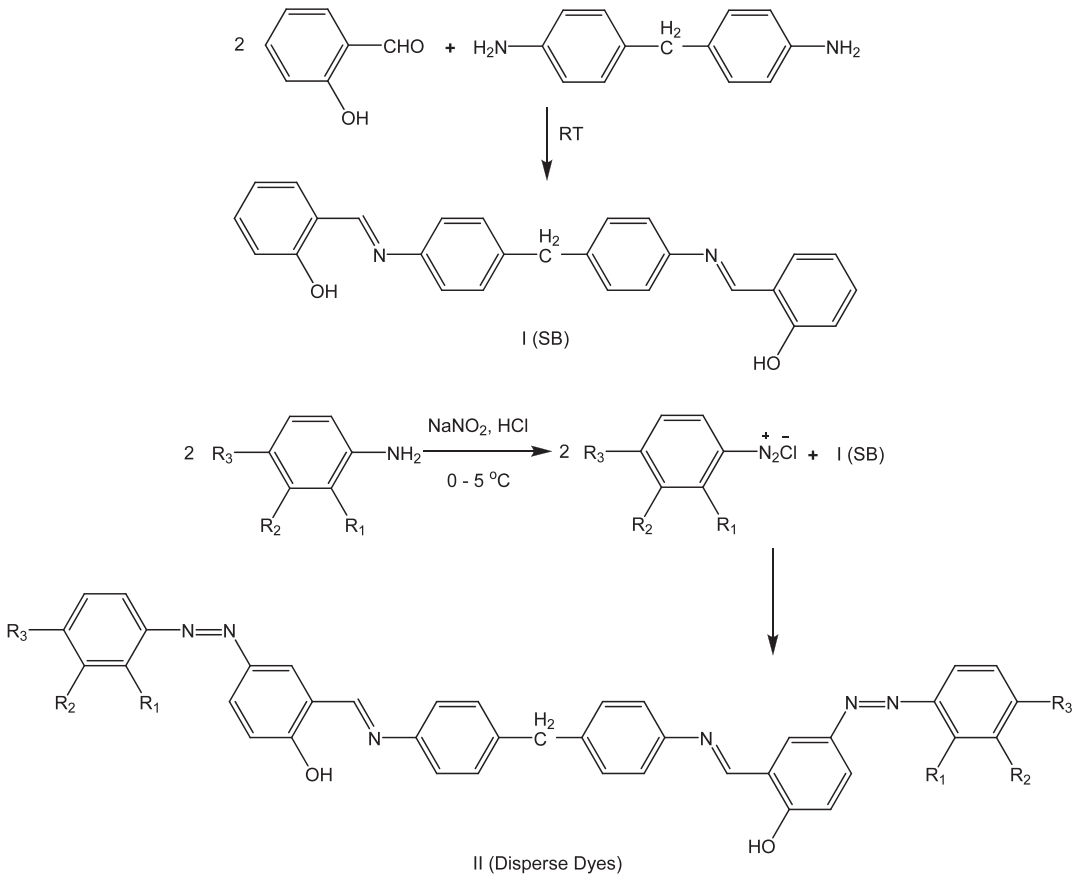

Where, substituent R_1, R_2 and R_3 of aromatic amines are given below

Dye No.	R_1	R_2	R_3	Amines
D_1	H	H	CH_3	4-methylaniline
D_2	H	H	H	Aminobenzene
D_3	H	H	NO_2	4-nitroaniline
D_4	H	NO_2	H	3-nitroaniline
D_5	H	Cl	H	3-chloroaniline
D_6	NO_2	H	H	2-nitroaniline
D_7	H	H	Cl	4-chloroaniline
D_8	H	H	OH	4-hydroxyaniline
D_9	H	OH	H	3-hydroxyaniline
D_{10}	H	H	Br	4-bromoaniline

Scheme 1

Hence, the present communication comprises the synthesis of a series of bisazo–bismethine disperse dyes based on 2,2′-{methylenebis[4,1-phenylenenitrilomethylylidene]}diphenol Schiff base. In addition to characterization of the dyes, they have been tested successfully as disperse dyes on polyester fabric.

2. Experimental

2.1. Materials and methods

All the chemicals used were of analytical grade and were further purified as and when required. DDM (4,4′-diaminodiphenylmethane), salicylaldehyde (2-hydroxybenzaldehyde), different aromatic primary amines, sodium hydroxide, sodium nitrite, hydrochloric acid were purchased from local market. The organic solvents used were purified by standard methods (Vogel, 1961). The aromatic amines used for diazotization are listed in Scheme 1. Polyester fabrics were gifted by Color Tax (Pvt.) Ltd., Surat. Melting points were determined by open capillary method and were found uncorrected. The visible absorption spectra of all the dyes were obtained by preparing solution (1×10^{-4} g/ml) in DMF and were recorded on a Carl Zeiss UV/VIS Specord spectrometer, and elemental analysis was carried out on Perkin Elmer CHNS/O Analyzer 2400 Series II. Infrared spectra were recorded on a Perkin–Elmer Spectrum GX FT-IR model between 4000 and 400 cm^{-1} using KBr pellets and ^1H NMR spectra were recorded on Bruker DRX-400 FT-NMR spectrometer at 400 MHz using in DMSO-d_6 as a solvent (Chemical shift in δ ppm). The purity