Journal of Saudi Chemical Society (2016) **20**, 523–529

King Saud University

Journal of Saudi Chemical Society

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ORIGINAL ARTICLE

Synthesis and dyeing performance of bisazo disperse dyes based on 3-[4-(4-amino-2-chlorophenoxy)anilino]phenol

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Received 20 April 2012; accepted 8 July 2012
Available online 8 September 2012

KEYWORDS

Polyester and nylon dyeing;
Fastness properties;
4-Amino-2,4′-dichlorodiphenyl ether;
DAP

Abstract The present communication aims to develop bisazo disperse dyes based on 3-[4-(4-amino-2-chlorophenoxy)anilino]phenol (DAP) both as a coupling component as well as a diazonium salt. Coupling reaction of DAP was carried out with a diazonium salt of 4-aminoacetanilide to yield a monoazo disperse dye, and then it was further used as a diazonium salt and coupled with a different aromatic phenol to synthesize bisazo disperse dyes. All the disperse dyes were characterized by elemental analysis, IR, NMR and UV–Visible spectral studies with a view to determine their chemical structure. The dyeing ability of these bisazo disperse dyes has been evaluated in terms of their dyeing behavior and fastness properties on different fabrics.

1. Introduction

Disperse dyes are the most widely used class of dyes for the dyeing of cellulose acetate as well as of synthetic fabrics. The history and development of these dyes is well documented by Fourness (1956). In recent years the main focus of research and development in the field of dyestuff is to improve fastness properties and to introduce or to modify new characteristics such as fire resistance, crease proofing, shrink proofing, and dimensional stability, to the fabrics (Binesh, 2005). In this context, one of the approaches is to enhance dye fiber affinity of the dyes. The starting materials 4-amino-2,4′-dichlorodiphenyl ether and *m*-amino phenol have been previously used successfully as coupling components to make disperse azo dyes (Nimmo and Hulms, 1980). The beginning of the synthetic fibers like nylon, polyester, polyacrylonitrile created significant challenge in the dyeing ability of hydrophobic fibers to dyestuff chemists. Consequently in the last three decades, the researchers focused their efforts on the synthesis of dyes for these fibers. Polyester is one of the most hydrophobic of all common fibers and generally dyed with disperse dyes because of their high tinctorial strength with good fastness properties. From the chemical point of view more than 50% of disperse dyes are simple azo compounds because of the ease with which a number of molecular combinations can be achieved by varying diazonium and coupling components, simple manufactur-

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Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.jscs.2012.07.012
1319-6103

ing process and providing a very wide color range of high color strength (Carr, 1995; Hamprecht and Westerkamp, 2003; Christi et al., 2000). As a result success has been achieved with the discovery of numerous new coupling and diazonium components intended to give disperse azo dyes especially for dyeing polyester and nylon fibers. Literature survey regarding bisazo disperse dyes based on 4-amino-2,4′-dichlorodiphenyl ether as well as DAP have not yet received much attention except for a few reports (Nimmo and Hulms, 1980) even though various 4-amino-2,4′-dichlorodiphenyl ether based dyes and intermediates have extensively been used in textile industries. Therefore, the present communication deals with the synthesis and application of novel bisazo disperse dyes based on DAP.

2. Experimental

2.1. Materials

4-amino-2,4′-dichlorodiphenylether was prepared by the reported method (Wilson and Dougal, 1963). All the other chemicals used were of analytical reagent grade and were crystallized before use.

2.2. Methods and instruments

All the intermediates and dyes were characterized by elemental analysis and spectral study such as UV–Visible, IR, ^{1}H NMR, ^{13}C NMR. NMR spectra were recorded in DMSO-d_6 solvent using Bruker 400 MHz NMR Spectrometer. Elemental analyses for C, H, N contents of DAP coupler and the dyes were carried out on Carlo Erba CHN Analyzer (Italy). The infrared absorption spectra were scanned on a Nicolet-400 D FTIR spectrophotometer using potassium bromide pressed pellet technique. The characteristic absorption bands that appeared in IR spectra of all the bisazo disperse dyes are shown in Figs. 1 and 2. The absorption spectra of all of the dyes in DMF–ethanol solution were scanned on a Beckmann UV–Vis spectrophotometer at a concentration of 1.6×10^{-2} mg/ml. The number of azo groups in all the dyes was estimated by redox titration method reported in the literature (Vogel, 1989).

2.3. Synthesis of 3-[4-(4-amino-2-chlorophenoxy)anilino] phenol (DAP)

3-[4-(4-amino-2-chlorophenoxy)anilino]phenol was prepared by the condensation of 4-amino-2,4′-dichlorodiphenyl ether with *m*-aminophenol in the presence of K_2CO_3. For this purpose, a solution of 4-amino-2,4′-dichlorodiphenyl ether (0.1 mol) in 40 ml methanol was taken in a round bottomed flask equipped with a condenser and was heated at a temperature of 65–70 °C under continuous stirring for 30 min. To this, methanolic solution of *m*-aminophenol (0.1 mole) aqueous K_2CO_3 (0.1 mole) was added. The reaction mixture was then refluxed for an hour and was allowed to stand for half an hour.

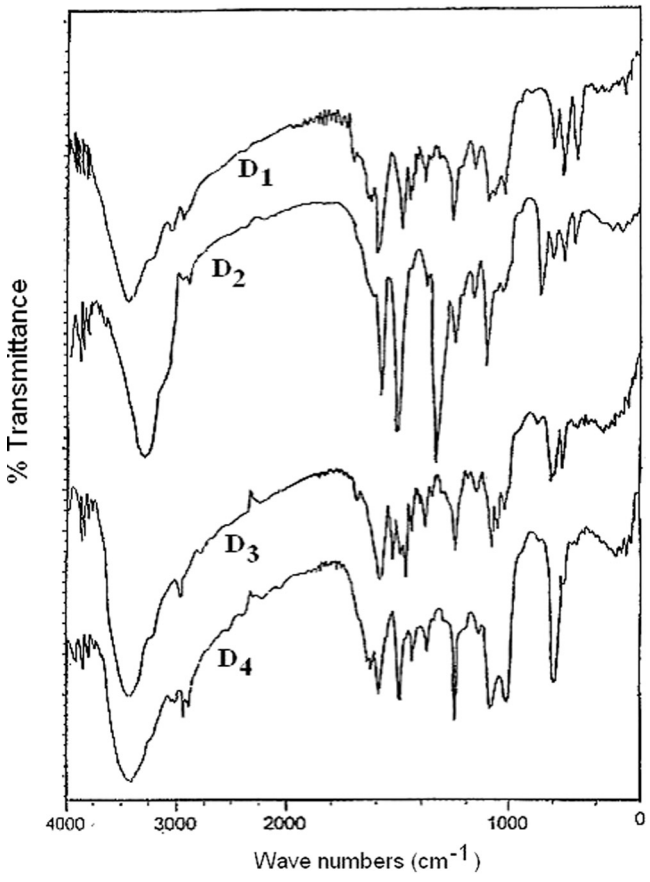

Figure 1 IR spectra of bisazo disperse dyes (D_1–D_4).

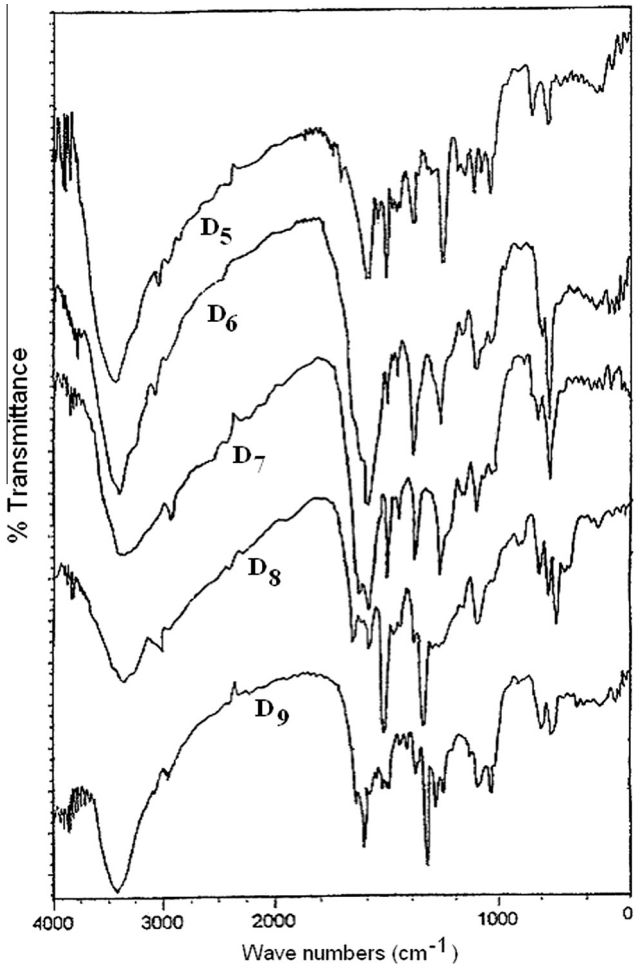

Figure 2 IR spectra of bisazo disperse dyes (D_5–D_9).