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## COMPARISON OF HPLC AND MICELLAR ELECTROKINETIC CHROMATOGRAPHY IN DETERMINATION OF SULFONATED AZO DYES IN WASTE WATER

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### ABSTRACT

Capillary electrophoresis (CE) and high-performance liquid chromatography (HPLC) are compared for the analytical separation of eight environmentally significant azo dyes, mono-, and di-sulfonated compounds. Optimum separation of these dyes by MEKC was achieved using a buffer of ammonium acetate 9.5 mM, Brij 35 0.1%, pH 9 and by applying electromigration injection at 12 kV for 30 s. Identification was made by the absorbance spectra of each peak. High-performance liquid chromatography separations were performed on a Discovery RP Amide C16 5  $\mu$ m with a gradient from 25% to 50% acetonitrile and a buffer, made of 1  $\mu$ g/L tetrabutylammonium bromide, 0.02%

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acetic acid and of 50 mg/L potassium hydroxide solution. The dyes were detected by absorbance at the wavelength of 214 nm.

The linear range of the proposed methods varied from 63 to 7600  $\mu\text{g/L}$  with a limit of detection ranging from 19–230  $\mu\text{g/L}$  by CE and varied from 73 to 5700  $\mu\text{g/L}$  with a limit of detection ranging from 22–280  $\mu\text{g/L}$  by HPLC regarding the assay of 500 mL of preconcentrated water sample.

## INTRODUCTION

Azo dyes are a very important group of synthetic chemicals. They are widely used as colouring agents in a variety of products, such as textiles, paper, leather, gasoline, and foodstuffs. However, some synthetic dyes may be pathogenic if they are consumed excessively. There is also evidence that synthetic precursors, intermediates, and degradation products of mentioned dyes could be potential health hazards due to their toxicity and their carcinogenic effects. These compounds are quite difficult to remove by conventional water treatment procedures and can, thus, be distributed from urban wastewater via rivers because of their high solubility in water.<sup>[1]</sup>

Up to the present, analytical methods for azo dyes have been frequently based on detection using ultraviolet-visible (UV-Vis) absorbance of these compounds.<sup>[2–4]</sup> For many sample types, including wastewater and solid waste, separation of these components from complex matrices is required prior to quantitative analysis using high-performance liquid chromatography (HPLC).<sup>[5,6]</sup> Unfortunately, the potential for interferences and errors in HPLC-UV-Vis methods is high, since the resolution obtained by HPLC is not always sufficient to completely separate all components in complex mixtures, and a great number of naturally occurring compounds and industrial contaminants also absorb in the same UV-Vis region. Therefore, in order to assess the potential environmental impact of these series of compounds, definitive analytical methods are needed. Recently, capillary electrophoresis (CE) has been developed as a rapid method for their determination, showing high resolution and good analytical performance. Capillary electrophoresis (CE) is a modern analytical technique which permits rapid and efficient separations of charged components present in small sample volumes. Separations are based on differences in the electrophoretic mobilities of ions in electrophoretic media inside small capillaries.<sup>[7–13]</sup> These capillaries consist of fused silica where all properties are of importance to obtain successful separations. The studied compounds were acid blue 113, acid red 73, acid red 13, mordant yellow 8, acid red 1, acid red 14, acid red 9, and acid yellow 23. Their structures are presented in Fig. 1. The aim of the present work is to compare the performance of CE and HPLC dye separations.