



B150 Capillary Electrophoresis/Diode Array Detection/Mass Spectrometry for the Forensic Analysis of Fiber Dyes

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The goal of this presentation is to determine the usefulness of capillary electrophoresis-diode array detection-mass spectrometry (CE-DAD-MS) on extracted fiber dyes for forensic fiber discrimination.

This presentation will impact the forensic community and/or humanity by demonstrating CE-DAD-MS of extracted fiber dyes represents a supplement to microscopy and microspectrophotometry for the forensic discrimination of fibers.

Fiber evidence is frequently used in forensic science to associate a suspect to a victim or crime scene. At times “questioned” fibers are collected from the crime scene and “known” fibers are collected from suspects for comparison. Evidence fibers are collected through a combination of picking, scraping, vacuuming, and sometimes taping clothing and areas of the crime scene. They are often mounted in a mounting material on microscope slides for comparison and storage. Once the fibers have been collected, questioned and known fibers are compared using a series of microscopic techniques to determine whether or not the fibers could have come from the same source. The first of these methods is often polarized light microscopy (PLM). Using PLM, the generic fiber type (polyester, acrylic, nylon, cotton, etc.) is determined, and color, fiber cross-sectional shape and fiber thickness are compared. This analysis is often followed by fluorescence microscopy and UV-Vis and fluorescence microspectrophotometry. If spectra of the known and questioned fibers are consistent, the hypothesis that the fibers originate from a common source should not be rejected. Additional discrimination may be achieved by extraction of the fibers dyes followed by chromatographic analysis. CE-DAD-MS was chosen as the analysis technique following extraction because of its high sensitivity and selectivity.

Fiber dyes were extracted using a Beckman-Coulter Biomek 2000 liquid sample-handling robot. Extracted dyes were analyzed using a Beckman-Coulter P/ACE MDQ capillary electrophoresis system coupled to a Micromass Q-TOF micro mass spectrometer. An external fiber optic light source with a xenon lamp was used as the light source for the diode array detector to enable simultaneous DAD and MS detection. This setup provides an improved signal to noise ratio in the visible region and a better agreement between peaks in the DAD and MS electropherograms.

CE-DAD of small molecules has often employed sodium acetate or phosphate buffers with cationic surfactants or cyclodextrins as buffer additives. However, because of the requirements of the electrospray ionization process, non-volatile buffers and buffer additives should be avoided in CEMS. CE-DAD-MS methods for the analysis of cationic dyes from acrylics, direct, vat, and reactive dyes from cotton, acid dyes from nylons, and disperse dyes from polyester were developed.

Overall, CE-DAD-MS of extracted fiber dyes represents an alternative approach for the forensic discrimination of fibers. However, because of the comparatively high cost and time requirements of CE/MS, extraction and further analysis may only be considered if additional discrimination is needed after forensic microspectroscopy and microspectrophotometry has been conducted.

Discrimination of Fiber Dyes, Capillary Electrophoresis, Mass Spectrometry