A113 Forensic Identification of Fluorescent Brighteners on Trace Evidence Fibers by Capillary Electrophoresis

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The goal of this presentation is to present the development of trace analytical methods for the analysis of fluorescent brighteners extracted from white fibers through capillary electrophoresis and followed by identification by UV/visible spectrophotometry and/or mass spectrometry.

This presentation will impact the forensic community by demonstrating that the characterization of white fibers with respect to fluorescent brighteners provides significant chemical marker information that is useful in identifying the origin and past history of such a fiber.

Textile fibers have become an important aspect of forensic science due to their abundance at crime scenes. Fibers are fundamental evidence as they could offer supportive evidence involving personal contact, whether between suspect and victim, or victim and inanimate objects such as cars, windows, and screen doors. Fibers fluoresce either because the colored dyes on them, the fiber polymer itself or the fluorescent brighteners (FBs) that have been added to the fiber. Due to the fact that FBs are the only dyes present on white fibers in most cases and the high number of compounds that can be used as FBs makes the probability of a matching combination of two or more apparently unrelated fibers highly improbable by coincidence alone. Although ultraviolet(UV)/visible and fluorescence microspectrophotometry allows direct and nondestructive analysis of a fiber of few mm in length, a more selective and sensitive technique such as capillary electrophoresis, is required to analyze diminutive amounts of dye (2-200 ng) present on forensically relevant analytes.

Neat white cotton, nylon and acrylic fabrics available at our lab were subject to simulated laundering by actual FBs industrially used on fibers. Suitable solvent conditions for the microextractions of optical brighteners from fibers were determined by screening experiments on small scale threads (2-5cm) following progress millimeter size threads were subject to extractions followed by reconstitution of the FBs with deionized water (ddH_2O). Individual and mixed standards of different types of FB's (e.g., coumarin, distyrylbiphenyls, heterocycle, pyrazolines, stilbenes and thiophene oxazole) used on white fibers were prepared by dissolving 1.0 mg of each standard in 1.0 mL of deionized water followed by a pre- cleaning stage using disposable pipette extraction (DPX) for the removal of surfactants. The FB analysis were performed with an Agilent 3D-CE system equipped with a diode array detector; the dyes were identified by matching migration times, UV/visible and fluorescence spectra. Optical brightener analysis through CE/MS will be performed after initial runs of FBs standard solutions performed with an Agilent 1100 Series LC/MS- TOF system due to technical difficulties with the CE/MS instrumentation available at the laboratory. The FBs present in the fibers were qualitatively identified and their relative quantitative composition was estimated. In addition the number of false positive and false negative matches, whether the FBs were correctly recognized, and the report of estimated proportions of multiple FBs was recorded.

The ability to discriminate white fibers from one another will add a new dimension to current fiber characterization technology. The successful use of CE/MS represents a promising analytical scheme for the detection and identification of fluorescent brighteners and dramatically increases the evidential value of white fibers.

Capillary Electrophoresis, Textile Fibers, Fluorescent Brighteners

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