B41 Evaluation of Solvent Systems and Mobile Phases for the Extraction and Identification of Fiber Dyes by Liquid Chromatography Mass Spectrometry (LC-MS)

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The objective of this presentation is to demonstrate the advantages of liquid chromatography – mass spectrometry (LC-MS) in the comparison of questioned and known fibers. The compatibility of LC-MS methods with existing dye extraction protocols will be emphasized.

This presentation will impact the forensic community and/or humanity by emphasizing the need for enhanced methods for the analysis of fiber evidence and demonstrating the compatibility of LC-MS methods with existing FBI SWGMAT dye extraction protocols.

Previous research has shown that cotton fibers that are indistinguishable by means of microspectrophotometry, HPLC analysis and FBI SWGMAT dye extraction protocols, may be discriminated by LC-MS analysis of the extracted dyes. Mass spectrometry provides a molecularlevel interrogation of the dye structure and, as a result, allows the differentiation of dyes having differing molecular structures. The same level of discrimination is not possible based only on UV-visible absorption profile, chromatographic behavior or extraction characteristics. The previously reported LC-MS analysis methods have been extended by evaluating their compatability with the solvent systems recommended by FBI SWGMAT protocols for fiber dye extraction. Solvent systemts that were evaluated for LC-MS analysis included pyridine/water, formic acid/water, acetic acid, chlorobenzene, chloroform, and dimethylformamide (DMF)/formic acid (1:1). The dyes that were extracted in each solvent system were readily chromatographed in a methanol/water gradient with the extraction solvent exerting no significant influence on the chromatographic behavior of the dyes. The chromatographic behavior of the dyes was found to be significantly influenced by the addition of 0.1% acetic acid or trifluoroacetic acid to the mobile phase for the analysis of basic dyes in positive ion mode. Similar enhancements were obtained by the addition of TEA (triethylamine) to the mobile phase for the analysis of acidic dyes in the negative ion mode. In both cases the additive enhanced sensitivity and separation efficiency of the dye by ESI-MS analysis and reversed phase chromatographic separation. The analyses were conducted on standards comprised of dyes of known structure that had been commercially applied to fibers of known composition.

This presentation will emphasize the need for enhanced methods for the analysis of fiber evidence and demonstrate the compatibility of LC-MS methods with existing FBI SWGMAT dye extraction protocols.

Fiber Analysis, Trace Evidence, Mass Spectrometry

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