A78 Room Temperature Fluorescence Spectroscopy as an Analytical Tool for the Forensic Examination of Textile Fibers

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After attending this presentation, attendees will be exposed to the application of analytical methods to forensic fiber examination. The analytical methods include high-performance liquid chromatography and fluorescence spectroscopy. The later technique will be introduced to the audience in the form of two-dimensional excitation and fluorescence spectra and excitation-emission matrices data formats.

This presentation will impact the forensic science community by introducing this technique to many practitioners in the forensic science field, as fluorescence spectroscopy has not been widely explored in the forensic science field. Forensic fiber evidence plays an important role in many criminal cases. Analytical techniques that can either discriminate between similar fibers or match a known to a questioned fiber are highly valuable in forensic science. When fibers cannot be discriminated by non-destructive tests, the next step is to extract the questioned and the known fiber for further dye analysis. Solvent extraction, enzymatic hydrolysis, and alkaline hydrolysis have been used to release dyes from the various types of fibers. Thin-layer chromatography (TLC), high-performance liquid-chromatography (HPLC) and capillary electrophoresis (CE) have been used to separate and identify colored dyes in fiber extracts. For the many hundreds of dyes used in the textile industry that appear to be the same color, that have highly similar molecular structures, virtually indistinguishable absorption spectra and identical or highly similar chromatographic retention times or electrophoretic migration times, the best approach appears to be the combination of mass spectrometry (MS) to HPLC (HPLC-MS) or to CE (CE-MS). Unfortunately, MS techniques destroy the fiber just like all the other methods that provide chemical information based on previous dye extraction. The main goal of this research is to provide the forensic scientist with nondestructive analytical methodology for textile fiber examination encountered as physical evidence in criminal investigations. A different aspect of fiber analysis based on the total fluorescence emission of fibers was evaluated. In addition to the contribution of the textile dye (or dyes) to the fluorescence spectrum of the fiber, the contribution of intrinsic fluorescence impurities (i.e., impurities imbedded into the fibers during fabrication of garments) as a reproducible source of fiber comparison was investigated. This presentation provides conclusive evidence on the reproducibility of fluorescence patterns for forensic fiber examination.

Textile Fiber Examination, Non-Destructive, Fluorescence

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