A79 Instrumental Set-Up for the Collection of Fluorescence Data Directly From Textile Fibers

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After attending this presentation, attendees will be introduced to the optimization of an instrumental set up for the collection of two- dimensional (2D) fluorescence spectra and excitation-emission matrixes (EEM) directly from a textile fiber. Published articles on fluorescence microscopy of fibers published have not taken full advantage of the information content that exists in the spectral signatures of textile fibers because measurements were made with excitation and emission band- pass filters. This presentation takes room temperature fluorescence (RTF) spectroscopy to a higher level of selectivity by optimizing the collection of 2D spectra and EEM directly from the fiber.

This presentation will impact the forensic science community by introducing instrumentation to forensic science practitioners that has the capability to explore the full potential of fluorescence microscopy not only for the analysis of textile fibers but also for other types of solid samples.

The nondestructive techniques currently available for comparing dyes in textile fibers; diffuse reflectance infrared Fourier transform spectroscopy and Raman spectroscopy have shown some promise. Unfortunately, the limited capability to detect small concentrations of dyes that could add valuable information to the signature of fibers certainly reduces their discrimination power for forensic fiber examination. A search of the literature has revealed that no efforts have been made to investigate the full potential of fluorescence spectroscopy for the purpose at hand. Articles on fluorescence microscopy of fibers took no advantage of the information content that exists in the spectral signatures of textile fibers because measurements were made with excitation and emission band-pass filters. This research takes room- temperature fluorescence (RTF) spectroscopy to a higher level of selectivity by optimizing the collection of fluorescence data directly from the fiber. The work presented here deals with the optimization of an instrumental set up for the collection of two-dimensional (2D) spectra and excitation-emission matrixes (EEM) directly from the fiber. The instrumental set up interfaces an epi-fluorescence microscope for reflected light fluorescence measurements to a spectrofluorimeter via fiber optic probes. The excitation source of the spectrofluorimeter consists of a continuous 100 W pulsed xenon lamp with broadband illumination from 200 to 2000 nm. Excitation and fluorescence spectra are recorded with two spectrometers holding the same reciprocal linear dispersion (4.2 $nm \cdot mm^{-1}$) and accuracy (±0.5 nm with 0.3 nm resolution). Both diffraction gratings have the same number of grooves per unit length (1200 $grooves \cdot mm^{-1}$) and are blazed at 330nm (excitation) and 500nm (emission). A photomultiplier tube (PMT) with spectral response from 185 to 850 nm is used for fluorescence detection operating at room temperature in the photon-counting mode. The sample compartment of the spectrofluorimeter is equipped with a fiber optic platform that optimizes collection efficiency with the PMT via two concave mirrors. An in-house made fiber holder facilitates the reproducible positioning of the microscope objective with respect to the fiber for reproducible collection of 2D spectra and EEM data formats.

Room Temperature Fluorescence, Microscopy, Textile Fibers

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