



E20 Universal Detection of Body Fluid Traces *In Situ* With Raman Hyperspectroscopy for Forensic Purposes

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The goal of this presentation is to demonstrate the difficulties of separating Raman spectra of a sample from that of a substrate and to present a brand new way to deal with this problem.

The presentation will impact the forensic science community by familiarizing attendees with the progress made on a new method for body fluid identification that is non-destructive, fast, easy, and can be used regardless of substrate.

Raman spectroscopy has been a boon to the field of forensic science. One area in which this technique exhibits exceptional promise is body fluid identification and characterization. Previous research has demonstrated that Raman spectra combined with advanced statistics can reliably differentiate body fluids. This is an improvement on current methods that are destructive to the evidence, specific to a single body fluid, and have numerous false positives and cross reactants; however, substrate interference remains a major impediment to its practical implementation.

The new approach outlined in this presentation has immediate application for body fluid detection and allows for a universal, automatic, non-destructive, on-field method for confirmatory identification of body fluid traces at a crime scene. To overcome substrate interference, previous research has been performed using different laser excitation wavelengths, spectral background subtraction, and statistical modeling; however, no one method was able to be used for every substrate tried. Here, an approach for the universal detection of body fluids, regardless of the substrate, is presented. This approach is based on Raman hyperspectroscopy and Multivariate Curve Resolution (MCR) and a new program called Hypothetical Addition Multivariate Analysis With Numerical Differentiation (HAMAND). These techniques were applied to datasets representing simulated semen evidence. Raman spectra of the target body fluid, semen, was first decomposed using MCR and standards were picked from the resulting components. These standards were used to train the program HAMAND. The HAMAND program was then applied to experimental spectra of a semen on substrates. HAMAND then extracted the standards from the experiment spectra, if they were present. Two experimental conditions were tried, one of semen on glass, and the other of semen on blue polyester. In every instance, the signal of the body fluid was extracted and matched to a reference spectra of semen. This approach is applicable to any analyte that is either a minor contributor or spatially distributed on a strongly interfering substrate.

Body Fluids, Raman Spectroscopy, Chemometrics