B6 Investigating the Use of Raman Spectroscopy for the Differentiation of Mixed Body Fluid Samples

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After attending this presentation, attendees will be aware of the potential of Raman spectroscopy to be integrated into forensic body fluid analysis. This includes its use in both identifying individual fluids, differentiating between fluids in mixed samples, and analyzing samples found on different substrates.

This presentation will impact the forensic science community by discussing the advantages and limitations of Raman spectroscopy with regard to its use in the identification and analysis of body fluids and their mixtures.

In forensic investigations, stains recovered from crime scenes can often be a combination of different body fluids (e.g., semen and saliva, or blood and saliva). With the success of forensic DNA typing over the past three decades, there are several strategies for the successful resolution of DNA mixtures; however, there has been little research into effective analytical methods for the resolution of mixtures of body fluids. While there are certain methods currently employed for the confirmatory identification of body fluids, many of these are destructive (in terms of consuming the sample), some have variable results and are labor intensive, while none have the capability of separating two body fluids in one sample. The non-destructive capabilities of Raman spectroscopy have allowed it to become a growing source of interest in the forensic science profession. Research has shown that Raman spectroscopy produces spectra which can be used to identify blood, semen, saliva, vaginal secretions, and sweat without consuming the sample.[1] The goal of this study was to investigate the use of Raman spectroscopy to identify the individual body fluids comprising a mixed body fluid sample.

Following informed consent, venous blood, semen, saliva, and urine were collected from five volunteers (n=20). Raman spectroscopy with a 785nm excitation wavelength under controlled laboratory conditions was performed on the individual body fluids, followed by body fluid mixtures of varying ratios. The body fluids were also tested on a variety of substrates (aluminum slide, black cotton, and white cotton). Last, DNA profiling was performed on a selection of the scanned samples to investigate the ability to obtain a DNA profile post-Raman analysis.

The results showed that each of the body fluids produced their own individual spectra. Mixture testing revealed that detection of both body fluids was possible with blood and semen, saliva and semen, saliva and urine, and semen and urine mixtures; however, the results indicated that the blood gave too strong a Raman signal to allow for saliva or urine to be fully detected. The substrate analysis revealed that blood was the only body fluid partially detected and was only detected on the white cotton. All mixtures tested on the substrates gave indefinite results due to interference from the substrates. Full DNA profiles were obtained from all samples tested.

This study reveals the successful use of Raman spectroscopy for the resolution of a number of mixed body fluid samples and highlights the potential of the technique to be introduced as a novel, non-destructive method for the identification of forensically relevant body fluids.

Reference(s):

1. Virkler K., Lednev I.K. (2008). Raman spectroscopy offers great potential for the nondestructive confirmatory identification of body fluids. *Forensic Science International*, 181(1–3), e1–e5. http://doi.org/10.1016/j.forsciint.2008.08.004

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