E81 A Raman Spectroscopic Method for Semen Identification: Azoospermia

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Learning Overview: After attending this presentation, attendees will understand: (1) the need for a non-destructive and more specific test for human semen, (2) the advantages of using Raman spectroscopy and chemometrics to identify semen, and (3) how sperm contribute to the Raman spectra of semen.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by showing alternative methods for body fluid identification that are improvements over current methods.

This presentation will focus on semen, a body fluid that is especially important in sexual assault cases, and the validation of an alternative method for its identification. Semen is a special body fluid because it is made of two distinct parts, seminal fluid and sperm. Sperm are the most unique part of semen and, therefore, the presence of sperm is the most reliable method of positive semen identification. However, current semen tests rely on the detection of proteins that are not unique to semen in the seminal fluid because some semen contains no sperm, a condition called azoospermia. The laboratory has been developing a Raman spectroscopic test for the identification of dry traces of body fluids, including semen, for forensic purposes. An automatic software has already been built for differentiating all main body fluids.[1]

The main objective of this study was to evaluate the ability of Raman spectroscopy to identify semen traces in the absence of sperm. This will ensure that the method is compatible, even with semen in disease states. For this purpose, a comparative analysis of Raman spectra of semen, seminal fluid, and sperm samples obtained from several donors was conducted. The spectra of seminal fluid were very similar to that of whole semen. Both of these spectra were dominated by contributions from the amino acids, tyrosine and phenylalanine, and the insoluble crystal spermine phosphate hexahydrate. The spectra of semen and seminal fluid were also very different from the spectra of sperm. It was determined that the contribution of seminal fluid dominates the Raman spectra of semen. This was further confirmed by analyzing Raman spectra of semen obtained from a donor who had had a vasectomy (azoospermia). These spectra very closely resembled those of semen and seminal fluid. The individual spectra from seminal fluid and azoospermatic semen were correctly identified with a previously made chemometric model as semen. It was concluded that the presence of sperm is not necessary for the correct identification of semen using Raman spectroscopy and chemometrics. This further demonstrates a great potential of Raman spectroscopy as a universal tool for confirmatory identification of all main body fluids for forensic purposes.

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Reference(s):

1. Muro, Claire K., Kyle L. Doty, Luciana Fernandes, and Igor Lednev. Forensic Body Fluid Identification and Differentiation by Raman Spectroscopy. *Forensic Chemistry*, 1 (2016): 31-38.

Semen, Raman Spectroscopy, Azoopsermia