

B67 The Identification of Various Body Fluids Obtained From the Crime Scene With Fourier Transform Infrared (FTIR) and Age Determination

Shabnam Maharramli, BS*, Üsküdar University, Istanbul 34662, TURKEY; Tugba Ünsal, PhD, Üsküdar University - Forensic Sciences, Istanbul 34662, TURKEY; Nurdan Kenan, MS, Istanbul, TURKEY; Kaan Yilancioglu, PhD, Üsküdar University, Istanbul 34662, TURKEY; Sevil Atasoy, PhD, Üsküdar Üniversitesi Adli Bilimler Enstitüsü, Istanbul, TURKEY

Learning Overview: After attending this presentation, attendees will have learned about the detection of body fluids (saliva, blood, semen, vaginal fluid, and urine) by FTIR and its advantages

Impact on the Forensic Science Community: This presentation will impact the forensic science community by enabling the determination of body fluids with FTIR and by giving a chance to advanced analysis since it doesn't have any sample loss.

Forensic science is a wide research field, which aimed at developing analytical methods to analyze evidence to ensure justice through criminal investigation. Identification of body fluids such as blood, semen, saliva, vaginal fluid, etc. should be done correctly since determination of time-dependent changes in these fluids and obtaining information about the time they were at the scene are very important in illuminating forensic cases. In addition, the development of DNA analysis requires proper collection and preservation of body fluids.¹ Many stains of body fluid are invisible, present in very small quantities or in a mixture, and therefore not always easy to identify. Identification of body fluids allows one to determine the biological source of stains, as well as conducting DNA analysis and interpreting their results. Identification of body fluids in forensic cases is generally evaluated by enzymatic and immunological tests as a screening test at the scene.² One of the important disadvantages of these tests is that they have margins of error and create cross-reactions between other species and tissues, since most of them are not specific to identify species. In addition, there is no improved enzymatic or immunological tissue test for vaginal secretion identification. These disadvantages have led to the development of IR spectroscopy, which is a non-destructive, fast, and confirmatory analyzation method.³

FTIR is emerging as the preferred method of analysis for non-destructive analysis of the chemical composition of unknown biological stains. FTIR has the ability to do preliminary identification and further studies to determine the age of unknown biological stains at crime scene and even make interspecies distinction. In addition, this method is advantageous over most existing biochemical tests due to its high specificity, universality, non-consumable nature, and allowing samples to be examined directly over the substrate in crime scenes.⁴

In this presentation, a new overview of applications of FTIR for forensic analysis of body fluid traces is presented. Body fluid samples were analyzed by taking on various substrates and exposing them to certain environmental conditions in order to simulate scenarios related to forensic events. Nine different parameters (fresh, 1 hour, 3 hours, 1 day, 3 days, 1 week, 15 days, 1 month, and 1 year waiting samples) were determined according to the time and were examined over five different body fluids, namely saliva, blood, semen, vaginal fluid, and urine. Samples taken from ten volunteer women and ten male individuals were stained on fabrics, which were not used before, and exposed to ultraviolet radiation for two hours after being washed in the washing machine at 90°C. After that, these staining samples were analyzed after being dried at 25°C (room temperature).

As a result of this study, samples were identified using FTIR spectroscopy without consumables instead of serological tests. In addition, age determination was made by using time-related changes in the chemical components in the body fluids.

Reference(s):

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2. Makhni T., Ilchenko O., Reynat A. et al. Age-Related Changes In FTIR And Raman Spectra of Human Bloodpacs. *Atoms and Molecules*. 2016;61(10).
3. Takamura A., Watanabe K., Akutsu T. Soft and Robust Identification of Body Fluid Using Fourier Transform Infrared Spectroscopy and Chemometric Strategies for Forensic Analysis. *Scientific Reports*, 2018; 8:8459.
4. Wei X., Yu K., Wu D. Species Identification of Semen Stains by ATR-FTIR Spectroscopy. *International Journal of Legal Medicine*, 2020.

Forensic Sciences, FTIR, Age Determination