



A37 HS-SPME/GC-MS Analysis of Various Biological Specimens Using VOCs

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The goal of this presentation is to provide the forensic community with an evaluation of volatile organic compounds (VOCs) present in biological specimens using headspace solid - phase microextraction/gas chromatography - mass spectrometry (HS-SPME/GC-MS).

The presentation will impact the forensic community by providing education on novel detection and analysis methods for the identification of detectable VOCs from biological specimens.

Optimum extraction times for the analysis of VOCs present in different biological specimens were evaluated. Various GC methods were also investigated. This research is a part of a larger study currently being conducted which aims to correlate VOCs found in individuals across different biological specimens including blood, breath, cheek swab, and hand odor.

The human odor is made up of a variety of organic compounds such as aldehydes, alcohols, alkanes, esters, fatty acids, and ketones. Volatile organic compound analysis in biological samples such as expired air (breath), sweat, blood, and urine has been used for various applications such as toxicology, medicine, and forensics. Over the recent years interest has increased regarding the identification of VOCs for metabolic profiling or diagnostic potentials for certain diseases that are known for its association with distinct odor.

A great deal of research has focused on HS-SPME and the determination of various volatile organic compounds across different biological matrices. HS-SPME has become extremely useful in the extraction of VOCs from biological matrices, as high molecular weight compound interferences are greatly reduced, allowing for small VOCs to be extracted from the headspace of the compound. Work in this area has involved matrices such as breath, cheek swab, and blood. Recently, SPME has been used to determine VOCs present in human scent from hand and armpit odor.

Expired air was sampled in a Teflon breath sampling apparatus. Whole blood was obtained by finger stick sampling and collected onto FTA cards. Cheek swabs were collected under typical forensic evidence collection methods. Blood and cheek swab samples were immediately transferred into 10mL headspace vials following collection. SPME- GC/MS was utilized to extract, separate, and identify the volatile components from the collected biological samples. Different SPME exposure times were investigated to evaluate the optimal extraction times for each specimen. No attempt was made to control microbial interactions with the samples as it may make contributions to the overall odor profile.

Optimal extraction times for each specimen were determined by a combination of the number of human scent compounds extracted and the abundances of selected extracted VOCs. Using the same GC method as previously determined for VOC extraction and analysis of hand odor, 21 hours was found to be the optimal extraction time for VOCs from cheek swab samples. For breath odor VOCs, the optimal extraction time was found to be 15 hours.

Through this research a novel blood analysis method is introduced; this method presents various applications, both in forensic and clinical areas. Forensically, HS-SPME provides a powerful tool in the analysis of blood VOCs, as FTA cards are widely used to store DNA. The thermal stability of FTA cards make the method described non-destructive to the sample allowing for continuous analysis of blood VOCs to take place while keeping any DNA information intact. Furthermore, preliminary research indicates a correlation between blood VOCs and human scent, thereby increasing the power and utility of the method presented here.

Volatile Organic Compounds, Biological Specimens, HS - SPME/GC - MS