D60 Detection and Identification of Volatile Organic Compounds in Dried Human Blood Samples by Instrumental Analysis and Canines

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After attending this presentation, attendees will have a better understanding of the volatile organic components in blood collected using different extraction methods.

This presentation will impact the forensic science community by being among the first to identify such volatile organic compounds (VOCs) in dried blood samples and show that a properly trained detector canine is capable of locating extremely small quantities of human blood.

Detector canines are commonly used by law enforcement, military, and private organizations to locate a diverse collection of targets, including explosives and drugs, as well as bedbugs and agricultural products. Canines are often trained to locate living and deceased humans and human blood. It is generally accepted by the canine community that detector canines locate the targets of interest using one or a combination of volatile organic compounds (VOCs) unique to that target odor. Several studies have been performed on the VOC odor profiles of specific targets of interest to the law enforcement community, including explosives, drugs, and humans (living and deceased); however, such a study has never been conducted to determine the components of blood odor. Furthermore, in all instances involving the detection of trace human blood via canines, dried human blood is used for training, which makes it difficult to establish detection thresholds using actual blood samples, and to eliminate other non-human sources of blood from consideration while on an investigation. For this reason, the use of human blood VOC mimics to assist handlers or canine specialists for training purposes to effectively locate dried blood associated with a crime is new and desirable.

In this research, VOCs from the dried human blood samples, similar to what may be found associated with a crime were analyzed. The VOCs were collected from the headspace of the blood samples using two different sampling methods: air sampling with traditional thermal desorption techniques and solid phase microextraction (SPME). All samples were analyzed by gas chromatography/mass spectrometry (GC/MS). The protocols used for the determination of VOCs for blood were developed for both sampling methods, using blood from a single human donor. Following method optimization, blood was collected from a small sample population in which the blood was dried under controlled conditions, and then the headspace was sampled and analyzed. The VOC content of each sample was compared and similar compounds were considered to be possible key compounds for canine detection. The VOCs produced by human blood during aging of the dried blood under oxygen-deprived and oxygen-rich environments were also compared. Further research included canine trials using dried blood from the sample population, as well as mixtures of such key compounds.

Based on the VOCs identified using both extraction methods it was observed that the two techniques do not necessarily yield similar results, yet instead can be considered complimentary extraction methods. Using both sampling methods a number of VOCs were identified and were shown to be consistent across the sample population. These compounds will likely be crucial to identifying the unique combination of VOCs utilized by blood-specific canines. Additionally, the trained blood canine was able to successfully locate small amounts of blood from different subjects. This study will be among the first to identify such VOCs in dried blood samples, and will be the first to scientifically show that a properly trained detector canine is capable of locating extremely small quantities of human blood as well as the VOCs responsible for the odor profile.

Canine Detection, Blood, Volatile Organic Compounds

 ** Presenting Author*