



B43 Volatile Compounds Produced by Decomposing Human Blood and Those Detected by Cadaver Dogs

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After attending this presentation, attendees will learn about the volatile organic compounds that are produced as human blood decomposes and the odor signature compounds cadaver dogs alert to.

By determining the odor signature compounds produced in aging blood, better and less hazardous training tools can be developed. Better training will lead to more reliable detection of human remains and trace blood spatters not readily visible and identification of crime scenes where bodies are not present. This presentation will impact the forensic community and/or humanity by assisting in the identification of the odor signature compounds which will lead to better trained cadaver dogs, more reliable evidence gathered, better results in finding bodies, and future development of instrumental methods with equal or better detection than detector dog teams.

Cadaver detection canines are dogs trained specifically to locate human remains. Although the use of canines as detection methods for items of forensic interest has been accepted historically for many years, the *Frye* and *Daubert* rulings of forensic evidence admissibility require validation of scientific processes. Accordingly, the canines must be capable of locating these remains in many environments, but must not be confused by the decomposition of other animal species. Therefore, the training protocols of most law enforcement agencies stipulate the use of human remains and human blood, both in various degrees of decomposition. Although these training practices are generally accepted within the canine handling community, the safety concerns regarding the biohazards of human tissue, and the possibility of infection of blood-borne disease such as HIV/AIDS, and hepatitis B/C confirms that the training aids used by handlers do pose a significant health risk. Currently available pseudoodors, those that mimic human decomposition, have been shown to be of limited application to canine training. Training aids that effectively reproduce the odor of decomposition without the associated risk of blood handling have the potential to replace real tissue aids in most circumstances, while maintaining the high standard of odor discrimination.

The process of blood decomposition involves coagulation of the blood, and thus may be limited or modified by the addition of anticoagulants such as EDTA and CPDA1 to the blood samples to extend shelf life or prevent decomposition during storage. To date, the role that each component of blood plays in the decomposition process has not been determined, nor have the compounds formed been identified. However with coagulation playing an important role in the overall process, it is proposed that the plasma component of blood is heavily involved.

Samples of blood and blood components, both with and without anticoagulants, have been allowed to decompose over time. The headspace of these samples has been collected and analyzed using Solid Phase Microextraction (SPME) with Gas Chromatography - Mass Spectrometry (GC-MS). Blood itself is a complex mixture of plasma and cells, hence given the complexity of the blood sample, and the diverse nature of the compounds present, polydimethylsiloxane (PDMS) and polydimethylsiloxane/divinylbenzene (PDMS/DVB) SPME fiber chemistries are combined in complementary analysis.

Several variables were considered during the development of a technique that will provide an efficient means of identifying the volatile compounds. Blood and blood component samples were kept in various temperatures including room temperature, 37 degree Celsius, and under excessive heat. Seven-year-old, one-year-old, three-month-old, and fresh blood samples were analyzed to determine the development and disappearance of the desired volatile compounds in the presence and in the absence of anticoagulant.

This study proposes that the volatile chemicals detected during the decomposition of human remains must also be present during the decomposition of human blood. The use of fresh blood that is permitted to decompose naturally, versus expired blood or plasma from a blood bank, has the potential to affect the decomposition odor observed.

SPME-GC-MS, Blood Decomposition, Cadaver Dogs