H93 An Investigation of the Decomposition Odor Profile Produced by Postmortem Microbes

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Learning Overview: After attending this presentation, attendees will understand the importance of building a reference library of Volatile Organic Compounds (VOCs) produced by postmortem microbes, as well as the general trends associated with VOC evolution from three postmortem microbial species.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the correlation between results of VOC profiling and the postmortem microbial clock, which may improve postmortem interval estimation and/or search and recovery procedures.

VOCs are the category of decomposition byproducts that comprise the odor associated with decomposing remains. While there have been substantial leaps forward in recent years toward characterizing this odor under various conditions (e.g., postmortem interval, geographical region, season), there exists a large gap in knowledge of the underlying mechanisms that produce these VOCs. A decomposing body is a complex resource of biotic and abiotic components, meaning that volatile by-products cannot always have their exact sources established. Substantial information has become available regarding the microbial community that exists on decomposing bodies, which may provide insight into the sources of critical VOCs released throughout decomposition. As VOCs are now being more closely investigated with hopes of improving cadaver-detection dog practices and introducing complementary portable sensor approaches, it is increasingly important to understand the relation of VOC production in relation to the postmortem microbial community.

The purpose of this study was to investigate VOC emissions from bacteria collected from decomposing remains using Solid-Phase Microextraction Arrow combined with Gas Chromatography/Mass Spectrometry (SPME Arrow-GC/MS). Three postmortem bacterial species (*Bacillus subtilis, Ignatzschineria indica,* and *I. ureiclastica*) were cultured in headspace vials on standard nutrient agar at 24°C and monitored over a period of five days. The hypothesis was that these species would release VOCs that have been previously identified in decomposition odor in temporal trends throughout their growth cycle.

The results of this work indicated that each species monitored in this study exhibits a specific VOC profile. In addition, VOCs monitored over time exhibited temporal trends; some compounds trended upward in abundance whereas others trended downward, depending on the compound and species of bacteria. SPME Arrow was effective and reproducible in producing bacterial VOC profiles. *I. ureiclastica* was the only major producer of dimethyl disulfide, a key decomposition VOC previously identified in all decomposition odor studies. Other compounds of interest included various alcohols, ketones, aldehydes, and aromatics.

This research is significant because it is the first primary study that links decomposition odor with postmortem microbial community. The trends developed in this study will assist in developing more accurate portable sensor arrays for decomposition odor, as well understanding the dynamics and variability of VOC production in previous literature. Future work on additional postmortem bacterial species and with more advanced chromatographic technology will assist in building a VOC database that can be accessed in future approaches profiling VOCs from whole cadaver decomposition in postmortem examination scenarios.

Taphonomy, Volatile Organic Compounds (VOCs), Postmortem Microbial Community