G111 Frozen-Thawed vs. Freshly Killed: A Comparison of the Volatile Organic Compounds Detected From Decomposing Remains

Norma I. Caraballo, BSc, Florida International University, International Forensic Research Institute, Department of Chemistry & Biochemistry, 11200 Southwest 8th Street, CP 344, Miami, FL 33199; and Kenneth G. Furton, PhD, Florida International University, International Forensic Research Institution, University Park, Miami, FL 33199*

After attending this presentation, attendees will have enhanced their understanding of the scent of death that is released during the decomposition process of a human cadaver analogue.

This presentation will impact the forensic science community by expanding upon the limited knowledge of volatile organic compounds (VOCs) that evolve from decomposing remains, as well as assessing the impacts that freezing and then thawing the remains may have on the VOCs generated.

The decomposition process, which starts soon after death (Vass 2001), has been studied under an array of conditions using a variety of animal models, such as pigs (Payne 1965), squirrels (Johnson 1975), rabbits (Johnson 1975), rats (Micozzi 1986) and humans (Mann et al. 1990). In the latter study, the effects of temperature on the decomposition process of human remains were investigated; it was found that when temperatures were cold or near freezing, the rate at which the cadavers decomposed reduced or ceased entirely. In the 1986 study conducted by Micozzi, the effects of temperature on the decomposition process were also evaluated. Within this study, the effects on rats that were frozen after being euthanized and then thawed versus those that were freshly killed were compared; it was determined that those rats that were frozen and then thawed decomposed from the "outside-in" while those that were freshly killed decomposed from the "inside-out."

Alive, the body consists of proteins, carbohydrates and lipids, and at death, these compounds breakdown into simpler molecules generating a putrid odor which has come to be known as the *scent of death*. Several research groups have evaluated the VOCs that are released during the decomposition process of human remains. Vass et al. (2004, 2008) conducted a two-part study: in part one, the authors discovered over 400 volatile organic compounds associated with the decomposition process of buried human remains and in part two, 30 compounds were selected as important markers in human burial decomposition and 19 out of those 30 compounds were identified in non-buried decomposing human remains. In a study conducted by Statheropoulos et al. (2005), volatile organic compounds that were released during the decomposition process of two cadavers were evaluated and over 80 compounds were detected. In another study conducted by Statheropoulos et al. (2007) over 30 decomposition-associated VOCs were detected. Hoffman et al. (2009) conducted a study evaluating the VOCs released from 14 separate tissue samples that were previously used as victim-recovery canine training aids; their study revealed over 30 volatile organic compounds. In a recent study performed by DeGreeff (2010), over 30 compounds were detected from human remains samples collected at a morgue and crematorium.

A method optimization study was performed, using a standard mixture of previously reported compounds for decomposing remains, to critically evaluate two different extraction techniques: Activated Charcoal Strip (ACS) and Solid-Phase Microextraction (SPME). In addition, different gas-chromatographic column chemistries were also explored to determine the best chromatographic stationary phase suitable for decomposition volatiles. The optimization study revealed that the use of SPME in combination with GC/MS equipped with a Sol-Gel Wax column provided the best response and selectivity for the target analytes. The optimized methods to evaluate the volatile organic compounds emanating from the decomposing remains of eight human cadaver analogues were utilized: four were frozen upon euthanizing then thawed prior to analysis and the remaining four were freshly killed. A variety of compounds were detected and included the following classes: aldehydes, ketones, carboxylic acids, and sulfur-containing compounds. A comparison between the human cadaver analogues that were frozen-thawed vs. freshly killed will highlight the similarities and differences between each set of specimens, as well as demonstrate the significant impact that freezing of the remains has on the VOCs detected.

Scent of Death, Decomposition, Volatile Organic Compounds (VOCs)

