A95 An Investigation Into the Volatile Organic Compounds Released From Submerged Remains

Norma I. Caraballo, BSc, and Kenneth G. Furton, PhD, Florida Int'l Univ, Dept Chemistry & Biochemistry, 11200 SW 8th St, CP 344, Miami, FL 33199*

After attending this presentation, attendees will have a better understanding of the chemistry of death, also known as thanatochemistry, the volatile organic compounds (VOCs) that evolve from decomposing remains and how they are affected by water.

This presentation will impact the forensic science community by providing results on a new facet in the study of decomposition that includes the assessment of VOCs from submerged remains, under controlled conditions.

Depending upon the environmental conditions and surroundings of the body, the decomposition process starts immediately after death and initiates with autolysis. In this stage, intra- and extracellular enzymes present within the body cause molecules and cells to break down, leading to the second phase of the decomposition process known as the putrefactive stage. The degradation of cells that occurs during autolysis creates an ideal environment for anaerobic microorganisms to break down large molecules, such as carbohydrates, nucleic acids, proteins, and lipids, causing the release of gases, which range in functionality (e.g., amines, sulfur-containing, acids, alcohols, etc.), as well as discoloration and bloating.[1,2] Thereafter, active decay is said to begin. In this phase, the body is no longer bloating and the decomposition process continues with additional degradation of proteins and fat. The subsequent stage is advanced decay, which is where the body dries up and remnants (e.g., skin, cartilage, etc.) are present. This stage paves the way to the final phase of decomposition, skeletonization. It is at this point that only bones and hair remain.[3]

The decomposition process is highly influenced by the environment that surrounds the body. Factors, such as moisture, temperature, presence of scavengers, and oxygen availability, can alter the manner in which a body decomposes and, thus, the liberation of volatile organic compounds. Previous studies have evaluated the effects of soil on the evolution of VOCs from both humans and analogues.[3,4,5] However, little to no research has been conducted on the VOCs that evolve from submerged remains. According to Osterkamp,[6] the increased use of water-search canines emphasized the importance of thoroughly understanding the VOCs released from submerged remains to improve canine performance in locating drowned individuals. As previously mentioned, there are a variety of factors that can affect the manner in which a body decomposes and water is another important aspect to consider. The decomposition process of a body submerged in water can either be reduced or accelerated depending upon the type, temperature, pH, and flow rate of water.

This study used Headspace Solid-Phase Microextraction (HS-SPME) coupled to Gas Chromatography-Mass Spectrometry (GC/MS) to evaluate the volatile organic compounds that are released from decomposing submerged remains. Freshly killed human cadaver analogues were placed into water and allowed to decompose while subsequently being monitored at different time intervals to assess VOCs that were being released. The compounds detected ranged in functionality from acids to sulfur-containing; moreover, the type and abundances of compounds detected changed over time, which was expected since mammalian decomposition is a process and not a single event. The results obtained were then compared to a previous study that evaluated the VOCs that were released during the decomposition process of non-submerged human cadaver analogues. Differences, as well as similarities, in the compounds detected will be discussed in this presentation, as well as the impact that water has on the release of VOCs from decomposing submerged remains.

References:

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 ** Presenting Author*