D5 A Quantifying Study of VOCs Released During Early Decomposition Using SPME and GC/MS and the Relationship to the Interval Since Death

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After attending this presentation, attendees will develop a better understanding of the human decomposition process and the analytical techniques used to analyze the volatile organic compounds emitted. Attendees will also learn that the gases released can provide forensic scientists with information on the interval since death as a alternative to cadaver dogs.

This presentation will impact the forensic science community by providing an insight on the chemical composition of the volatile organic compounds humans release during decomposition. It will also provide clues about the impact that the environment has on the decomposition process and the VOCs released. Furthering this study, will benefit the forensic science community by establishing a new method for detecting and quantifying VOCs which can ultimately assist in victim recovery such as in mass graves and clandestine burial sites.

The basis for human decomposition has been studied and researched thoroughly for a long time. Decomposition refers to the reduction of the body of a formerly living organism into simpler forms of matter. The process of decomposition can be divided into two categories. Phase one is where the production of vapors occur. In the second phase, liquid materials form and the flesh matter begins to decompose. The progression of decomposition in a living organism occurs in four stages: fresh, bloat, decay, and dry. Fresh is the stage of decomposition that occurs in the first few days following death. During this stage of decomposition, the body enters algor mortis, which is where the body cools to a temperature consistent with its surroundings. When the body reaches the final stage of autolysis, an anaerobic (without air) environment is created. When this environment is generated, it allows the normal bacteria to breakdown the remaining carbohydrates, proteins, and lipids in the body. The products of the breakdown then create acids, gases, and other products which then produce volatile organic compounds (VOC). The putrefaction stage is where odor, color change, and bloating of the body occur. The bacteria activity occurring in the cecum, area near the small intestine, causes the lower abdomen to turn green which is a result from the breakdown of the hemoglobin into sulfohemoglobin ultimately causing the green color change. The formation of gases enters the abdomen which forces liquid and feces out of the body. The bacterium formed in this stage enters the venous system therefore causing the blood to hemolyze. Once the putrefaction process concludes, the body enters the black putrefaction stage. During this stage the body cavity ruptures, the abdominal gases escape, and the body darkens from its greenish color. This stage ends when the bones of the corpse become evident, which can take anywhere from 10-20 days after death. The conclusion of this stage is dependent on the temperature and region where the body is located. The Butyric fermentation stage is where mummification of the body starts to take place. During this stage the body starts to dry out and then goes through adipocere formation. The final stage of human decomposition is dry decay. There are a number of factors that affect the rate and manner of decomposition such as temperature, humidity, rainfall, and bug activity.

Human decomposition is a very complex process and has not been well studied at the chemical level. Many studies have been done to measure the accumulation of volatile organic compounds (VOC) that are produced during the early stages of human decomposition. Studying the development of VOCs over a certain period of time using pig (*Porcus*) carcasses as an alternative to human bodies could possibly provide important results about the unknown chemical composition of death. The VOCs will be collected using solid phase microextraction (SPME) fibers. Once the compounds are collected, they will be quantified and identified using gas chromatography/mass spectrometry (GC/MS). The data will be used to determine if there is a correlation between the compounds present and the interval since death. The results will also be studied to determine whether or not the environmental conditions have an impact on the formation and distribution of the VOCs from the body during the decomposition process. Four different scenarios will be established to measure the VOCs released during the early decomposition of a pig. According to current literature publications, the VOCs that release during this process occur most often within 0-3 days after death. The pig carcasses will be monitored at varying time intervals ranging from hours to days. Each scenario will take into account different environmental factors such as humidity, temperature, and rainfall which could possibly affect the decomposition process of the pig and ultimately the release of VOCs. **Human Decomposition, Volatile Organic Compounds, Interval Since Death**

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