Improving our vision on human cadaveric decomposition chemistry

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For the last few decades, investigations have been conducted to better learn the process of body decomposition by mean of the measurement of the VOCs released during decay. However, the chemical fingerprint of the decomposition odor is still far from being elucidated. We recently developed an analytical strategy that relies on the use of thermal desorption (TD) coupled to comprehensive two-dimensional GC coupled to time-of-flight MS (GC×GC-TOFMS) for the profiling of cadaveric VOCs from grave soils and decaying bodies.[1,2] The additional peak capacity of GC×GC, the spectral deconvolution algorithms applied to unskewed mass spectral data, and the use of robust specific data mining strategies allowed the generation of characteristic VOC profiles across the various stages of soft-tissue decomposition.[3]

For practical and ethical reasons, human analogs (Sus domesticus L. carcasses) were used in these early investigations. For the present study, we investigated the VOC profile of early stage decomposition of human bodies. We analyzed samples collected during different trials organized during different seasons in a body farm located in Texas. Samples included environmental controls, pig carcasses, and human bodies (protected or not from scavenger insects). Human remains detection (HRD) canines utilize this odor signature to locate human remains during police investigations and recovery missions in the event of a mass disaster. Currently, it is unknown what compounds or combinations of compounds are recognized by the HRD canines.[4]

We developed a specific data processing approach based on Fisher ratio calculations and use of a z-score based cutoff to create data matrices that can further be processed in multivariate analysis. This allowed to isolate and to identify many additional specific markers of the human cadaveric decomposition process. The better understanding of the VOC profile released by dead or injured bodies will possibly help to designing more realistic canine artificial scent training solutions, but also allow enhancing the specificity of electronic noses which, so far, still suffers from poor efficiency at least partly due to the lack of information about the decomposition chemistry. This approach is a step forward in producing specific complex odor profiles that could be used in various types of forensic investigations.

[1]Dekeirsschieter, J. et al. PLoS ONE (2012) 7, e39005.
[2]Brasseur C. et al. J Chromatogr A (2012) 1255, 163–170.
[3]Stadler, S. et al. Anal Chem (2013) 85, 998–1005.
[4]Stadler, S. et al. J Chromatogr A (2012) 1255, 202–206.