Exploring new dimensions in cadaveric decomposition odour profiling using GC×GC-HRTOFMS

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Abstract

The search for human remains is often performed by cadaver-detection dogs but may also, in future, extend to handheld detection instrumentation. Profiling volatile organic compounds (VOCs) produced by decomposing remains is important for these applications, and requires high confidence in analyte identification. This will provide accurate information for cadaver-detection dog training procedures and for the potential development of handheld devices. This study demonstrates the first documented use of comprehensive two-dimensional gas chromatography – high-resolution time-of-flight mass spectrometry (GC×GC-HRTOFMS) for VOC analysis in the forensic sciences. VOC samples were collected actively onto sorbent tubes from the soil surrounding pig carcasses in late stage decomposition and compared with VOC samples from control soil containing no decomposing remains. GC×GC provided sufficient separation of the complex mixture of VOCs present in decomposition odour samples. High-resolution mass spectral data provided an additional dimension of information that afforded higher confidence in analyte identification than with traditional low-resolution mass spectrometry. The coupling of GC×GC to HRTOFMS will be advantageous in the future for generating an updated reference database of decomposition VOCs that will act as a tool for researchers and increase reporting accuracy across studies. GC×GC-HRTOFMS will be valuable for future studies examining decomposition odour as well as other complex volatile matrices.