

A forensic case study of cadaveric odor analysis using GC×GC-HRTOFMS

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Abstract

Odor analysis is still highly controversial in the legal system regardless of its foundation in well-established gas chromatography – mass spectrometry (GC-MS) techniques. Despite extensive research characterizing decomposition odor, it has been disputed in a recent court case as being too untested. The literature depicts a different story whereby GC-MS analysis of decomposition odor is rapidly becoming outdated and replaced by comprehensive two-dimensional gas chromatography – mass spectrometry (GC×GC-MS). GC×GC coupled with high-resolution time-of-flight mass spectrometry (HRTOFMS) was applied to the analysis of volatile organic compounds (VOCs) from case samples recovered at the site of a decomposing body in a forensic case. The goals were to accurately profile decomposition odor from case samples using GC×GC, establish the start of a long-term case study, and understand future challenges. Adipocere and soil samples from the cadaver decomposition island were collected at the discovery site to reflect the heterogeneity of the decomposition environment. VOCs identified in the soil samples reflected previous studies, while the profile of adipocere was demonstrated for the first time by GC×GC-MS and was dominated by volatile acids and esters. Difficulties were identified with interpreting complex decomposition VOC mixtures due to the low specificity of VOCs; therefore, VOC quantification and ratios were recognized as being important for future advancement. The power of GC×GC images in court testimony was considered to be of high potential. This study represents the first application of GC×GC in a realistic case scenario, which demonstrates the progression of this technique in the field in past years.