Analysis of VOCs from surface decomposition of human analogues via comprehensive two dimensional gas chromatography–time of flight mass spectroscopy

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Taphonomic studies have previously focused on the analysis of decomposition fluid and soil and until recently, the volatile organic compounds (VOCs) present within the headspace of decomposition have received little attention. Identifying and characterizing the profile of these decomposition products can provide additional information on the chemical breakdown of the body as well as provide key information on signalling molecules used for remains detection. In this study the VOCs from the surface decomposition of human analogues (Sus scrofa) were collected over the late summer months in Southern Ontario. The VOCs were collected using multisorbent thermal desorption tubes and analysed via thermal desorption – two dimensional gas chromatography – time of flight mass spectroscopy (TD-GCxGC-ToFMS). The application of this advanced chromatographic technique provides the increased resolution and cleaner mass spectra required for the analysis of these complex samples. The headspace of decomposition contained a large number of compounds from numerous chemical classes that were distinguishable from control samples. These include key decomposition products such as poly-sulphides, indolic compounds, alcohols and ketones. The complexity of the samples increased through to the active decay stage which exhibited the greatest number and variety of compounds, whereas the fresh and later stages of decay exhibited lower compound loads. The ratio of chemical classes did not remain consistent over the course of decomposition but exhibited different temporal trends. The change in the production of these by-products suggests that there is a potential sequence in the degradation of the body's tissues. During the early anaerobic phase of decomposition, proteins and carbohydrates appear to be the primary substrate as evidenced by higher levels of sulphides, carboxylic acids. The later aerobic stages exhibit higher levels of lipid degradation products such as aldehydes. Further research into VOCs from individual tissue types as well as the microbial activity present during decomposition will aid in the understanding of the production of VOCs and the overall chemical process of decomposition.