Abstract

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The identification of chemicals to estimate the post-mortem interval of aquatic mammalian cadavers using Nuclear Magnetic Resonance and Liquid Chromatography

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Abstract

This study analysed water samples from controlled laboratory experiments murine models placed in ultra-pure water and of porcine cadavers in large containers of water that were placed out in the open. Spectra and chromatograms of targeted decomposition chemicals, specifically, free amino acids and biogenic amines were collected with a 400Mhz JEOL Nuclear Magnetic Resonance (NMR) spectrometer using a 1H solvent suppression method and high-performance liquid chromatography coupled to an ultraviolet detector (HPLC-UV). These techniques were used to accurately estimate post-mortem interval (PMI) as current estimation methods may not be suitable due to the uniqueness of each investigation. Data suggested that NMR will be useful in estimating the PMI of mammalian cadavers discovered in an aquatic environment despite the expected low sensitivity disadvantages of the instrument as the targeted chemicals from the samples were not extracted or concentrated considering the chemicals were expected to be at trace levels. The chemical patterns from the NMR spectra are similar for the murine and porcine models although at different time periods as expected most likely due to the cadaver masses, temperature conditions and size of the containers. Although NMR can be used to quantify chemicals, poor peak resolution of the amino acids and biogenic amines were present due to the 400MHz magnet therefore, liquid chromatography methods were chosen to separate out and quantify the chemicals present. Three liquid chromatography methods are being developed to separate the amino acids and biogenic amines, UHPLC-UV using a DEEMM derivatization, HPLC-FLD using an OPA derivatization and LC-MS underivatized sample preparation, the amino acids and amines found were at nanomole levels. Comparisons of these methods were decided by the ease and speed of sample derivatisation, limit of detection and quantification, future portability for field use and availability of instruments to law enforcement.

Biography

Simon completed a master's degree in chemistry and then took up a position as a chemistry analyst in the cement industry where he was part of a team that developed and tested new and existing products. Simon then moved back into academia as a technical specialist supporting students and local businesses. Being exposed to various research he gained an interest in taphonomy from a forensic chemical perspective where he has undertaken a PhD in this area.

