B135 Persistence of Gunshot Residue (GSR) in Decomposing Tissue Samples

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After attending this presentation, attendees will understand the problems associated with detecting gunshot residue (GSR) in decomposed tissue samples.

This presentation will impact the forensic community and/or humanity by detailing appropriate tissue sample collection methods and storage procedures, as well as sample preparation and instrumental analysis procedures. The cost-effectiveness, and feasibility and applicability of scanning electron microscopy energy dispersive X-Ray detection (SEM/EDX) and inductively coupled plasma-mass spectrometry (ICPMS) for the detection of GSR in tissue samples will be discussed.

In a badly decomposed body, cause of death by gunshot wound may be difficult to discern since the wound itself and any tattooing around the wound are not visible and may be misidentified. In the absence of any other pertinent evidence, this can make cause of death determinations difficult for the forensic pathologist. The objective of this research is to develop and optimize instrumental methods for the detection of GSR in decomposed tissues samples, which ultimately could be used to aid forensic pathologists in their cause of death determinations.

Ten gunshots were fired into a euthanized pig carcass using a 9 mm Glock pistol and 115 grain, full metal-jacketed cartridges. The gun and cartridges were chosen to accurately represent commonly recovered equipment from gun-related criminal cases. Shots were fired by a veteran firearms specialist from a local police department at a distance of 5 cm muzzle to target, which allowed visible tattooing but no cross- contamination between wounds. The gun was cleaned thoroughly between shots fired. The carcass was subsequently placed out in a field, along with a control carcass into which no shots were fired. Both carcasses were covered in screened cages to prevent interference by predators while still exposing the carcasses to the elements. Over the following seven days, wounds were excised from one carcass and suitable controls were collected from the second. The tissue samples were wrapped in wax paper and stored at -80° C until analysis.

Presently, there are numerous publications detailing the detection and collection of GSR using techniques such as flame atomic absorption spectrometry, differential pulse anodic stripping voltammetry, X-Ray microfluorescence, SEM/EDX, and many chemical reagent color tests. However, these studies typically detect GSR from cloth, hand swabs, or dried skin samples; a very limited selection of literature describes experiments in which GSR is collected and analyzed from decomposed tissue samples. Most tests analyze samples for evidence which is described as characteristic of GSR, this is typically a specific elemental analysis monitoring levels of Pb, Sb, and Ba. The tests are determined positive or negative compared to levels of Pb, Sb, and Ba detected from that of a control sample.

In this study light microscopy was used to observe tattooing of the skin prior to further instrumental analysis. GSR morphology, elemental composition and its persistence was determined through SEM/EDX, which is a commonly accepted method of GSR analysis with concurrent determination by ICPMS which is a sensitive technique capable of analyzing samples with complex matrices. Optimization of sampling technique, analysis procedure, as well as instrumental parameters for both analytical methods were performed during the course of this study.

The data presented herein serves to supplement the development of novel techniques for difficult, time-consuming analyses.

GSR, ICPMS, SEM/EDX

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