

Bioaccumulation and Forensic Relevance of Gunshot Residue in Forensically Relevant Blowflies

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Abstract : Gun violence internationally is increasing at an unprecedented level, becoming a favoured means for executing violence against another individual. Not only is this putting a strain on forensic scientists who attempt to determine the cause of death in circumstances where firearms have been involved in the death of an individual, but it also highlights the need for an alternative technique of identification of a gunshot wound when other established techniques have been exhausted. A corpse may be colonized by necrophagous insects following death, and this close association between the time of death and insect colonization makes entomological samples valuable evidence when remains become decomposed beyond toxicological utility. Entomotoxicology provides the potential for the identification of toxins in a decomposing corpse, with recent research uncovering the capabilities of entomotoxicology to detect gunshot residue (GSR) in a corpse. However, shortcomings of the limited literature available on this topic have not been addressed, with the bioaccumulation, detection limits, and sensitivity to gunshots not considered thus far, leaving questions as to the applicability of this new technique in the forensic context. Larvae were placed on meat contaminated with GSR at different concentrations and compared to a control meat sample to establish the uptake of GSR by the larvae, with bioaccumulation established by placing the larvae on fresh, uncontaminated meat for a period of time before analysis using ICP-MS. The findings of Pb, Ba, and Sb at each stage of the lifecycle and bioaccumulation in the larvae will be presented. In addition, throughout these previously mentioned experiments, larvae were washed once, twice and three times to evaluate the effectiveness of existing entomological practices in removing external toxins from specimens prior to entomotoxicological analysis. Analysis of these larval washes will be presented. By addressing these points, this research extends the utility of entomotoxicology in cause-of-death investigations and provides an additional source of evidence for forensic scientists in the circumstances involving a gunshot wound on a corpse, in addition to advising the effectiveness of current entomology collection protocols.

Keywords : bioaccumulation, chemistry, entomology, gunshot residue, toxicology

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