A148 Quantitative Mapping of Post-Blast Nitroglycerin Residues on Pipe Bomb Fragments Using Total Vaporization Headspace (TV-HS) Solid Phase Microextraction-Gas Chromatography/Mass Spectrometry (SPME-GC/MS)

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After attending this presentation, attendees will understand the importance of quantitation of explosive chemical residue on pipe bomb fragments, although it is not common investigative practice to do so. Quantitation will be accomplished using a new technique, Total Vaporization Headspace (TV-HS) Solid Phase Microextraction Gas Chromatography (SPME-GC/MS), which has several advantages over other methods. The validity of residue distribution mapping will also be discussed.

This presentation will impact the forensic science community by quantitation of explosive residue using a novel technique and diagramming its dispersal which can be valuable to both crime scene investigators and laboratory analysts examining pipe bomb fragments. By knowing the concentration of key residue components, analytical techniques can be tailored to optimize efficiency. This in turn will maximize throughput and evidence turnaround time. In addition, if the dispersal of residue indicates any trends, this information can heighten the understanding of the explosion process, such as the progression of deflagration.

Although residue from the explosive filler in a pipe bomb is routinely found on the post-blast container fragments, the amount of this residue is not quantified. The main reason for this is that the legal question at hand is what, not how much, explosive is present; however, there is value to tracking the distribution of explosive residue on device components. In particular, such “residue mapping” would provide general guidance as to what fragments may be more likely to contain high levels of residue. In addition, the distribution of residues would also shed light on the process by which the explosive filler deflagrates, resulting in the ultimate failure of the device container. In this study, TV-HS-SPME-GC/MS was used to identify low levels of nitroglycerin (~5ppb), which is an energetic component found in double-base smokeless powder. Traditional headspace SPME involves a three-phase system consisting of the sample, either in solid or liquid form, the headspace, and the fiber; however, by completely vaporizing the sample, the partitioning between the liquid and headspace is eliminated, simplifying the thermodynamics of the system and therefore increasing sensitivity. Another benefit of this technique is minimal sample preparation due to the high boiling, solid, and non-volatile components not transitioning into the headspace. Additionally, significantly higher sample volumes can be analyzed, even 100 times more when compared to liquid injection. Ongoing work involves applying this analytical technique to numerous explosive devices constructed from Polyvinylchloride (PVC) and galvanized steel pipes and filled with Double-Base Smokeless Powder (DBSP).

Explosives, Nitroglycerin, SPME

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