B6 The Analysis of Ignitable Liquid Residues and Explosive Material Using SPME/ GC/MS/MS

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This presentation will describe a comprehensive approach to improve the operating procedures of GC/MS and GC/MS/MS for the analysis and identification of ignitable liquid residues and to determine the absolute detection limits for the widely used GC/MS method and a proposed GC/MS/MS method for the organic class of compounds in a standard accelerant mixture (SAM). The analysis of explosives material will also be evaluated using SPME/GC/MS and SPME/GC/MS/MS.

Fire debris evidence from suspected arson cases and post-blast debris evidence from suspected explosions can be significantly degraded or destroyed during the crime and the subsequent scene recovery effort in such a manner that it is sometimes difficult to identify the compounds of interest. All aspects of the analysis of both types of debris must be evaluated in order to create a method for extraction, separation, analysis, and interpretation that will produce the best information for the investigators and, eventually, the tiers of fact.

Solid phase micro-extraction (SPME) provides some improvements over the use of activated charcoal strips (ACS) in the analysis of fire debris and explosive evidence due to its selectivity, cost, ease of use, shorter extraction times, and solvent free extractions. This presentation will briefly describe a comprehensive approach to improve the operating procedures of GC/MS and GC/MS/MS for the analysis and identification of ignitable liquid residues (ILR) and explosives in addition to looking at the use of SPME as an extraction technique.

A Varian 3400 Gas Chromatography instrument is used for separation while a Varian Saturn 2000 Ion Trap Mass Spectrometer with MS^n capabilities is used as a detector. Solid phase micro-extraction sampling of residues from debris containing ignitable liquid residues and organic explosives was compared to the more traditional method of activated charcoal strips. Standards are used to determine the analytical detection limit for the MS and MS/MS method in the presence and absence of background matrix products. SPME is also evaluated against activated charcoal strips to determine the absolute detection limits of target analyte compounds in the typical debris sample. The SAM compounds were studied for the ILR and the following high explosives were also studied: nitrobenzene, 2-nitrotoluene, 3-nitrotoluene, 4-nitrotoluene, nitrobenzene, 1,3-dinitrobenzene, 2,4-dinitrotoluene, 2,4,6trinitrotoluene, 4-amino-2,6-dinitrotoluene, 2-amino-4,6-dinitrotolene, tetryl, RDX, HMX, EGDN, PETN and nitroglycerine.

SPME/GC/MS/MS is demonstrated to improve the selectivity and sensitivity for the analysis of ILR compounds in the presence of pyrolysis products. This simplified method also reduces the background material in the extraction of organic explosives from a complex matrix. SPME/GC/MS/MS shows a great potential for incorporation into the standard analysis protocols of both ILR and high explosives analysis.

Additional work will involve studying ion-molecule interactions within the ion trap detector in order to best identify and characterize those compounds that are characteristic of explosives, ignitable liquid residues, and of pyrolysis products found in scene debris and from other sources.

Fire Debris Analysis, SPME, Explosives Analysis

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