B77 A Quantitative Approach to Differentiating Mixtures of Gasoline and No. 2 Fuel Oil From No. 2 Fuel Oil Using Gas Chromatography/Mass Spectrometry (GC/MS) Target Compound Analysis Ratios

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After attending this presentation, attendees will better understand the significance and fundamental importance of a quantitative approach to the analysis of ignitable liquids and fire debris samples.

This presentation will impact the forensic science community by demonstrating the application of a quantitative approach and methodology to characterize ignitable liquids and mixtures of ignitable liquids that can be implemented to facilitate the interpretation of analytical data.

The investigation of a suspected arson intimately involves the forensic laboratory. Ignitable liquids, in particular gasoline, are commonly used as accelerants. It is critical to an arson investigation that the presence of a trace amount of an ignitable liquid be detected and correctly identified by the laboratory. The laboratory detection, identification, and proper classification of ignitable liquids recovered from fire debris can be critical to an investigation.

In the United States, many homes and establishments are heated with No. 2 fuel oil. Gasoline, a common fuel and a common accelerant, is detected in many arson cases. A complication can arise when the fire scene involves a home or establishment that is heated with No. 2 fuel. The No. 2 fuel oil product inherently contains the compounds common to gasoline. The task of determining if gasoline is absent or present as a mixture with a No. 2 fuel oil can be both challenging and problematic under certain conditions.

The American Society for Testing and Materials (ASTM) E1618-14, Standard Test Method for Ignitable Liquid Residues in Extracts from Fire Debris Samples by Gas Chromatography/Mass Spectrometry, is a test method utilized in many forensic laboratories. E1618-14 does not address or provide guidance in the identification and classification of complex ignitable liquid mixtures.

The data presented here include samples of gasoline, home heating fuel oil, and diesel fuel oil collected twice from selected distributors over an eight-month period. The collected samples were analyzed as neat liquids, combinations of neat liquids, liquids at varying degrees of (percent) evaporation, combinations of these evaporated liquids, and mixtures of neat liquids with the liquids at the varying degrees of evaporation. Diesel fuel samples were also collected in light of the fact that the diesel fuel product is purported to be identical to the home heating product without consideration of additives and the dyes used for identification. The samples were prepared with a deuterated internal standard containing benzene-d6, ethylbenzene-d10, and naphthalene-d8 and analyzed by GC/MS.

The data presented will demonstrate the utility of a quantitative approach and target compound ratio analysis methodology in differentiating complex mixtures of gasoline and No. 2 fuel oil from No. 2 fuel oil alone. The analytical methodology presented can be applied to further develop the criteria for the identification, classification, and discrimination of petroleum products and ignitable liquids.

Fire Debris, Ignitable Liquids, GC/MS