B99 Characterization of Ignitable Liquid Residues and Interfering Pyrolysis Products of Common Substrates in Forensic Fire Debris Analysis

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Learning Overview: The goals of this presentation are to help attendees regarding: (1) the correct identifications of the accelerants and their residues from commonly encountered fire debris samples; (2) the retainability of the ignitable liquids by different substrates at the fire scenes; (3) the Pyrolysis Products (PyPs), if any, originating from the substrates that may be wrongly interpreted as the residues of ignitable liquids in the fire/arson cases; and (4) the retaining ability of the traces of Ignitable Liquid Residues (IGLRs) from different accelerants (Gasoline, Kerosene, and Diesel [GKD]) at the fire/arson scene.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing insight to correctly interpret the IGLR case samples in the presence of substrate interference PyPs.

Forensic investigation of fire and arson cases is an emerging field in Pakistan. A characterization of the traces of the ignitable liquids (GKD) and their IGLRs from the debris collected from the fire/arson scenes is needed. The incorporation of the false positive identifications of the IGLRs from the debris due to the PyPs of the substrates was studied. The substrates commonly available in the houses, offices, and community areas of Pakistan that had never been examined for forensic purpose were selected for this study.

Neat ignitable liquids (GKD) were diluted with n-pentane to prepare a solution of 2.5µL/mL. A mixture of equal quantities of GKD was diluted with n-pentane to obtain a concentration of 2.5µL/mL. The concentrated n-pentane extracts of neat 19 substrates, unburnt substrates, and burnt substrates (with and without IGL) were prepared for analysis. The analysis was performed using gas-chromatograph (7890A) mass spectrometer (5975C) with electron impact ionization applying full scan mode.

The pre-burning examination of substrates showed no interfering peaks that may be confused with IGLR, whereas some burnt substrates showed the limited amount of PyPs similar to IGLRs (n-alkanes, cycloalkanes and alkyl aromatics). The type and surface texture of 19 substrates also imparted their role regarding the retainability of IGLRs in their post-burning debris. This study also clarified that the chemistry of ignitable liquids also played an important role in leaving their traces at the fire/arson scene.

This study concluded that the intact substrates did not show any interfering peaks, whereas the post-burning examination of the substrates revealed the absence of interfering PyP similar to IGLR in most substrates. Very few substrates interfered but produced a limited number of compounds that could be ruled out using their controls in analysis as well as by following the American Society for Testing and Materials (ASTM) 1618–19. The overall identification of IGLR was not affected by the PyPs of substrates. The IGLR persistency comparison of GKD from post-burning debris showed that kerosene and diesel (medium to heavy petroleum distillates) left more traces as compared to the gasoline.

Ignitable Liquid Residues, Substrates, Pyrolysis Products

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