Analysis of Accelerants in Fire Debris — Data Interpretation

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ABSTRACT: Analysis of accelerants in fire debris involves the isolation of residual volatiles from the matrix and the analysis of these volatiles, usually by gas chromatography (GC). The resulting chromatograms are interpreted by comparing to a library of accelerant chromatograms obtained under similar conditions. This review first mentions ASTM's system in classifying fire accelerants into light petroleum distillates, gasoline, medium petroleum distillates, kerosene, heavy petroleum distillates, and unclassified compounds. Chromatograms with well-resolved *n*-alkane homolog patterns are most recognizable. Chromatograms that are inadequately resolved can be improved by columns having higher efficiency or selectivity, while those with too much interference can be improved by physical removal or reduction of these interfering compounds or selective detection. Using a mass spectrometer (MS) as the detector in GC/MS applications allows the display of common ions shared by compounds with similar structural features, thus greatly facilitating pattern recognition practices. Computer algorithms are now available for automated recognition of patterns possessed by various categories of accelerants.

The state-of-the-art in forensic laboratories' analysis of accelerants in fire debris is presented as an appendix to this review. Data generated in annual proficiency tests over an 8-year period (1987–1995) revealed increased use of GC/MS instrumentation and some persisting problems, which include false positives and difficulties associated with component discrimination in the sample preparation process and recognition of partially evaporated distillates.

KEY WORDS: Accelerants, expert systems, fire debris, gas chromatography/mass spectrometry, interferences, laboratory proficiency testing, pattern recognition, petroleum distillates, pyrolysis.