B126 Detailed Chemical Composition of Ignitable Liquids Determined With Comprehensive Two-Dimensional Gas Chromatography-Mass Spectrometry

Glenn S. Frysinger, PhD, U.S. Coast Guard Academy, Department of Science, 27 Mohegan Avenue, New London, CT 06320-8101*

After attending this presentation, attendees will understand that comprehensive two-dimensional gas chromatography with mass spectrometry detection produces detailed chemical composition information about ignitable liquids that can be used to identify these substances in complex fire debris samples.

The presentation will describe advances in analytical chemistry that will have a significant impact on the field of forensic fire debris analysis. Comprehensive two-dimensional gas chromatography methods provide an order of magnitude improvement in the chemical separation of complex mixtures that will lead to enhanced identification of ignitable liquids.

Comprehensive two-dimensional gas chromatography with mass spectrometry detection (GCxGC/MS) is a three-dimensional hyphenated analytical method that is ideal for exploring the complex chemical composition of ignitable liquids. The increased separation and identification capability of GCxGC/MS represents a significant analytical advantage over traditional gas chromatography (GC) and gas chromatographymass spectrometry (GC/MS) methods for the analysis of complex mixtures. GCxGC uses two chromatography columns with different stationary phases that are coupled serially by a modulator. Ignitable liquid compounds can be separated by a combination of volatility and polarity or shape mechanisms to produce a two-dimensional chromatogram with hundreds of compound peaks distributed across a two-dimensional retention time plane. The two-dimensional separation is a significant improvement over traditional GC separations because many more peaks are resolved and the peaks are arranged into groups according to their chemical class. In this way, alkanes, alkenes, cycloalkanes, aromatics, and oxygenated compounds are rapidly classified. When GCxGC separations are coupled with a mass spectrometer, each two-dimensional chromatogram peak has an associated mass spectrum that leads to accurate identification with mass spectral libraries.

In this work, the chemical composition of common ignitable liquids such as paint thinner, lacquer thinner, gasoline, and kerosene will be examined. Compounds separated by GCxGC will be assigned to a chemical class and identified by mass spectrometry. The comprehensive chemical information will be used to fingerprint ignitable liquids in the presence of chemical interferences from fire debris combustion and pyrolysis products.

Arson, Gas Chromatography-Mass Spectrometry, Ignitable Liquids

Copyright 2004 by the AAFS. Unless stated otherwise, noncommercial *photocopying* of editorial published in this periodical is permitted by AAFS. Permission to reprint, publish, or otherwise reproduce such material in any form other than photocopying must be obtained by AAFS. ** Presenting Author*