A135 Fast Gas Chromatography Applications in Ignitable Liquids and Drug Identification

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The goal of this presentation is to highlight applications of fast gas chromatography (Fast GC) in ignitable liquids as well as drug identification while also assessing the use of hydrogen mobile phase.

This presentation will impact the forensic science community by demonstrating the value of Fast GC and hydrogen mobile phases to forensic analysts in units using conventional gas chromatography by demonstrating statistically significant improvements in retention time, resolution, and laboratory supply costs with implementation.

The objective of this project is designed to assist crime laboratories' assessment of new separation techniques and gauge the feasibility of implementation. The first objective of this project is an assessment of the expected gain in resolution and sample throughput in ignitable liquid and drug identification analysis using a combination of Fast GC and hydrogen carrier gases. This area of application is prime ground for realizing the full potential of Fast GC – H_2. In 2008, a joint project funded by the Midwest Forensics Resource Center between the University of Wisconsin – Platteville (UWP) and the Wisconsin State Crime Laboratory – Madison demonstrated incredible reductions of over 50% in retention times of ignitable liquids from arson debris using the Fast GC. This study also found that the use of hydrogen as a carrier gas more than compensated for resolution losses related to Fast GC. In fact, the more compressible hydrogen carrier produced improvements in resolution for the Fast GC analysis compared to a conventional GC technique using helium carrier gas ($p < 0.01$). Fast GC-H_2 separation of drug identification samples could potentially decrease retention times of straightforward matrices to several tens to a few hundred seconds. In addition to presenting the 2008 results to the AAFS, this presentation addresses the limiting factors of this technique including the scanning rate of the quadrupole mass spectrometer and effects on detection limits of illicit drugs.

Experimental design involves the Fast GC and conventional analysis of one dozen Scheduled compounds including cocaine, tetrahydrocannabinol (THC), heroin, 3,4-Methylenedioxymethamphetamine (MDMA), trifluoromethylphenylpiperazine (TFMPP), lysergic acid diethylamide (LSD), buprenorphine, synthetic cannabinoids, alprazolam, clonazepam, boldenone, and nandrolone. The figures of merit selected for ANOVA ($p < 0.05$) comparisons center on retention times and chromatographic resolution of a master standard containing these twelve compounds. Given that many laboratories may hesitate to modify existing units for Fast GC, the first assessment examines the benefit in simply switching to the less expensive hydrogen mobile phases from the helium mobile phase. The control in this experiment is the conventional GC operating with a standard DB-5, 30 m column and helium mobile phase. The hydrogen is employed instead, and a data set is generated with resolutions compared to the helium gas. Subsequently, the heating ramp of the conventional GC is increased without altering other variables to assess just how aggressive of a heating ramp can be used to reproducibly equal the conventional use of helium. The second set of experiments uses solely helium while comparing Fast GC and conventional GC in the event that a laboratory is not ready or able to convert to hydrogen carrier but is interested in the Fast GC gains. In this particular case, the data demonstrate the resolution decrease for cost: benefit analysis. Finally, the two variables (Fast GC and hydrogen mobile phase) are combined to assess the maximum benefit.

Fast GC, Ignitables, Drugs

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