# B166 Analysis of Arson Fire Debris by Low Temperature Dynamic Headspace Adsorption Porous Layer Open Tubular (PLOT) Columns

*Thomas J. Bruno, PhD*, National Institute of Standards and Technology, 325 Broadway, Boulder, CO 80305; Tara M. Lovestead, PhD, NIST, 325 Broadway, Boulder, CO 80305; Jessica Nichols, BS, NIST, 325 Broadway, Boulder, CO 80305; and Megan Harries, BS, NIST, 325 Broadway, Boulder, CO 80305*

After attending this presentation, attendees will have an understanding of: (1) the general metrology of PLOT-cryoadsorption (cryo); (2) the advantages of PLOT-cryo for fire debris sampling; (3) the ability to use PLOT-cryo in the field; and, (4) the use of high throughput PLOT modules for rapid analyses.

This presentation will impact the forensic science community by providing familiarity with the evolving scope of application afforded by PLOT-cryo.

Many Ignitable Liquids (IL) can be used to start an arson fire, the most common being gasoline, diesel fuel, kerosene, charcoal lighter fluid, paint thinners, and solvents; however, many less-common fuels have been used as well. Attention is even being paid to the new alternative fuels such as biodiesel fuel as potential ILs. Forensic scientists must routinely identify and characterize the accelerant or IL in a credible, defensible manner. The analysis of fire debris for the presence of residual IL has long been an accepted and routine aspect of arson investigations and the techniques available for such analyses have evolved. The nature of ILs as multi-component, moderately volatile fluids makes Gas Chromatography (GC) the most important and widely used method for fire debris analysis and the majority of liquid residue analyses performed in forensic laboratories utilize GC with some combination of detectors and peripherals. The most common is GC with mass spectrometry as the detector. In practice, the use of a single quadrupole mass filter is most common; however, tandem mass spectrometric methods have been used as well. Once presented to the instrument, the analysis of a sample is usually straightforward. There is a challenge in rapidly and reliably obtaining a sample for analysis from the vapor headspace of fire debris collected at the scene.

In this presentation, results of the application of PLOT-cryo to the analysis of ignitable liquids in fire debris are presented.[1] This study tested ignitable liquids, broadly divided into fuels and solvents (although the majority of the results that will be presented were obtained with gasoline and diesel fuel) on three substrates: douglas fir, oak plywood, and nylon carpet. It was determined that PLOT-cryo allows the analyst to distinguish all of the ignitable liquids tested by use of a very rapid sampling protocol and performs better (more recovered components, higher efficiency, lower elution solvent volumes) than a conventional purge-and-trap method. This study also tested the effect of latency (the time period between applying the ignitable liquid and ignition) and tested a variety of sampling times and a variety of PLOT capillary lengths. Reliable results can be obtained with sampling time periods as short as three minutes and, on PLOT capillaries, as short as 20cm. The variability of separate samples was also assessed, a study made possible by the high throughput nature of the PLOT-cryo method. It was also determined that the method performs better than the conventional carbon strip method that is commonly used in fire debris analysis. Variations of the PLOT-cryo method to provide for high-sample throughput and portable operation in the field will also be described.[2-5]

**References:**

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2. T.J. Bruno, Simple, quantitative headspace analysis by cryoadsorption on a short alumina PLOT column, *J. Chromatogr. Sci.*, 47 (2009) 5069-5074.
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4. T.M. Lovestead, T.J. Bruno, Trace Headspace Sampling for Quantitative Analysis of Explosives with Cryoadsorption on Short Alumina Porous Layer Open Tubular Columns, *Anal. Chem.*, 82 (2010) 5621-5627.
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**PLOT-Cryoadsorption, Fire Debris, Ignitable Liquids**