ON-SITE DETECTION OF ARSON ACCELERANTS USING A FIELD PORTABLE MINIATURIZED ION TRAP MASS SPECTROMETER

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ABSTRACT

It is well known that the probability of solving a crime diminishes quickly with time after discovery. Hence, the ability to analyze forensic samples quickly dramatically improves law enforcement’s ability to solve arson related crimes. However, the adversarial nature of the prosecution process demands that analyses be unambiguous and specific. Various methods are used in laboratories for the forensic quality analysis of residual traces of volatile accelerants in suspected arson samples; however, all of these methods involve collecting a sample at the site of the incident and transporting the sample back to a lab for analysis which a) uses critical time in the immediate hours after a crime is discovered and b) potentially introduces discrepancies in the chain of custody. Here, we show the advantage of providing forensic quality chemical analysis using a portable mass spectrometer directly at the crime scene by comparing several accelerants measured after a burn event with a training set measured from the original samples.

Figure 1: MMS-1000 on-site for accelerant detection.
Arson is a difficult crime to investigate and prosecute due to difficulties of identifying the incendiary origin of the fire [1]. Although it is routinely possible to identify accelerants with GC/MS; one of the most difficult processes during an arson investigation is collecting proper headspace samples for analysis. Care must be taken to properly identify the fire origin, collect the sample appropriately, and preserve the sample for transport and laboratory analyses [2].

In order to circumvent this problem, the ideal solution would be to bring the instrument into the field to perform the analysis. 1st Detect, a leader in miniaturization of mass spectrometers provides such a solution with the MMS-1000™. The instrument’s small size, low weight, and low power consumption allow for the instrument to be carried directly to the scene of the crime. The high performance instrument can also provide forensic quality analyses quickly and on-site, allowing investigators to determine the origin of the fire as well as identify the accelerant.

This application note will illustrate the transportability of the MMS-1000 and the ability to detect and identify accelerants in the field after they have been ignited.

**EXPERIMENTAL**

**Instrumentation:** All analyses were performed using the 1st Detect MMS-1000 mass spectrometer (1st Detect, Webster, Texas, USA) with a heated membrane inlet system and electron ionization. The instrument requires no carrier or background gases and can powered from either 110/220 VAC line power or from standard vehicle power. Furthermore, all pumps and electronics required to operate the instrument are contained within the instrument.

**Sample preparation:** Samples of accelerants (Mineral Spirits, Lighter Fluid, Gasoline, and Lacquer Thinner) were purchased and the headspace sampled to create a mass spectral training library. Several of the samples were then soaked into a rug and burned until the flame extinguished. The burned rug was then sampled by taking a small sample of the burned carpet, placing it in a small vial, and sampling the headspace using the heated membrane. The resulting spectrum was compared to the training library to identify the accelerant used to create the fire.
RESULTS

The resulting spectra are shown in Figure 3 (Mineral Spirits & Lacquer Thinner) and Figure 4 (Gasoline and Lighter Fluid) below. The headspace measured from the bulk sample are shown on the top, the headspace measured from the burned carpet are shown on the bottom.

![Figure 3: Spectra showing headspace measured from bulk accelerant (top) and burned samples (bottom) of mineral spirits (left) and lacquer thinner (right).](image)

![Figure 4: Spectra showing headspace measured from bulk accelerant (top) and burned samples (bottom) of gasoline (left) and lighter fluid (right).](image)
This study illustrates the capability of the MMS-1000 to detect and identify accelerants used to start a fire. Due to the small size and transportability, the MMS-1000 can be brought to the crime scene, allow law enforcement officers to find the origin of the fire, and quickly identify the accelerant used thus saving critical time in the immediate period after a crime. Furthermore, by bringing the instrument to the sample, more samples may be analyzed in near real time and problems arising from contamination of samples and disconnects in the chain of custody are removed.

References:


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