D14 Use of Portable Instruments for Locating and Sampling Suspected Arson Debris in the Field

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Attendees will learn about a method for location of possible accelerants at a fire scene and collection of volatile compounds from debris in the field, eliminating the need to store large amounts of debris. This presentation will impact the forensic community by demonstrating a novel use of technologies that may be more efficient than current methods.

Arson is a serious crime resulting in hundreds of deaths and billions of dollars in property damage per year. Many fires are started by the use of an accelerant but the cause of an arson fire can be difficult to find. Electronic noses were evaluated in this study for their ability to detect the presence of accelerants in specific areas of a scene. After the location of possible accelerants has been detected by these devices, they may be collected using a dynamic headspace sampler to concentrate volatile compounds into an absorbent filled tube. The instruments were studied for their abilities to detect various types of compounds. Diesel fuel, cigarette lighter fluid, charcoal lighter fluid, and gasoline were examined neat or spiked onto a matrix material and burned. The substances chosen cover the volatility range of common ignitable liquid residues in order to express any inefficiency in the collection range of the instruments.

These electronic noses are small battery operated instruments that give a reading of the amount of VOC's present in air. In this way, they can be used to scan a scene for areas of interest. Accelerant detecting canines can be used for the same purpose. These instruments, while possibly not as accurate as canines, can be inexpensive and do not require a highly skilled operator. Several types of instruments are available, but this study utilizes the TLV Sniffer® (Bacharach, Inc., Pittsburgh, PA). The TLV Sniffer® is not complex in design. A small pump pulls samples of air into the instrument. The change in temperature of a resistance element is measured and expressed on the meter in parts per million of hexane. Another commercially available detector, the tpi®Pocket Combustible Gas Leak Detector (Test Products International) has also been tested. This detector gives an audible alarm and four lights indicating the level of alert.

Different matrices were examined with and without accelerant using the TLV Sniffer®. Carpet and padding, wood, Styrofoam, plastic, newspaper, wood and laboratory tissues were studied burned alone or with accelerant. Carpet and padding, wood, newspaper, and cotton without accelerant showed similar levels burned alone as samples burned with accelerant. Therefore, high readings do not necessarily indicate the presence of accelerant. The type and amount of matrix must be considered in the analysis of debris. All of the matrix materials were mixed together to form a representative matrix of common household materials for further testing. The tpi®Pocket Combustible Gas Leak Detector has also been shown to alert to small amounts of accelerant but did alert in a few instances to burned debris alone. Interfering substances can cause difficulties with these types of instruments. However, when used as a preliminary indicator of where to sample, they have shown to be useful.

The Canine Accelerant Detection Association proficiency test for canines was replicated using the TLV Sniffer®. The detector was found to successfully discriminate between samples containing only matrix and those containing accelerants. However, it was not able to alert to the location of a small amount of accelerant spiked onto pine board.

For field collection of volatile compounds from debris the Portable Arson Sampler (Portable Arson Samplers, Tooele, UT) was used. The device uses dynamic headspace concentration to remove possible ignitable liquid residues from debris and store them in an adsorbent filled tube. A pump draws air from a heated debris chamber and the volatile compounds in the debris are absorbed to the polymer beads in a pre-packed glass tube. Use of this instrument in the field potentially eliminates the need to transport large volumes of debris to the laboratory. Compounds are removed from the adsorbent by solvent desorbtion and can then be analyzed using gas chromatography/mass spectrometry. The data analysis methods used are intended to help confirm or exclude the presence of an accelerant in a suspected arson sample despite possible interferences from background, pyrolysis, and combustion products. The spectra are examined for the characteristic patterns of known accelerants. By this method, the Portable Arson Sampler has shown its ability to concentrate small amounts of accelerants from debris. The lowest volatility compounds were not efficiently collected under normal operating conditions, but enough of the characteristic pattern of the accelerant is recovered to allow identification.

Electronic Nose, Dynamic Headspace, Arson

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