B74 Comparing the Response of Portable Hydrocarbon Detectors to Laboratory Analysis of Household Substrates

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After attending this presentation, attendees will better understand the effectiveness of electronic hydrocarbon detectors (often referred to as sniffers or electronic noses).

This presentation will impact the forensic science community by informing attendees of the appropriate use of hydrocarbon detectors, which should be used with great caution and as a presumptive tool only.

Electronic hydrocarbon detectors have been commonly used in the field of fire investigations to aid in the possible location of ignitable liquid residues. These devices alert to the presence of volatile hydrocarbons to indicate a potential sampling location. In this study, the selectivity and sensitivity of two different brands of hydrocarbon detectors were examined. Sixteen common household substrates and building materials were tested, including foams, wood, flooring, carpet, and roofing material. Each substrate was tested in triplicate, using both hydrocarbon detectors, and the results were compared to laboratory analysis. Each substrate was tested in unburned and burned conditions to evaluate the effect of the addition of pyrolysis and combustion products. No ignitable liquids were spiked on substrates in this study; however, several substrates known to inherently contain petroleum products were intentionally chosen to determine detector efficacy in detecting such ignitable liquids.

Inherent petroleum products were identified by Gas Chromatography/Mass Spectrometry (GC/MS) in 5 of 16 substrates chosen. For each of these unburned substrates, both hydrocarbon detectors gave negative or inconclusive responses. These were considered false negatives. A sharp increase in the number of positive responses by the hydrocarbon detectors was observed for the burned substrates; however, only pyrolysis or combustion products were identified by GC/MS. These were considered false positives.

Overall, both detectors showed numerous false positives, false negatives, and inconclusive results. For both unburned and burned substrates, the hydrocarbon detectors yielded wrong or inconclusive results ranging from 31% to 56% of the tested samples. Additionally, consistent use of the detectors proved to be difficult as the sensitivity varied greatly during use. On each detector, a knob or dial was used to set the sensitivity, which is expressed as an audible chirp. Instructions regarding these devices require that they emit an audible chirp every one to two seconds, with the chirp increasing in frequency when volatile components are detected. During the study, the frequency of the chirp increased and decreased without any apparent cause. As this study was conducted in a static, climate-controlled environment, the variable sensitivity and poor selectivity could be extremely problematic on a fire scene. As such, these on-scene instruments should be used with great caution and as a presumptive tool only for sample location and selection and should not replace an investigator's training and experience.

Fire Debris, Fire Investigation, Ignitable Liquids