Forensic Research-2013

OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference on
Forensic Research & Technology

October 7-9, 2013 Las Vegas, USA

Ignitable liquid residue distribution in pour patterns

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Abstract

Collection of fire debris evidence from a fire scene most commonly falls on the shoulders of the fire investigator in charge of the scene. The sample is then sent to the lab to be analyzed by a fire debris analyst for the presence of ignitable liquid (IL) residues. For the best chromatographic results the evidence samples must be collected from an area of the pour pattern suspected to contain the highest concentration of IL residue. The question is whether it is best to collect from the center of the burn pattern, the edges of the burn pattern, or somewhere in between. Most texts and manuals to date suggest collecting from the edge of the pattern. One factor to consider is whether the substrate the IL was poured onto has any effect on the prime area to collect the sample from. Carpeting, for example, can wick the IL away from the original pour pattern diluting the IL over a larger area. Some newer synthetic carpets can also self-sustain combustion beyond the edge of the original pour pattern leaving a completely unrelated pattern. Sampling from the edge of this pattern could potentially give negative results. Cut pile carpet with raised or lowered patterns in it may also have an effect on the way in which the IL disperses and burns off. An experiment was designed to test the concentrations of IL residues in different specified areas of pour patterns post burn. A circular pour pattern representing a central dump of IL was tested, as well as a linear pattern representing a trailer. Substrates were allowed to burn to 70% completion and were extinguished with water. Multiple samples were collected at designated areas across the pattern. Any volatile IL residues present were collected by passive headspace analysis on activated charcoal strips and submitted to analysis by gas chromatography mass spectrometry (GC/MS). Total ion chromatograms for each sample were analyzed qualitatively and quantitatively. Ratios of target compounds in the IL to the peak area of the 3-phenyltoluene internal standard were calculated to normalize the chromatographic data to the amount of IL residues present. Full scale test burns have also been performed in two bedrooms of a house. New low pile carpet was laid in each room and contents from the property were added to the rooms to increase the fuel load. Diesel fuel was poured in a large "S" shaped pattern on the floor of each room and ignited. The fires were allowed to progress to flashover before extinguishing. Samples were taken around the ends of the "S" pattern in Room 1 (the larger room) and straight across the entire pattern in Room 2 (the smaller room.) Initially, the results have shown that higher concentrations of IL residues can be found toward the center of the pour patterns compared to the outer edges under these conditions. The residues found near the center are also more similar chromatographically to neat injections of the IL used. This would suggest that, when possible, the center of a pattern would be the best place for fire investigators to sample for the best results. Differences in relative concentration of IL residue due to substrate, actual pour pattern and class of IL will be presented.