



B141 Using Solid Phase Extraction (SPE) to Reduce Interference in Gas Chromatography/Mass Spectrometry (GC/MS) Analysis of Fire Debris Samples

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After attending this presentation, attendees will better understand how SPE with GC/MS increases the chances of determining whether a hydrocarbon accelerant is present, then correctly identifying the accelerant used, even in the presence of matrix interferences.

This presentation will impact the forensic science community by describing another way to improve the identification of fire debris samples that otherwise would have been unidentifiable due to matrix interferences.

Interferences can be broken down into three types: (1) substrate products; (2) pyrolysis products; and, (3) combustion products.¹ Their presence makes identification of the accelerant components challenging, thus hindering the interpretation of arson samples. To reduce the interference and make it easier for identification, a simple method of extraction with SPE cartridges can be used to purify the samples. Silica and amino propyl cartridges were evaluated as they remove compounds with which hydrogen bonds, but they do not have π bond interactions, such as aromatics. Accelerants containing hydrocarbons were used in this study.

There were two phases to the research. The first phase was to document the degree to which SPE affects the components of ten neat accelerants of different classes. The neat accelerant samples were collected using passive headspace with activated charcoal strips to adsorb the compounds.² The cans were heated overnight in an oven. Approximately 1mL of Carbon Disulfide (CS_2) was used to extract the compounds from the strips in amber vials. Three activated charcoal strips were used per sample during the heating stage of research. One strip went through a Silicon Dioxide (SiO_2) cartridge, another through an amino (NH_2) cartridge, and the third strip remained as is. Each accelerant was sampled in triplicate. All extracts were analyzed by GC/MS.

The chromatograms from the neat, silica cartridge and amino propyl cartridge were compared for each accelerant by first isolating the six most prominent peaks. The compounds were then identified using the reference library from the GC/MS and verified from the National Center for Forensic Science (NCFS).³ The areas for these six prominent peaks were normalized for each sample, then the mean normalized area was calculated and standard deviation was calculated for the triplicate samples. Finally, the upper and lower confidence limits were calculated for the differences in the mean normalized areas of the neat versus the mean normalized areas for each of the sample sets run on the different SPE media. In all of the tested accelerants, there were no statistical differences in the normalized means of the six most prominent peaks.

Phase two of the research focused on testing the effectiveness against interferences. Various interfering matrices were placed in the cans, then burned until a smoldering smoke was observed. At this point, the cans were spiked with an accelerant mix consisting of a 1:1:2 volume/volume (v/v) gasoline, kerosene, and diesel and sealed with three charcoal strips inside. The strips were extracted as before and one strip was analyzed with no clean-up, while the other strips were cleaned via SPE, one strip using the silica cartridge and the other using the amino-propyl cartridge. After the extracts were analyzed by GC/MS, the prominent interference peaks in the samples were normalized against the largest accelerant peak and decrease in the normalized intensity was documented.



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Reference(s):

1. Stauffer E. Sources of interference in fire debris analysis. In: Niamw Nic Daeid, editor. *Fire investigation*. CRC Press, 2004;1-36.
2. Pert A.D., Baron M.G., Birkett J.W. Review of analytical techniques for arson residues. *J Forensic Sci.* 2006;51(5):1033-49.
3. *Online Ignitable Liquids Reference Collection Database*. (Internet). National Center for Forensic Science, University of Central Florida. 2016/07/25. Available from: <http://ilrc.ucf.edu/>.

Arson, GC/MS, Solid Phase Extraction