B55 An Investigation Into the Preservation and Storage Conditions for Extracts of Ignitable Liquid Residues

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After attending this presentation, attendees will understand how the storage conditions of activated charcoal strips can affect the preservation of sample extracts of ignitable liquid residues from fire debris samples. Attendees will be provided with a short review of past documented preservation techniques and ideas as to what practitioners can do to create a consensus in the field.

This presentation will impact the forensic science community by providing information on storage and reanalysis conditions of carbon disulfide extracts of residues preserved on activated charcoal strips.

Fire debris analysis presents a constant challenge to those who investigate the scene. Practitioners responsible for determining what ignitable liquid may have been used to intentionally set a fire have a difficult challenge. It is crucial for practitioners to not only correctly identify which ignitable liquid is present, if any, but to also preserve extracts for future analysis and peer review. Forensic scientists commonly use passive headspace to sample and concentrate ignitable liquid residues onto activated charcoal strips. There have been some studies conducted on this topic, but little work has been reported on the preservation and reanalysis of activated charcoal strips that have been previously extracted with carbon disulfide. Presently, there is no accepted standard practice for storing and preserving these extracts. The American Society for Testing and Materials (ASTM) E2451-13 states "… changes to a preserved sample extract and the length of time it remains viable under storage conditions are unknown".[1] Clear standards and validation of the conditions for preservation of the extracts should be documented and universally accepted within the field.

In this study, Gas Chromatography/Mass Spectrometry (GC/MS) was used to analyze passive headspace extracts to study the changes of a Standard Accelerant Mixture (SAM) adsorbed onto activated charcoal strips and preserved under different storage conditions. The SAM consisted of a mixture of 1:1:2 ratio of gasoline, kerosene, and diesel fuel. Two different types of chromatographic vials were compared, screw cap vials and snap cap vials. Four different storage conditions for the extracts were studied: (1) room temperature (25°C); (2) refrigeration (4°C); (3) freezer (-20°C); and, (4) freeze and thaw cycles. The study examined three different conditions in regard to the preservation of the sample in a chromatographic vial during analysis: (1) no change to the septum after each injection of multiple injections; (2) septum replaced after each injection; and, (3) cap removed and carbon disulfide evaporated in order to reconstitute with carbon disulfide once the strip is dried. Area normalization of peak abundances was used to calculate recovery and reproducibility of GC patterns. Chromatographic peaks used for the quantitative comparison were validated through mass spectral analysis and comparison to library standard reference spectra.

The results indicate ignitable liquid residue passive headspace-activated carbon strip samples extracted with carbon disulfide may be dried and reconstituted at least two times with no loss of sample integrity or diagnostic chromatographic peaks used for identification. After three evaporation/reconstitution cycles, lighter constituents began to evaporate and affect the chromatographic validity of the data. Sample vial, storage temperature, and conditions are crucial aspects of fire debris sample preservation. Further studies are necessary to understand how

the sample extracts should best be stored and preserved in order to test them in the future.

Reference(s):

1. ASTM E 2451-13. Standard Practice for Preserving Ignitable Liquids and Ignitable Liquid Residue Extracts from Fire Debris Samples. *American Society for Testing and Materials.* Philadelphia, Pennsylvania 2013.

Fire Debris, Ignitable Liquid Residues, Sample Extract Preservation