A150 Evaluation of a Novel Methodology for the Recovery of Volatiles From Fire Debris Samples

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After attending this presentation, attendees will understand the difficulties of recovering low molecular weight volatiles from fire debris samples and the need for the development of a new method for detecting these products. Attendees will learn about a new technique which seeks to improve the recovery of volatiles from fire debris and may be used to compliment the carbon strip extraction method.

This presentation will impact the forensic science community by evaluating a new methodology for the recovery of acetone and low molecular weight alcohols from samples collected during arson investigations. This research study aims to optimize adsorption and desorption of volatiles in comparison to the commonly used activated carbon strip.

Within the field of fire debris analysis, one of the most common methods for the extraction of traces of ignitable liquids from evidence samples is the passive headspace technique. This technique, as outlined in ASTM Standard Practice E-1412-07, employs the use of a charcoal based adsorption medium to capture volatile components from the headspace above a heated sample. As this procedure is carried out over a given period of time, it allows for the concentration of a representative sample of volatile compounds within the sample. Once collected, the compounds are easily eluted with a suitable solvent and analyzed using gas chromatography/mass spectrometry (GC/MS) for the potential identification of any ignitable liquid residues that may be present. This is a very sensitive technique that is capable of capturing minute amounts of volatile compounds.

While this technique has been well accepted in the fire debris analysis community, the difficulty of recovering volatiles from fire debris samples is an area in need of improvement. Given carbon's higher affinity for heavy molecular weight products over low molecular weight products and hydrocarbons over alcohols, the detection of low molecular weight alcohols and acetone is severely compromised. Previous research has shown a reduction in the recoverability of acetone and low molecular weight alcohols in the presence of heavier molecular weight products. This study seeks to develop a new methodology for fire debris analysis that may compliment the carbon strip method by having a greater affinity for low molecular weight alcohols and acetone. This new methodology utilizes zeolites for the adsorption and identification of volatiles from fire debris samples. Zeolites are both naturally occurring and synthetically prepared crystalline aluminosilicate mineral structures with uniform molecular sized pores. They are stable at high temperatures and can be used as catalysts or molecular sieves due to their unique pore sizes, which determine their application. The pores are formed from the tetrahedral framework of Si, Al, and O atoms and allow molecules to adsorb on the internal surface area of the structure based on the size of the pores as well as the polarity of the zeolite. The objective of this study is to evaluate the application of zeolites for the adsorption of volatiles from fire debris samples and determine the ease with which any retained compounds can

be subsequently desorbed with an appropriate solvent for analysis using GC/MS.

Forensic Chemistry, Fire Debris Analysis, Volatiles

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