A172 Surfactant Pyrolysis Products: Implications for Fire Debris Analysis

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The goal of this presentation is to discuss pyrolysate of surfactants, specifically those based upon linear alkylbenzene sulfonates, and how these interferences can affect interpretation in fire debris analyses.

This presentation will impact the forensic science community by providing additional insight into the affects of materials and pyrolysates for interpreting results of ignitable liquid analyses.

Determining substrate interferences in ignitable liquid investigation is an ongoing concern for analysts performing laboratory analysis of fire debris samples. Previous studies have shown interferences for substrate materials such as asphalt, wood, and polymers. This presentation; however, will discuss the potential that substances used in the extinguishing of a fire may complicate the interpretation of ignitable liquid analyses.

Observed in a recent case sample was a distribution of linear alkylbenzenes, with a linear chain of ten to twelve carbons. Linear alkylbenzenes are used in the manufacture of surfactants through aromatic sulfonation to yield linear alkylbenzene sulfonates, which are used in many common household soaps and detergents. Liquid detergents, possibly containing linear alkylbenzene sulfonates, were utilized in the suppression of the fire in question. This was done by aspirating the liquid detergent into the water hose to produce fire suppression foam, as a substitute for sodium perfluorinated alkylsulfonates (AFFF). Desulfonation of the linear alkylbenzenes is hypothesized as the origin of the compounds detected due to aromatic desulfonation which can occur at high temperatures and in the presence of water.

Aromatic compounds such as ethylbenzenes, propylbenzenes, and naphthalenes were also observed in the case sample. These compounds can be indicative of an ignitable liquid, such as gasoline. The objective of this study was to determine the origin of these aromatic compounds, whether from an ignitable liquid or degradation from the linear alkylbenzenes. It is proposed that decomposition of the carbon chains in the linear alkyl benzenes, similar to what is observed in the pyrolysate of polyethylene, contributed to the observed aromatics in the sample. A series of trials were performed by pyrolyzing various liquid detergents in order to replicate compounds and patterns to those observed in the case sample. Several mediums, such as terry cloth, cotton, and aluminum foil, were tested in an attempt to replicate pyrolysis conditions without contributing additional interferences in the resulting chromatograms. Samples were extracted using passive headspace and analyzed by gas chromatography/mass selective detection in accordance to ASTM 1618-

6. Preliminary results indicate the presence of light aromatic compounds when linear alkylbenzenes were also detected in the sample. Light aromatic compound ratios observed in the presence of linear alkylbenzenes; however, do not correspond to light aromatic compound ratios observed in gasoline. Subsequent tests are being conducted to provide further interference information on additional mediums and detergents.

This presentation will discuss and compare the test methods utilized, as well as compare the results from the different trial conditions. Summed ion profiling will be utilized to aid in distinguishing pyrolysate interferences from linear alkylbenzes and ignitable liquids, such as gasoline.

Fire Debris Analysis, Surfactants, Pyrolysis

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