A91 Competitive Adsorption of Ignitable Liquids on Charred Wood

Ronald L. Kelly, BS, Federal Bureau of Investigation, FBI Laboratory, 2501 Investigation Parkway, Explosives Unit, Room 4140, Quantico, VA 22135*

After attending this presentation, attendees will have learned about the complications that may arise in the analysis of ignitable liquids extracted from charred wood in fire debris (arson) cases. An understanding of the complications that result from this problem may assist an analyst to more thoroughly understand the results obtained from the analysis of certain fire debris samples.

This presentation is from results of a study that qualitatively examined the complications associated with the extraction of ignitable liquids onto carbon strips from heavily charred wood. The charred wood has a potential to retain ignitable liquid residues resulting in skewed chromatographic patterns of the liquids, or compete for vapors in the headspace above the debris, either of which can prevent an analyst's from properly classifying the residue per ASTM criteria. This presentation will impact the forensic science community by examining these effects and documented the skewed patterns, which in practice, can be used to explain unexpected variations of peak ratios of compounds of ignitable liquids adsorbed onto carbon strips from heavily charred wood. It is desirable for the fire debris chemist to be familiar with the criteria necessary for the proper identification of ignitable liquids as well as understand the factors which may cause variations from the expected norms.

Fire debris is most often analyzed for ignitable liquids in the forensic laboratory using an ASTM extraction method which utilizes a heated passive adsorption onto activated charcoal strips. Identification of the extracted ignitable liquid residues is accomplished by ASTM E-1618 test method which employs gas-chromatographic-mass spectrometry as a separation, detection, and classification technique for ignitable liquids. A fairly strict set of data interpretation guidelines are used in the reporting and classification of ignitable liquids. Data interpretation is often complicated by the presence of background hydrocarbons, combustion products, and pyrolysis products making it difficult to distinguish even common products, such as gasoline, from the complicated chemical profile of the fire debris. Typically these interfering compounds are the same compounds that comprise the ignitable liquid. The problem presented by charred wood in fire debris is that the ASTM extraction technique is using charcoal, essentially the same material as charred wood, as the receptor or absorbent medium to capture the vapors of the ignitable liquid as it heats during extraction. The process is further complicated because charred wood seems to also selectively retained compounds of ignitable liquids. This study qualitatively looked at the competitive adsorption and retention of volatile compounds on charred wood and the variation of compound ratios typically used by the fire debris analysts in the interpretation, classification, and reporting of ignitable liquids. Various types of wood and varying degrees of charring

were variables studied in the project. Some attention was also given to the affects of temperature and length of extraction on the recovery of the ignitable liquid. Additional work was performed using different classes of ignitable liquid products (such as distillates) to see if or how the presence of charred wood affects these products.

Fire Debris, Competitive Adsorption, Ignitable Liquids

 ** Presenting Author*