A153 The Effects of Carbon Disulfide on the Elution and Solvation Phases of Light and Medium Range Ignitable Liquids

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After attending this presentation, attendees will learn that activated charcoal strip elution by CS_2 occurs immediately once the CS_2 comes in contact with the activated charcoal strip. Attendee will also learn that light and medium range ignitable liquids have a lifespan of one month when dissolved in the solvent, CS_2.

This presentation will impact the forensic science community by demonstrating that elution by CS_2 occurs immediately upon contact with the charcoal strip. Also, after attending this presentation, attendees will know that neat ignitable liquids dissolved in CS_2 are stable compounds for one month. Therefore, fire debris analysts will be able to improve their practice by keeping their standards for up to one month under proper conditions instead of remaking a new standard for every case. This will save supplies, time, and laboraotry finances.

The objective of this research was to understand the effects of CS_2 on the elution and solvation phases of ignitable liquids over time. All data was collected and analyzed by GC/MS. Statistics were used to determine differences and/or similarities among the samples over time. An internal standard, tetrachloroethylene at a concentration of 100 ppm, was used to compare samples.[1] This particular internal standard was used because:
(1) its retention time falls within the middle of the ranges for all the ignitable liquid categories tested; and,
(2) it allowed for normalization of the data.

It has been shown that CS_2 is the universal solvent for activated charcoal strip elution.[2] The elution study conducted explored how well

CS_2 completely extracts ignitable liquid residues (ILRs) from an activated charcoal strip. This study was comprised of a series of sub- studies: a vortex study, an elution period study, and a washing study. The first sub-study explored whether vortexing for one minute was necessary for lab procedures by varying the vortex time from no vortex to a one minute vortex. The second sub-study explored if a 15 minute waiting period was necessary for complete elution to occur by varying the waiting period after a one minute vortex from no waiting period to a waiting period of one hour. The third sub-study determined if CS_2 immediately extracted any ignitable liquid residue (ILR) from an activated charcoal strip and whether immediate extraction occurred for all ILRs or only certain types. This washing study was completed by rinsing three charcoal strips with varying amounts of CS_2 with neither a vortex period nor a waiting period.

The second part of the time study, the solvation study, explored the evaporation pattern of ignitable liquids in CS_2 solution over a one month period. The ignitable liquids tested included light petroleum distillates (LPD), gasoline (GAS), medium petroleum distillates (MPD), and medium range isoparaffins (ISOP). Two milliliters of a 1% ILR solution v/v in CS_2 were prepared for each sample. The time intervals tested were immediate sampling of IL/ CS_2 solutions after preparation, and sampling of each of the solutions after one hour, one day, one week, two weeks, three weeks, and one month. Samples were stored in a -10°C freezer between removals for analysis.

Three different statistical tests were used to determine differences or similarities among the samples in each study over time. These tests included a Tukey Honestly Significant Difference (HSD) test, Principle Component Analysis (PCA) with cluster analysis, and Pearson Correlation with a Student's t-test and ROC plots. The Tukey test demonstrated that minimal differences occurred among samples in all

studies. Using PCA, it was seen that minimal to no difference existed among samples in all studies as well. This was followed by cluster analysis which demonstrated the same results with the observance of extremely low Euclidean distances in all studies. The Pearson correlation coefficients for all studies ranged from 0.7000 to 0.9999. These correlations were followed by the Student's t-test, where the averages from two different sample means-those within the same time interval (STI) and those between different time intervals (DTI)-were compared. The experimental t-values between the STI and DTI were extremely low across all studies.

Based on research thus far, a waiting period is not necessary for complete elution to occur; CS_2 immediately extracts residue from the

activated charcoal strip. From the solvation study, standard light and medium range ignitable liquids dissolved in CS_2 can be stored under normal conditions in a freezer for up to one month without evaporating or chromatographic skewing.

References:

1. Lentini JJ. Scientific Protocols for Fire Investigation. Boca Raton: CRC Press, 2006. 150.
2. Dolan JA, Newman R, Stauffer E. Fire Debris Analysis. Burlington: Elsevier, Inc, 2008. 399-439.

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