A191 The Persistence of Gasoline on Fabrics Constructed of Natural and Manufactured Fibers

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After attending this presentation, attendees will understand that it is imperative to collect and secure fabric samples in vapor-proof packaging within 24-hours of the gasoline deposition to ensure the highest potential of detection and identification. Furthermore, the fabric fiber type and the environmental conditions to which the fabric was exposed must be known in order to predict the elapsed time since deposition of the gasoline.

This presentation will impact the forensic science community by describing some of the challenges associated with the detection and identification of gasoline on fabrics and demonstrating the impact of environmental factors on the prediction of the elapsed time between the deposition of an ignitable liquid and the detection of the residue on fabrics.

This study examined the persistence of gasoline on single-component fabrics constructed of the natural fibers cotton and silk and the manufactured fibers acetate, acrylic, nylon, polyester, olefin, and rayon. The study was designed to determine if the type of fabric affected the detection of evaporated gasoline and if that information could be used to predict the length of time between the deposition of the gasoline to the collection and analysis of the material. The persistence was evaluated with constant and variable airflow, humidity, and temperatures ranging from 34°F to 87°F. All samples were placed in vapor-proof nylon bags and extracted using the passive headspace concentration method (ASTM E1412). One-half of an activated charcoal strip (ACS) was placed in the bag with each fabric. The bag was resealed and heated at 80°C for 16 hours. Each half strip was eluted with carbon disulfide and analyzed by gas chromatography-mass spectrometry (ASTM E1618). The extracted ion chromatograms (EIC) for the molecular ion 105 of the gasoline-spiked substrates were compared to the C3 akylbenzenes profile of gasoline which consists of m-ethyltoluene (1-methyl-3-ethylbenzene), p-ethyltoluene (1-methyl-4-ethylbenzene), o-ethyltoluene (1-methyl-2-ethylbenzene), and 1, 2, 4-trimethylbenzene (pseudodocumene). The plots of the selected ion total peak areas versus time for these compounds demonstrated the subjectivity of gasoline evaporation from the different types of fabric substrates when exposed to various environmental conditions. Generally, there was an inverse relationship between the exposure temperature and the time interval that gasoline remained detectable on the fabrics. The results for the constant and variable environment conditions were not consistent among the fabrics tested. For example, cotton retained gasoline for up to five days in the EIC at a temperature of 76°F and constant airflow. However, with variable conditions, gasoline was only detectable in the EIC for up to 24 hours. Gasoline could be detected in the EIC for nylon, olefin, and polyester for up to five days after deposition depending upon the conditions. In contrast, gasoline was identifiable in the total ion chromatogram for acetate for up to five days after deposition in both constant and variable conditions. The fabrics that were least retentive of gasoline were acrylic, rayon, and silk. Given the results of this study, it is imperative to collect and secure fabric samples in vapor-proof packaging within 24 hours of the gasoline deposition to ensure the highest potential of detection and identification. Furthermore, this study shows that the environmental conditions to which the fabric was exposed must be known in order to predict the elapsed time since deposition of the gasoline.

Gasoline, Fire Debris, Fibers

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