B120 Transfer and Adherence of Gasoline Vapors Onto Clothing in an Enclosed Room

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The goal of this presentation is to provide information regarding the exposure of clothing to gasoline vapors in an enclosed room and the subsequent laboratory testing of the clothing.

Chemists who analyze fire debris are sometimes requested to examine a suspect's clothing for the presence of ignitable liquids. The presence or absence of ignitable liquids on a suspect's clothing may play a significant role in a trial. Several factors may have an effect on the retention of ignitable liquids and or vapors on the clothing. These factors include whether or not liquid was spilled on the clothing, duration of exposure and the time between exposure and collection of the clothing.

This study was conducted as part of the ATF certification program for certified fire investigators and examined the transfer and adherence of gasoline vapors to various clothing materials and the effect of time between exposure and collection. The clothing items used in this study were swatches from a pair of 100% cotton jeans, a 100% cotton t-shirt, a 100% polyester t-shirt, and a 50:50 cotton:polyester sweatshirt. In order to simulate a standard room, a 1:12 scale model of a 10-foot by 12-foot room was constructed using plywood, drywall and pressboard flooring. No doors or windows were cut into the walls in order to minimize the escape of vapors. The interior of the room was not finished in order to minimize the available material on to which the gasoline vapors could adhere. These factors were selected to simulate a worst-case scenario for an enclosed room. Four rooms were constructed - one for each type of fabric. A metal baking pan was placed on the floor of each model to contain the liquid gasoline. Fishing wire and binder clips were used to suspend five three-inch square swatches of each fabric material approximately three inches above the metal pan.

It was assumed that one-half gallon of gasoline would be a sufficient amount to pour around a 10-foot by 12-foot room. This volume of gasoline was reduced by a factor of 12 and poured into the metal pan. A drywall ceiling was put into place and the room was enclosed for a period of 15 minutes. After 15 minutes, the ceiling was displaced and the fabric swatches were removed. One swatch was immediately placed into a quart can, and the can was sealed. The remaining swatches were exposed to atmospheric conditions for 15 minutes, 30 minutes, 60 minutes, and 24 hours. After each time frame, one fabric swatch was placed in a quart can and the can was sealed. This process was repeated twice more with fresh gasoline for each trial. A control sample of each fabric was also collected.

Each fabric sample was extracted using passive headspace concentration with a charcoal strip (ASTM E-1412). Each sample was heated at 65°C for 16 hours and extracted with 150 µL of carbon disulfide. The samples were then analyzed using a gas chromatograph – mass spectrometer. The total ion chromatogram and the aromatic (m/z = 91 + 105 + 119 + 133) extracted ion profile were used to evaluate the data.

All of the control samples were negative for the presence of gasoline. Each fabric sample packaged immediately after exposure showed indications of gasoline in both the total ion chromatogram and the extracted aromatic profile, but the patterns were not significant enough to warrant a positive identification of gasoline. After 15 minutes of atmospheric exposure, only the polyester t-shirt and the sweatshirt showed indications of gasoline in the aromatic extracted profile. After 30 minutes of atmospheric exposure, none of the samples showed any indications of gasoline.

This test was repeated with 20 µL gasoline placed on each of the fabric swatches to simulate approximately 12 drops of gasoline spilled on each fabric sample. Positive identification of gasoline (evaporated) on each of the fabric materials could be made on the samples immediately packaged and after 15 minutes of atmospheric exposure. After 30 minutes, gasoline (evaporated) could be identified on the jeans, the cotton t-shirt, and the sweatshirt. After 60 minutes gasoline (evaporated) could be identified only on the jeans.

This study demonstrates that in an enclosed room the volatile components of gasoline may adhere to various types of clothing material. However, a positive identification of gasoline by the laboratory would be unlikely even if the clothing was packaged immediately after the exposure. After being exposed to the environment for a short period of time, any indications of gasoline are eliminated. However, when liquid gasoline comes in contact with clothing, the laboratory can make a positive identification of gasoline if the clothing is collected a short period of time after the exposure.

Gasoline, Clothing, Ignitable Liquid

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