



## Criminalistics Section - 2016

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### **B156 Gas Chromatography/Mass Spectrometry (GC/MS) Measurement of Gasoline Vapor Absorption on Clothing in a Confined Space**

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After attending this presentation, attendees will better understand gasoline vapor absorption on cotton clothing in a confined space.

This presentation will impact the forensic science community by adding to the body of knowledge regarding the transfer of gasoline vapors to clothing in a confined space, information particularly important to the ignitable liquid/arson debris analysis community.

A recent case produced a question regarding the possible deposition of gasoline vapors on clothing as a suspect walked across a room in which the vapors were present. In the course of testimony, the defense council noted that gasoline was present on the defendant's footwear, yet there was no determination of gasoline on the defendant's clothing.

This research project focuses on the absorption of gasoline vapors by clothing in confined spaces. Research by Folkman et al., Coulson et al., and Errata et al. (under review) primarily deals with splashing or spilling of ignitable liquids onto clothing and the persistence of sufficient concentrations of ignitable liquids for identification.<sup>1-3</sup>

The experimental process was as follows. New, never-laundered, same-sourced cotton T-shirts were purchased along with new, one-gallon paint cans. An unventilated, steel, flammable 1.6m x 0.8m x 0.5m cabinet containing approximately 30L of 87-octane gasoline in standard one-gallon gasoline containers was used as the source of gasoline fumes. Vapors were allowed to accumulate in the cabinet for three months prior to the experiment. Samples were taken in triplicate of cotton T-shirts stored inside the cabinet for six hours, one hour, and fifteen minutes. In addition, one experimental condition measured the amount of absorbed gasoline vapor after 15 minutes of exposure followed by a one-hour ventilation in a fume hood. Subsequently, an additional experiment was performed on three T-shirts left hanging one meter from the open doors of the cabinet. Each T-shirt was placed in a clean, new, one-gallon paint can. An activated charcoal strip was suspended in the can, which was then heated at 70°C for 16 hours. The activated charcoal strips were washed with carbon disulfide and analyzed by GC/MS.

Results of the experiment show detectable amounts of gasoline (BET, alkylbenzenes, and naphthalenes) for the T-shirts exposed to gasoline vapors in the cabinet for periods of six hours and one hour; however, even in the extremely confined and unventilated space, the T-shirts exposed for 15 minutes did not display sufficient naphthalene concentrations for an identification, even prior to the one-hour, in-hood ventilation. The conclusion is that the necessary concentration for gasoline vapors to absorb into cotton T-shirts and be detected would likely lead to the incapacitation or death of the individual wearing the clothing.<sup>4</sup> The absorption and persistence of solely gasoline vapors onto cotton clothing of a suspect who has left the crime scene appears very unlikely according to the results of these experiments.

#### **Reference(s):**

1. Folkman T.E., Kuehl A.M., Groves R.J., Beveridge A.D. (1990). Evaporation Rate of Gasoline from Shoes, Clothing, Wood and Carpet Materials and Kerosene from Shoes and Clothing. *Canadian Society of Forensic Science Journal*, 23(2,3): 49-59.
2. Coulson S.A., Morgan-Smith R.K. (2000). The Transfer of Petrol on to Clothing and Shoes while Pouring Petrol around a room. *Forensic Science International*, 112: 135-141.
3. Coulson S., Morgan-Smith R., Mitchell S., McBriar T. (2008). An Investigation into the Presence of Petrol on the Clothing and Shoes of Members of the Public. *Forensic Science International*, 175: 44-54.
4. Papi L., Chericoni S, Bresci F., Giusiani M (2013). Fatal Acute Poisoning from Massive Inhalation of Gasoline Vapors: Case Report and Comparison with Similar Cases. *Journal of Forensic Sciences*, 58(2): 552-555.

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#### **Gasoline, Ignitable Liquid, Clothing**

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