

Analysis of Fiber Interference in Fire Debris Residue Using Solid Phase Microextraction (SPME) and Gas-Chromatography Mass-Spectrometry (GC-MS)

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Structured Abstract

Background: Arson, sometimes referred to as deliberate fire, invariably entails the utilisation of flammable liquids. Synthetic fabrics may contain components that are present in ignitable liquids, as they are derived from petroleum-based sources. A significant proportion of the fabrics exhibited the presence of alkylbenzenes and n-alkanes. In a previous incident, an individual was falsely implicated in an act of arson due to the discovery of ignitable liquid residue, specifically toluene, on the suspect's footwear. Subsequent investigations revealed that the compound did not originate from an intentionally introduced flammable substance, but rather was an inherent constituent of the shoe substrate. The objective of this study is to assess if the chosen synthetic textile fibre has any components of ignitable liquids when subjected to combustion. The idea is to aid fire investigators by examining the potential interference that may arise from the presence of such components.

Methods: In the present investigation, each of the three fabric samples underwent combustion experiments involving the use of petrol and diesel as an ignitable liquid, as well as experiments conducted without the presence of any ignitable liquids. The fabric is ignited for approximately five seconds, and the partially burned fabric is promptly transferred into a headspace vial for extraction using Solid Phase Microextraction (SPME) under certain conditions. This is then followed with GCMS analysis.

Results: The results showed that, Components corresponding to characteristic peaks for all clothing samples when burnt with petrol are consisting of homologues benzenes and naphthalene components. On the other hand, hydrocarbons such n-decane and aromatic hydrocarbon, o-Cymene, are present in diesel as corresponding peak. These are components with higher boiling points and more complicated chain, as retention time increases when carbon chain length increases. All the synthetic fabric tested in this study showed no interference to the detection of petrol and diesel when burned together, nor presence of any component of ignitable liquid in the fabrics when burned without ignitable liquids.

Conclusion: In conclusion, neither petrol nor diesel have been significantly impacted by any of the three samples. Thus, it determined that synthetic fibres do not cause interference in petrol and diesel identification after burn.

Keywords: Synthetic fibre, ignitable liquids, interference, arson

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