CASE REPORT

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A Fire Investigation Involving Combustion of Carpet Material

REFERENCE: Howard J. and McKague, A. B., **"A Fire Investigation Involving Combustion of Carpet Material,"** *Journal of Forensic Sciences*, JFSCA, Vol. 29, No. 3, July 1984, pp. 919-922.

ABSTRACT: Headspace samples taken from a charred carpet recovered from a fire site and from pyrolyzed styrene-butadiene copolymer were analyzed by gas chromatography and gas chromatography/mass spectrometry. The results showed that all volatile components associated with the carpet samples could be accounted for by pyrolysis of styrene-butadiene rubber used in either foam underlays or latex carpet backing adhesives. No evidence for arson was found.

KEYWORDS: criminalistics, arson, chromatographic analysis, gas chromatography, gas chromatography/mass spectrometry, headspace analysis, styrene-butadiene and pyrolysis

Gas chromatography is commonly used in cases of suspected arson to identify accelerants [*1,2*]. Recently, the technique of "mass chromatography" was described to distinguish hydrocarbons characteristic of accelerants from those produced by the combustion of carpets [*3*].

This communication reports a similar experience in a case where carpet samples were submitted for accelerant analysis because a fire investigator noticed they had a distinctive odor of a flammable solvent.

Case History

A suspicious fire in a downtown rooming house with a history of such events resulted in a fatality. A private fire investigator was called in by the house insurers a week after the event to investigate the possibility of arson since this could affect liability. During site inspection, carpet previously overlooked because it had been covered by fallen debris was discovered and found to have a pronounced solvent-like odor. Since the area where the carpet was found was close to an upholstered chair where witnesses claimed the fire had started, a possible connection between the odor and an accelerant had to be investigated.

Presented to the International Association of Arson Investigators Seminiar, 3-5 May 1983, Richmond, British Columbia, Canada. Received for publication 11 July 1983; revised manuscript received 2 Sept. 1983; accepted for publication 13 Sept. 1983.

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Analytical Findings

Air samples from over carpet debris sealed in metal tins for two days at room temperature were obtained by drawing on the headspace at 200 mL/min for 15 min using a small pump and trapping the organic vapors on charcoal air-sampling tubes (Mine Safety Appliances Co., Pittsburgh, PA). The charcoal (150 mg) was then eluted with carbon disulfide (1 mL) and the solution analyzed by gas chromatography (flame ionization detector) on a 15-m by 0.2-mm inside diameter SE30 capillary column. The temperature was held at 50°C for 5 min, then programmed to 250°C at 4°/min. A number of volatile components were tentatively identified by their matching retention times, including benzene and toluene, both of which are components of gasoline (Fig. 1). However, the major peak in the chromatogram was identified as being styrene, a known combustion product of carpet materials containing polystyrene copolymers [*3*].

As the presence of styrene in the headspace sample did not exclude the possible use of an accelerant on the carpet, an analysis was made of the headspace sample produced by pyrolyzing a sample of authentic styrene/butadiene copolymer rubber (85% styrene, Scientific Polymer Products, Inc., Ontario, NY). The sample (500 mg) was pyrolyzed by placing it in a test tube (150 mm) which had a side arm, and heating the tube with a Bunsen burner. The headspace sample was collected by drawing air in through the side arm using a pump as described above. The resultant chromatogram (Fig. 2) was remarkably similar to that obtained from the charred carpet (Fig. 1) with respect to the relative intensities of the early eluting components.

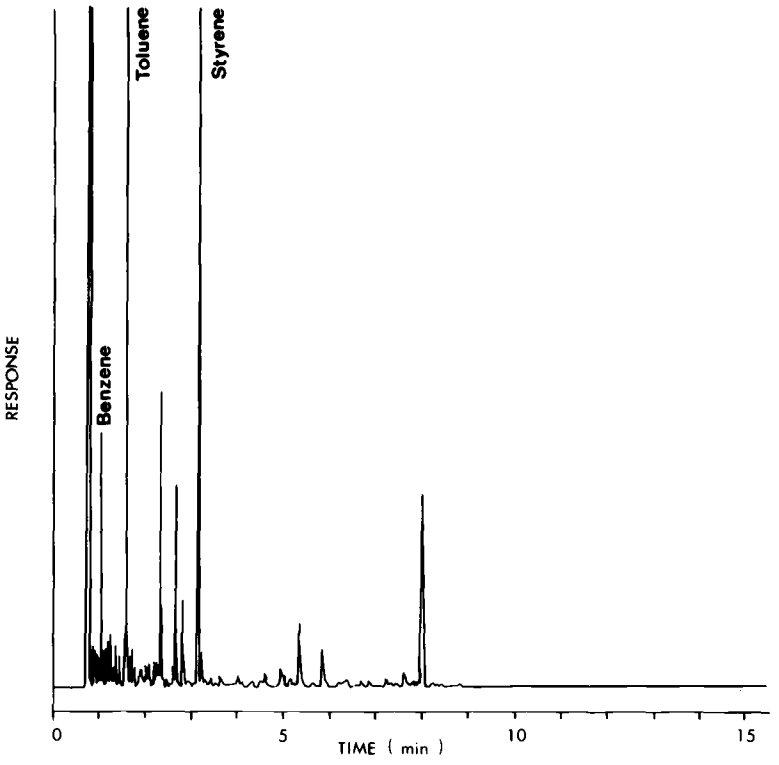

FIG. 1—*Chromatograms of headspace components from charred carpet.*

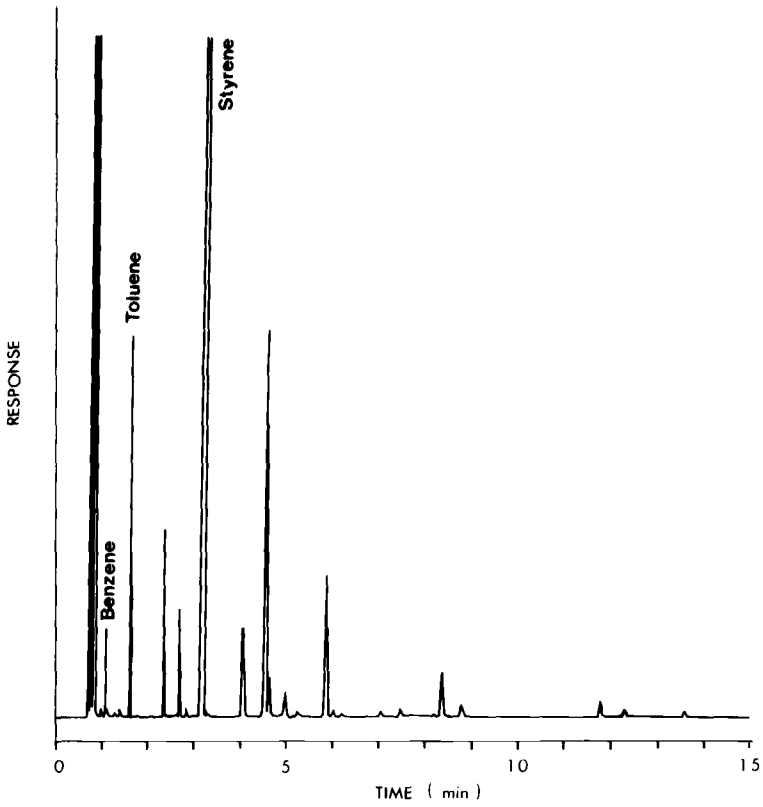

FIG. 2—*Combustion products from pyrolysis of styrene/butadiene copolymer rubber (85% styrene).*

The carbon disulfide solution of the headspace components from the charred carpet was analysed using a Finnigan OWA-30 gas chromatograph/mass spectrometer fitted with a 15-m by 0.25-mm inside diameter SE 54 fused silica capillary column. Using a temperature program similar to that described above and the National Bureau of Standards (NBS) library, additional evidence confirmed that virtually all the peaks in the chromatogram from the charred carpet (Fig. 3) were styrene- and butadiene-related and could be explained by the combustion of carpet materials unaided by an accelerant. The chromatogram was virtually identical to that obtained from carpet by a previous worker [*3*].

Conclusion

Hydrocarbons present in the headspace sample of carpet material recovered from a fire were shown to be derived from combustion of the carpet and not from the use of an accelerant.

Acknowledgments

The work was supported by B. C. Research.

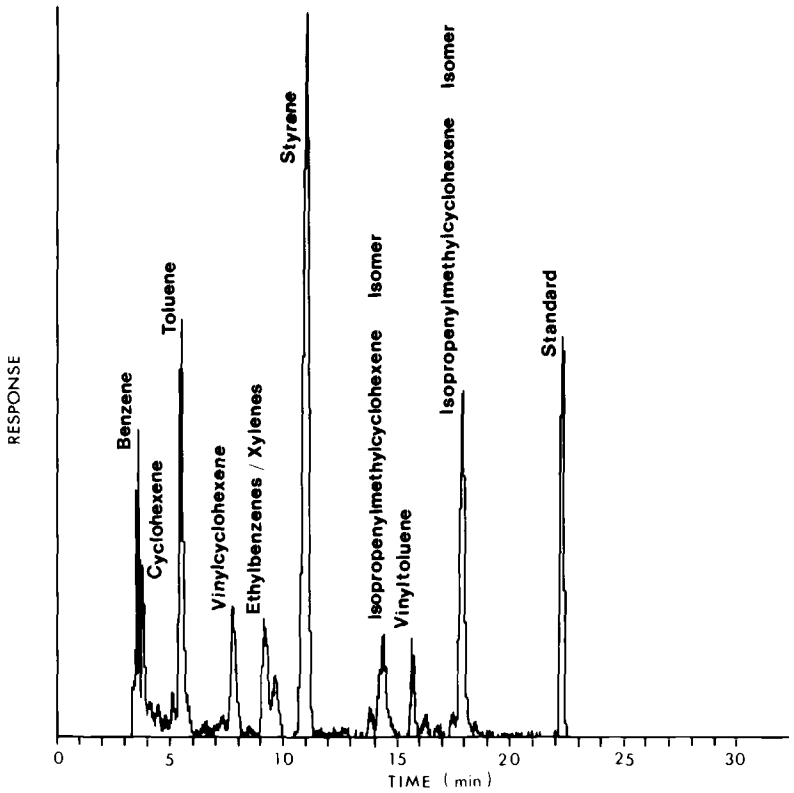

FIG. 3—*Ion chromatograms of charred carpet headspace components.*

References

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