

TECHNICAL NOTE

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A Comparison of Decomposition Products from Selected Burned Materials with Common Arson Accelerants

The purpose of this study was to determine whether or not the burning of certain building materials could produce products that could be confused with gasoline, diesel fuel, kerosene, or jet fuel. The subject of laboratory investigation of arson has been treated elsewhere in the literature [1], as have specific procedures for residue isolation [2-4] and identification [2,4,5]. A study of the amounts of hydrocarbons which may be obtained from charred materials has been made [6].

Materials and Equipment

Regular gasoline, diesel fuel, kerosene, and jet fuel were obtained from a local refinery for use as reference standards. Forty-gram samples of oak and white pine were cut into 6 by 0.5-in. (152 by 13-mm) strips.

Carpet samples of nylon, polypropylene olefin, polyester, acrylic, and modacrylic were cut into 1 by 6-in. (25 by 152-mm) strips. Sample weights ranged from 40 to 80 g. Foam carpet padding and rubber-backed nylon carpet samples of 31 and 40 g, respectively, were cut into 1 by 6-in. (25 by 152-mm) strips.

Composition roof shingle (84 g) and roof tar (190 g) were broken into approximately 1-in. (25-mm) squares, and 20 g of asphalt floor tile with adhesive was also broken into 1-in. squares.

The gas chromatographic analyses were performed on a Hewlett-Packard Model 5700A gas chromatograph equipped with a flame ionization detector and a 6-ft (1.8-m) by 0.25-in. (6.35-mm) glass column with 3% SE-30 on 60/80 mesh Chromosorb W. Charring was carried out in a 1000-ml ground-glass Erlenmeyer flask fitted with an 18-in. (457-mm) reflux condenser and heated with a Fisher burner.

Steam distillations were carried out in the charring apparatus fitted with a distilling receiver, and burning was performed with a bunsen flame in a laboratory hood.

Charring and Steam Distillation

It was determined that burning of the material resulted in a considerable loss of the

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volatile products. To obtain better recovery of the organic products, and, in turn, a better representation of products produced, the charring apparatus was employed.

With the exception of the white pine, which was steam distilled both before and after charring, all samples were charred, allowed to cool for 30 min, and then steam-distilled. Distillation was continued until no further organic distillate was recovered. The organic fractions ranged in volume from a trace to 1 ml (Table 1). These fractions were stored in water-filled glass vials. No lubricants were used in the glass joint of the distillation apparatus so that contamination by the lubricant would be avoided.

TABLE 1—*Steam distillation product values.*

Sample	Volume Collected, ml
Roof tar	0.5
Roof shingle	2.0
White pine	0.9
Oak	trace
Nylon with rubber padding	1.0
Nylon	1.0
Polypropylene olefin	0.4
Herculon® polyester	1.0
Acrlon® acrylic	1.0
70% Acrlon acrylic	0.5
30% modacrylic	
Foam padding	0.3
Floor tile and adhesive	0.5

To determine whether or not the charring procedure was representative of conditions produced during a fire, two carpet samples were burned in the laboratory hood. These samples were cooled and steam-distilled as previously described.

Analysis and Discussion

One-microliter samples of regular-grade gasoline, diesel fuel, kerosene, and jet fuel were injected into the gas chromatograph, which was programmed from 40 to 250°C at 32°C/min with an 8-min final hold. The carrier gas was helium with a flow rate of 60 ml/min. The injection port and detector were maintained at 300°C. The chart speed was 2 in./min (51 mm/min). The same conditions were used for each of the chromatograms. For trace samples, 1 ml of chloroform was added.

At the time of collection, odor, specific gravity (determined as being less than, greater than, or approximately equal to 1), color, and flammability of each distillate were determined.

The chromatograms obtained from the various distillates and the accelerants were compared, with no attempt being made to identify specific peaks. The distillate chromatograms obtained were complex, having from 30 to 60 peaks, and were easily distinguishable from the accelerant chromatograms obtained.

Only roof tar yielded a distillate with a specific gravity greater than 1. The wood samples yielded distillates with specific gravities approximately equal to 1, while all carpet, floor tile with adhesive, and padding distillates had specific gravities less than 1.

All carpet and padding distillates were yellow to yellow-green in color; distillates recovered from tar and roof shingles were black. Wood samples produced yellow-orange distillates, while floor tile with adhesive yielded a brown distillate. None of the distillates

had odors which might be confused with the accelerants tested. All distillates were found to be flammable.

The burning process produced organic products that were subsequently steam-distilled. In each case the chromatogram of this distillate was compared with the chromatogram of the distillate obtained from the corresponding charred carpet. Except for an expected loss of earlier eluted compounds, the two chromatograms were consistent. This indicated that the conditions of the charring process closely approximated the conditions of the burning process.

Conclusion

The steam distillation products of charred carpet, padding, wood, floor tile with adhesive, and roofing materials are easily distinguished from gasoline, kerosene, diesel fuel, and jet fuel by gas chromatographic analysis under the conditions used. Variations in odor, color, and specific gravity were also noted.

References

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