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TECHNICAL NOTE

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An Examination of Selected Automobile Rubber Bumper Guards

The purpose of this study was to determine whether or not rubber from an automobile bumper could be used to aid in the identification of a vehicle involved in a hit-and-run accident.

Inspection of 20 vehicles, which had been involved in front-end collisions, showed substantial loss of rubber from the bumpers. This rubber, if left at the scene of a hit-and-run accident, might offer clues as to the identity of the vehicle involved. Such clues might include physical properties such as color, compressibility, surface appearance, and foreign material present, as well as the chemical composition of the specimen. The possibility of obtaining a physical match to the suspect vehicle would also exist.

Gas chromatography was used to compare the thermal degradation products of rubber bumper guards from a representative group of 19 different models of 1975 and 1976 American automobiles. Models tested are listed in Table 1.

TABLE 1—*Automobile rubber bumper guards tested.*

Chrysler Corporation
1975 Dodge Dart
1976 Dodge Dart
1975 Plymouth Duster
1976 Plymouth Duster
1976 Dodge Colt
1976 Dodge Aspen
Ford Motor Company
1976 Ford Pinto
1976 Ford Elite
1975 Ford Torino
1976 Ford Maverick
General Motors
1976 Chevrolet Camaro
1976 Chevrolet Nova
1975 Pontiac Bonneville
1976 Pontiac Grand Prix
1976 Pontiac Astre
1976 Cadillac Eldorado
1976 Oldsmobile Cutless
1976 Oldsmobile Delta 88
American Motors
1975 Gremlin

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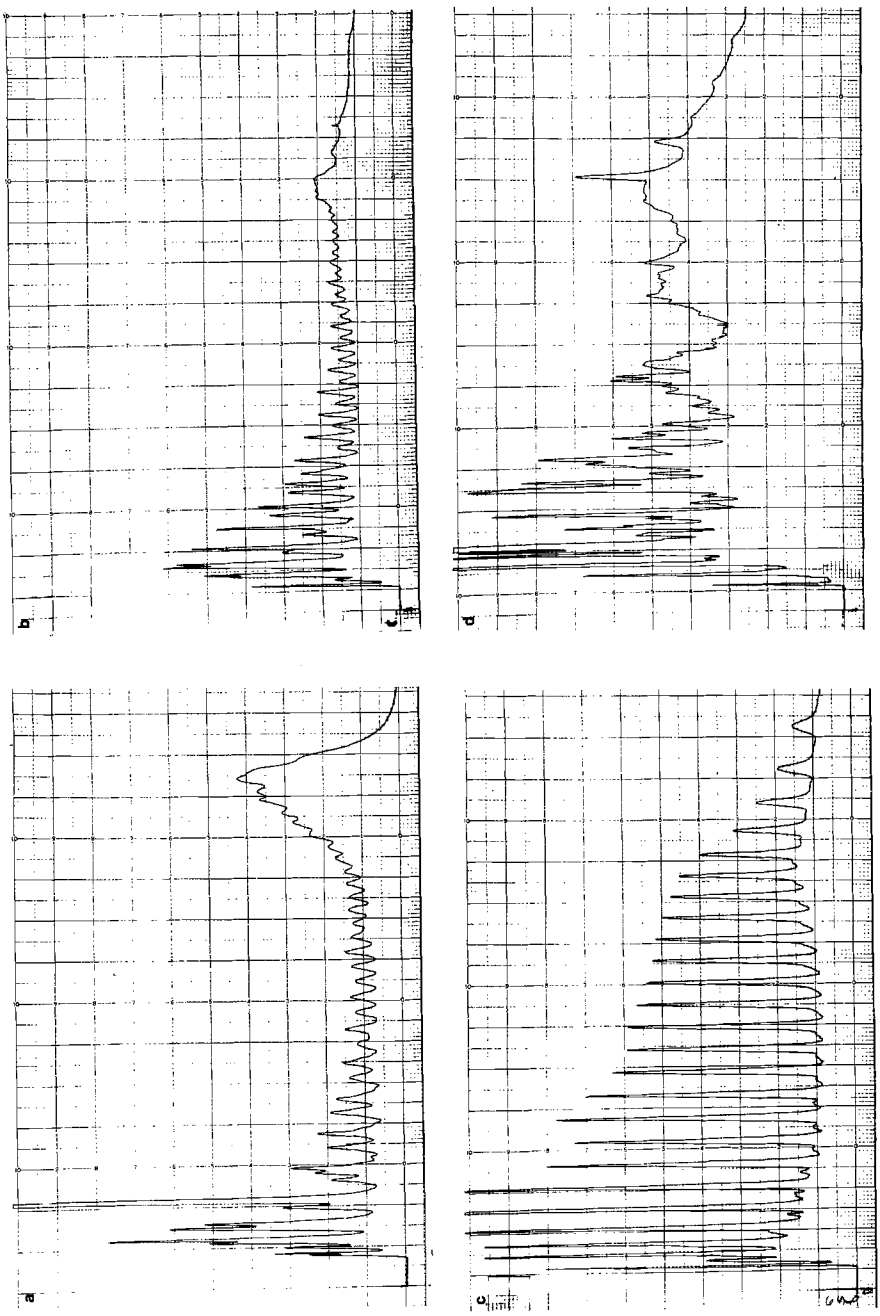

FIG. 1—*Gas chromatographic separation of the degradation products obtained from automobile rubber bumper guards: (a) 1975 American Motors Gremlin; (b) 1976 Chevrolet Camaro; (c) 1976 Ford Elite; and (d) 1975 Dodge Dart.*

Equipment and Materials

The gas chromatographic analyses were performed on a Hewlett-Packard Model 5700-A gas chromatograph equipped with a flame ionization detector and a 1.8 m by 6.35-mm glass column with 3% SE-30 on 60-80 mesh Chromosorb W. The column temperature was 80 to 280°C at 32°C/min, and the injection port temperature was 300°C. Carbon disulfide was used as solvent, and the carrier gas was helium at a flow rate of 70 ml/min. The chart speed was 5 cm/min.

Spectrograde carbon disulfide was obtained from Mallinckrodt Chemical Works. Thermal degradations were carried out in 144-mm Pasteur pipets. Samples of rubber bumper guards from a representative group of 19 different models of 1975 and 1976 American automobiles were obtained from a local salvage yard.

Analysis and Discussion

After heat-sealing the tip of a Pasteur pipet, a 1 to 2-mg sample of rubber bumper guard was placed into the pipet. The sample was concentrated in the tip by gentle tapping of the pipet on a table top. Thermal degradation was accomplished by holding the pipet tip in a Bunsen flame. It was observed that a condensation product formed in the narrow diameter portion of the pipet a few millimetres above the sample. Once degradation had taken place, and while the glass was still soft, a hemostat was used to reseal the pipet tip below the condensation product (care should be taken to exclude the portion of the pipet tip containing the nonvolatile solid residue). After the pipet was allowed to cool the upper portion of the pipet was broken off, leaving a 45-mm section containing the condensation product of the thermal degradation. Six microlitres of carbon disulfide was used to wash the condensation product into the pipet tip (carbon disulfide was selected as a solvent since it is not detected by the flame ionization detector). A 1.0-μl portion of the solution was injected into the gas chromatograph. All samples were treated the same way.

It was found that rubber bumper guards could be distinguished on the basis of the chromatograms obtained from the thermal degradation products (typical chromatograms appear in Fig. 1), with one exception: the chromatograms obtained from rubber removed from two 1976 Dodge Colts could not be distinguished from that in the specimens from General Motors automobiles. The possibility of other inconsistencies indicates the need for further examination to include other models of American and foreign automobiles. Once the possible class of automobile has been determined, the characterization of a particular vehicle might be accomplished by examining the rubber for additional evidence to include paint (particularly that resulting from "overspray"), weathering, road tar, color, surface design, and compressibility. Ultimately, a physical match of the rubber from the scene to the remaining rubber on a suspect vehicle may be attempted.

Conclusion

Gas chromatographic analysis of the thermal degradation products of the rubber left at the scene of a hit-and-run accident may provide useful information for the possible determination of the make of vehicle involved.

A more complete study including other models of American and foreign vehicles is indicated.

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