A176 Differentiation of Tire Rubber by Pyrolysis- Gas Chromatography/Mass Spectrometry

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The goal of this presentation is to demonstrate how pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS) can be used to differentiate tire rubber samples.

This research will impact the forensic community by showing that tires between and within manufacturers and product lines are chemically

distinct allowing methodologies to be developed that can lead to their differentiation and identification.

Vehicles are commonly associated with crimes, whether deliberate or accidental, such as hit and runs, kidnapping or carjacking. Traces of tire rubber can be found on road surfaces due to the friction between the tire and road as the vehicle applies its brakes or quickly accelerates.[1] The main component of a tire is rubber, which is approximately 60% of a tire's composition. Rubber can be natural or synthetic. The tire industry typically uses styrene-butadiene rubber (SBR), along with natural rubber (isoprene), and butadiene rubber.[2] In previous research, Sarkissian *et al.*[2] performed research on tires and tire traces using pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS). They collected 59 samples for analysis and used a pyrolysis temperature of 450°C to pyrolyze the tire rubber. A total of twenty seven compounds were used to classify the samples by target compound identification. Principal Component Analysis was used to identify the scores for the principal components. The first six components scores were calculated and used for linear discrimination analysis. Linear discrimination analysis was able to discriminate 98.3% of the samples, making it the respectable method for analysis.

Used passenger tires from different manufacturers were collected from various auto body shops to determine if brands and styles within brands could be distinguished from each other. Two separate runs were performed on each of the tire rubber samples on different days to account for reproducibility within a particular type of tire. Samples were placed in quartz tubes and placed in a coil probe and pyrolyzed at 550°C for 20 seconds using a CDS Analytical Pyroprobe 5000. Ion chromatograms were produced using an Agilent 6890N Network GC System 5873 Network Mass Selective Detector. Chromatographic runs were performed at a maximum temperature 315°C for 30 minutes. The GC total ion chromatograms obtained were examined and differences in peaks present and relative ratios of the peaks were noted. In cases where the total ion chromatograms between samples were similar, select ion profiling using ions common to tire rubber was performed to differentiate the samples.

Tires were tested for homogeneity within a single tire by collecting samples from five random locations on the tire's tread.

Results showed that the five samples for each tire were analytically indistinguishable, demonstrating homogeneity within each tire. Samples collected from tires of the same product line that were manufactured at different weeks and years from the same manufacturing plant were also analytically indistinguishable. Tires produced from the same manufacturing plant in the same week and year were also collected and analyzed. Results showed homogeneity of all tested rubber batches. Tires of the same brand but different styles were also studied. Results of this test set showed that styles within a brand could be differentiated from each other. Lastly, tires of different brands were differentiated using the methodology employed.

All tire rubber samples tested were differentiated using this method. Thus, Py-GC/MS shows potential to be a valid, reproducible method for the differentiation of tire rubber between and within manufacturers. **References:**

1 Sarkissian G. The Analysis of Tire Rubber Traces Collected After Braking Incidents Using Pyrolysis-Gas Chromatography/Mass Spectrometry. J Forensic Sci 2007;52(2):1050-1056.

2 Sarkissian G, Keegan J, Du Pasquer E, Depriester J-P, Rousselot P. The Analysis of Tires and Tire Traces Using FTIR and Py-GC/MS.
Can Soc Forensic Sci J 2004;37(1):19-37

Tire Rubber, Pyrolysis-Gas Chromatography/Mass Spectrometry, Trace Evidence

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