B166 Analysis of Fingerprint Residue by Pyrolysis GC-MS

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The goal of this presentation is to discuss the analysis of fingerprint residue by pyrolysis gas chromatography/mass spectrometry (GC-MS). The contents of the discussion will stem from research which seeks to 1) identify and quantify the components in fingerprint residue, 2) analyze how these components decompose when exposed to high heat, and 3) determine if useful information may be obtained from the decomposed fingerprint.

This presentation will impact the forensic community and/or humanity by providing a method for analyzing latent fingerprints which have been decomposed by heat (as in arson cases and weapon cartridges). In addition, the ability to prepare a mixture of fingerprint components at their respective representative concentrations will prove to be beneficial to others performing fingerprint research and may aid in the potential pro- duction of a standard fingerprint residue.

For little over a century, fingerprint patterns have been classified with the Henry system and used to include or exclude persons from criminal investigations. Fingerprints can be seen, developed, and lifted from many different surfaces such as paper, drywall, glass, and metal. These patterns can even be lifted from the surfaces of firearms and cartridge cases. However, if a cartridge case has been fired after handling, the latent print may no longer be visible. In addition, most fingerprint evidence is gathered from surfaces at or near room temperature. A comprehensive literature search revealed no significant effort directed toward learning how finger- prints decompose at high temperatures and how this decomposition affects subsequent analysis. A comprehensive understanding of thermal degra- dation of fingerprint residues could lead to the development of reagents tar- geting such residues. These specialized developers could be used for evi- dence recovered from arson scenes and cartridge cases for example.

This study was performed in two phases. First, a list of fingerprint residue components was compiled as completely and quantitatively as pos- sible in order to allow the bulk production of a representative fingerprint residue. Current studies show the main components of fingerprint residue (mostly eccrine sweat and sebaceous fluid) to be amino acids (such as valine, alanine, and tyrosine), cations (barium, sodium, and calcium), anions (such as phosphate and sulfate), biochemicals (such as pyruvate and uric acid), vitamins, and proteins. Therefore, techniques such as HPLC (high performance liquid chromatography), gas chromatography, and mass spectrometry were used to identify the primary components of fingerprint residue. From these laboratory studies, a synthetic fingerprint residue solution was generated.

Finally, this mixture was utilized in the second phase of the work via pyrolysis GC-MS. A Perkin-Elmer Clarus 500 gas chromatograph and mass spectrometer were coupled with a CDS Analytical Pyroprobe 5150 to perform this analysis. The goal was to simulate the high heat conditions that latent prints may be exposed to in situations such as when a cartridge is fired from a weapon, an arson crime is committed, or related combustion events occur. Results were used to construct a comprehensive list of pyrolytic products.

Pyrolysis, Synthetic Fingerprint Residue, Arson

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