A13 Development of a Chemically Relevant Artificial Fingerprint Material

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After attending this presentation, attendees will be aware of the development of a novel artificial fingerprint material, comparing to both human fingerprints and other artificial fingerprint materials, and discussing the use of mass spectrometry techniques to qualitatively compare the composition of both natural and artificial fingerprints.

This presentation will impact the forensic science community by providing a potential method for developing a chemically relevant artificial fingerprint material and a number of different possible applications in which the use of artificial fingerprint material could be used.

The main focus of this work was development of an artificial fingerprint material to provide a reproducible sample for completing fingerprint aging studies as well as degradation studies; however, a comprehensive artificial fingerprint material could also be used in understanding the mechanism of development techniques, evaluating the efficiency of developing techniques, and understanding the interactions of fingerprint materials with various surfaces.

Human fingerprints are generally composed of two types of secretions – eccrine and sebaceous. The eccrine secretions, which are almost completely composed of water, also contain a number of other components including salts, amino acids, lactic acid, proteins, and vitamins. Sebaceous secretions contain chemicals such as free fatty acids, cholesterols, esters, and glycerides. While it would be extremely difficult to replicate the entire chemical composition of a human fingerprint, it is possible to develop an artificial fingerprint material containing a number of the most abundant and chemically relevant fingerprint components.

In this work, a series of mass spectrometry based techniques – including Secondary Ion Mass Spectrometry (SIMS), Direct Analysis in Real Time Mass Spectrometry (DART®-MS), and Desorption Electrospray Ionization Mass Spectrometry (DESI-MS) have been used to characterize real fingerprints and identify individual compounds typically found in fingerprints. These components were then compared to those discussed in literature. From the results of these analyses, several iterations of artificial fingerprints, containing either or both sebum and eccrine secretions, were prepared. Every iteration was then compared, using multiple mass spectrometry techniques, to the collection of spectra from human fingerprints. Furthermore, the artificial fingerprint material was also compared to a number of other artificial fingerprint materials, both commercially available and reported in literature. Finally, once a chemically relevant artificial fingerprint material was developed, a way to reproducibly deposit the material was attempted. Initial studies are being completed to evaluate how piezoelectric inkjet printing can provide a way of accurately controlling the amount of material deposited on a surface of interest. The printing technique has the ability to print single spots or arrays of spots in a range of masses and possibly without the need of dissolving the fingerprint material in a solvent.

The ability to make a chemically relevant fingerprint material can have wideranging applications. It can allow for a reproducible sample set for any type of latent fingerprint research. The ability to deposit the fingerprint in spatially selected areas using inkjet printing could also be extremely useful for certain applications.

Fingerprints, Sebum, Mass Spectrometry

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