B168 Spectrochemical Analysis and Spectral Imaging of Latent Fingerprints and Trace Evidence Included Within the Prints

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The goal of this paper is to inform the attendees of the capabilities of spectral imaging of latent fingerprints. The presentation will describe how latent fingerprints can be non-invasively imaged to develop prints not orig- inally observable by the human eye. Attendees will be shown ways to enhance latent fingerprints using mathematical operations on the data. Additionally, ways will be shown how to detect and identify evidential materials within latent fingerprint ridge lines. The research described in this presentation has not yet been validated for casework.

This presentation will impact the forensic community and/or humanity by demonstrating how spectral imaging should become a signif- icant means to non-invasively image latent fingerprints, physical evidence within the prints, and other types of physical evidence. This method not only can produce an image showing the environment of the evidence, but can potentially be used to obtain the chemical composition of all the mate- rials imaged. This method does not have the clarity of visible light microscopy when the objects are visible, but because a wide range of the electromagnetic spectrum can be used for imaging, particular wavelengths that are most sensitive to the material in question can be utilized to develop images and to potentially identify the material.

Fingerprints and trace evidence are critically integral to forensic investigations. Latent prints primarily contain residual material from an individual in contrast to fingerprints with ridge patterns imprinted in sub- stances such as blood. They typically require invasive techniques using chemical reagents to develop the fingerprint patterns. Forensic trace evi- dence characterization traditionally involves the identification of the sur- rounding environment, determination of the material's identity, and the establishment of a possible source. Then, the material is circumstantially associated to the prints in the vicinity. Trace evidence gathering often requires invasive and destructive approaches to latent fingerprints. For example, swabbing or taping techniques to remove trace materials for analysis are likely to destroy latent prints. At present, print containing areas are avoided in the removal of trace evidence. Consequently, analysis of trace evidence within a print is not currently done.

In this paper, a non-invasive infrared spectroscopic imaging approach to detect and record latent prints will be demonstrated. Additionally, the simultaneous determination has been made of the presence and identity of contained trace evidence will be discussed. The spectroscopic separation of overlapped prints and nanogram detection of included fibres, drugs, and explosives will be demonstrated. Not requiring analyte transfer to an instrument, non-optimized sensitivity arises from the spatial localization afforded by imaging and is amenable to detecting a number of different chemical species simultaneously. For the first time, probable correlations can be conducted between the individual identifiers of fingerprints and trace evidence.

Spectral Imaging, Infrared Spectroscopy, Latent Fingerprints

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