B128 An Analysis of Amino Acids in Latent Fingerprints Using Gas Chromatography/Mass Spectrometry (GC/MS)

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Learning Overview: The goal of this presentation is to inform attendees of the method developed for removing latent fingerprints from a glass surface and the subsequent derivatization and analysis of amino acid content of latent fingerprints using GC/MS. Attendees will learn how each step of the sample preparation and instrumental analysis is optimized and developed for a successful analysis. Attendees will be presented with the data obtained from the analysis of standard mixtures of amino acids as well as the data obtained from real latent fingerprint samples.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by introducing a method that can potentially be used at crime scenes for the analysis of amino acid content of latent fingerprints. The amino acid content has the potential to provide information about the suspects, such as gender, possible diseases, or even ethnicity, which can help narrow the list of suspects when a match is not found in the national database.

Latent fingerprints are formed by the deposition of perspiration and oils, contained in the ridges of the skin, on a surface. In the case of a crime, latent fingerprints located at a crime scene are developed, and the ridge patterns are compared to those of possible suspects or criminal databases for identification purposes. However, if no suspect exists or there is no database match, the developed fingerprint is merely saved within the database for future reference. Recently, scientists have demonstrated that fingerprints can provide more information about potential suspects than the physical pattern of their skin ridges. One study has demonstrated a qualitative relationship between the overall levels of amino acids and the sex of the individuals. Since amino acid levels in biological samples of individuals are influenced by many factors, such as ethnicity, sex, diseases, and dietary habits, accurate amino acid profiling could help to provide more physiological insight into the individual who has left the fingerprint behind at a crime scene. However, the procedures employed to date have not been successful in individual analysis of amino acids in fingerprints and are not readily applicable in everyday crime scene situations, and more practical procedures need to be developed and validated.

The purpose of this project was to develop a quantitative and feasible method for reliably removing and analyzing amino acids from latent fingerprints. In this study, the amounts of individual amino acids were measured in latent fingerprints after being deposited on glass slides. The deposited latent fingerprint was first swabbed from the surface using a Q-tip® soaked in a mixture of solvents (n-butanol:acetic acid:acetone:toluene:water), which was then transferred to a vial and washed two times with the same mixture. The wash mixture was then evaporated, and the proteins and peptides in the fingerprint were hydrolyzed with a 6 M HCl solution at 110°C overnight. The HCl solution was then evaporated, and the derivatizing reagent and solvent, N,O-Bis(trimethylsilyl)trifluoroacetamide (BSTFA) and acetonitrile, were added respectively after purging the vial with nitrogen gas. The derivatization was performed at 60°C for four hours. The derivatized amino acids were then separated and identified using GC/MS. Identification was performed by comparing the mass spectra and retention times of the derivatized amino acids in the fingerprints to those of the derivatized standard amino acids. The developed method was tested for the analysis of amino acids in male and female latent fingerprints. To perform quantitative analysis, the same procedure was applied to the glass slides spiked with a mixture of standard amino acids at different concentrations. The hydrolysis step was omitted for the standard mixtures. The data obtained from the standard amino acids were used to plot calibration graphs, which were used to calculate the amount of identified amino acids in the fingerprint samples.

Latent Fingerprint, Amino Acids, Gas Chromatography

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