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Uncovering the invisible world of fingerprints by FT-ICR-MS

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Resumo

Introduction: Fingerprints are unique features of each person, corresponding to a complex pattern of ridges and valleys of utmost usefulness in Forensic Science [1]. Untargeted metabolomics based on extreme resolution mass spectrometry, such as Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR-MS), enables to detail the chemical complexity of dermopapillary residues [2,3]. However, the development of latent fingerprints generally requires the use of different reagents [4] which pose a significant challenge to the analysis of the chemical fingerprints themselves, making their characterisation by mass spectrometry extremely complex. **Objectives:** The main goal is to improve the metabolite extraction method from fresh latent fingerprints and to further detail on their constituents by FT-ICR-MS. **Materials and Methods:** Three sampling methods were used to collect the fingerprint residue deposited on a glass slide, based on filter paper and solvent solution (water/methanol). Metabolites were analysed by FT-ICR-MS in a 7 Tesla Solarix XR (Bruker). Samples were analysed by direct infusion in positive electrospray ionization mode and processed in absorption mode with a 4M transient. Metabolite identification was

performed using the Human Metabolome Database. Statistical analysis was carried out by hierarchical clustering analysis and principal component analysis. **Results:** 474 compounds were identified in fingerprint residues, 98 of which being present in all samples. Fingerprint lipids were identified as major constituents, namely squalene and palmitic acid. Some exogenous compounds, including pharmaceuticals, were also identified. Right and left latent fingerprints from the same donor did not differ on their qualitative profiles. The extraction procedures, based on the previous use of filter paper to collect fingerprint residues and those relying on the direct use of solvent, led to different outcomes on the chemical profiles. Given the extreme sensitivity of FT-ICR-MS, contaminants extracted from the filter paper were detected, making this approach inadequate for this purpose. **Conclusion:** Due to the high sensitivity of FT-ICR-MS, latent fingerprint sampling methods using filter paper are not adequate for this mass spectrometry analysis technology. The analysis of right and left latent fingerprints led to similar chemical profiles. Further tests will be performed to assess the interference of the developing reagents in the fingerprint residues.

Keywords: fingerprint chemical profile; fingerprint development agents; latent fingerprints; mass spectrometry; untargeted metabolomics.

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