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Use of MALDI-ToF mass spectrometry for analyzing latent fingerprints

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Latent fingerprints have long been used as critical forensic evidences by criminal investigation bodies globally. Traditionally, fingerprint ridge patterns have been utilized as unique identification of suspects. While the robustness of this approach has been reasonably well-established, in cases of smudged, incomplete or multiple overlapping fingerprints, the ridge pattern may be inconclusive. Recently, a parallel approach has been developed which can analyze the chemical compounds found on fingerprints. This approach uses carbon-black doped silica nanoparticles (as fingerprinting dust) which can simultaneously serve as a matrix substance for Matrix-Assisted Laser Desorption Ionization – Time of Flight – Mass Spectrometry (MALDI-ToF-MS) matrix. While on-the-spot ridge pattern identification is still possible, this approach provides the opportunity to further analyze the deposited fingerprints for endogenous markers and exogenous contaminants. Minimal sample preparation and high speed of analysis which the MALDI-ToF-MS technology offers, make such an approach cost and time effective as well as being very user friendly. It has been successfully shown that such an approach can detect a plethora of biomolecules excreted with sweat (endogenous markers) as well as trace levels of many common abuse drugs and explosives (exogenous contaminants). The imaging function of MALDI-ToF-MS allows further visualization of such distributions and also resolution of individual fingerprints in cases of multiple overlapping fingerprints. The possible application of this relatively new approach are aplenty and further research into optimizing the nanoparticle formulation, improving the dusting process (to enhance the print), and developing a database of possible markers could cement this as a go-to technique for future forensic investigations.

Biography

Mustafa Hussain Kathawala completed his PhD at the age of 27 years from the School of Materials Science and Engineering, Nanyang Technological University in 2016. He was trained as a Materials Engineer and his dissertation focused on studying the toxicity of nanoparticles on skin cells. Currently, he is working as a post-doctoral research fellow at the School of Materials Science and Engineering, Nanyang Technological University. His current research focuses on developing nanoparticles which can be simultaneously used as fingerprinting dust and MALDI-ToF-MS matrix to analyze the chemical composition of deposited chemical compounds in latent fingerprints.

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