B157 A Characterization of Artificial Fingerprint Samples

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Learning Overview: The goal of this presentation is to build upon research surrounding artificial fingerprint samples and provide insight to using these samples for method development. Topics to be covered include reproducibility of DNA recovery from artificial fingerprint samples, ability to be visualized by several standard forensic imaging techniques, sample stability of both surface deposited and solution formats, and applicability and use on various challenging surfaces, including brass shell casings, wood, and tape.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by further characterizing the biology and behavior of artificial fingerprint samples. These samples have value for touch sample method development by reducing the DNA variability associated with human latent prints and removing Institutional Review Board (IRB) -related complications related with collecting human-donated samples.

Assessment of DNA recovery from touch samples is difficult, as the initial amount of DNA deposited cannot be known and the amount of deposited DNA varies widely among individuals. This can make method development for touch samples challenging, and current approaches rely on the frequency of successful analysis and generation of complete profiles. However, these metrics do not enable a quantitative understanding of DNA recovery with a given method. To help overcome these challenges, this study developed artificial fingerprint samples containing a defined amount of single source human DNA in a sebaceous background. Previous work had established that the artificial fingerprint matrix mimic latent touch samples and lead to recoverable DNA from non-porous surfaces.[1] This study expanded on this prior work to further characterized artificial fingerprint samples, with the goal of evaluating artificial fingerprints as a broader touch sample method development tool.

This research performed several studies, including reproducibility of DNA recovery, ability to be imaged by standard forensic techniques, sample stability, and the extensibility to a variety of challenging substrates. Artificial fingerprint samples had reproducible DNA recoveries, in contrast to the range of DNA from human donor samples. As the initial DNA amount in the artificial fingerprint samples is known, this study determined the efficiency of the collection and extraction method, recovering ~8% of the total DNA deposited. To evaluate the ability to be imaged, artificial fingerprint samples were generated with ridge patterns and processed by conventional imaging techniques, including dusting, ninhydrin, and cyanoacrylate fuming with rhodamine 6G. Dusting powders were generally unsuccessful but both ninhydrin and cyanoacrylate fuming were able to adhere to artificial fingerprints and allow visualization.

This study wanted to understand the stability of the DNA in artificial fingerprint samples. Glass-deposited samples showed recoveries comparable to day one collected samples up to two weeks post-deposition under ambient storage conditions. Last, this study investigated the DNA recovery from more challenging substrates beyond glass, including wood, adhesive tape, and brass shell casings. DNA was recovered from all three surfaces with varying degrees of success. Brass required development of a deposition method that enabled DNA to be recoverable and not severely degraded. Assessment of chelators and various drying methods identified rapid drying under vacuum to most successfully preserve the DNA in the sample. Overall, these artificial fingerprint samples provide a reproducible test bed matrix for touch sample method development, may assist in evaluating methods that involve visualization, and can be compatible with a variety of surfaces for DNA recovery.

Reference(s):

1. Danielle S. LeSassier et al. Artificial Fingerprints for Cross-Comparison of Forensic DNA and Protein Recovery Methods. ed. Andy T.Y. Lau, *PLOS ONE* 14, no. 10 (October 3, 2019): e0223170, https://doi.org/10.1371/journal.pone.0223170.

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