E9 Getting Unstuck on Tape Testing

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Learning Overview: Handling tape during the DNA extraction process has long been a challenge, but the value of this type of evidence makes it worth the headaches associated with handling and processing tape. Most labs are either "stuck" with taking cuttings of this hard-to-handle matrix, wrangling it into an extraction tube without it getting stuck, or swabbing it and potentially leaving behind DNA from touch depositions on the adhesive side. The goal of this presentation is to discuss a new method that solves these problems and improves overall DNA results.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by informing attendees that using this new method for processing tape can increase the forensic value of the adhesive sides of tape samples and improve DNA recovery over current methods.

The analysis of adhesive samples presents a significant logistical challenge to forensic laboratories. First, manipulating tape carries a significant risk of contamination as material from the environment or the casework analyst comes into contact with the adhesive. In addition, handling challenges also create the possibility of stretching or creasing the tap, which risks altering fingermark analysis. Finally, current Latent Print (LP) and DNA methods do not allow for testing of both signatures on the same sample. Dyes or compounds used to visualize latent fingerprints can act as inhibitors for DNA analysis, or their application processes can wash or brush away a portion of the DNA. Conversely, DNA extraction is a destructive process for any LP patterns on the surface. Ultimately, the factors associated with tape handling, LP visualization, and DNA analysis often work against each other, forcing forensic laboratories to prioritize/triage investigating specific signatures and analyses over others.

To solve this problem, Signature Science, LLC (SigSci) developed a method, termed Tape Analysis For Forensic Identification (TAFFI™), to allow the processing of adhesive surfaces for both LP and DNA on these substrates. The TAFFI™ workflow starts by attaching the non-adhesive side of evidentiary tape to a backing strip that holds the tape flat and keeps the adhesive side accessible for print imaging and DNA collection/extraction. The backing strip can also be applied after developing the fingermarks in order to accommodate samples where the prints of interest are located on the non-adhesive side of the tape.

Fingermark visualization on the tape is accomplished via cyanoacrylate fuming followed by nebulization of a fluorescent dye mixture selected to reduce potential downstream inhibition during DNA analysis. Following LP development, the backing strip/tape sample is rolled up, then inserted into a spin basket. The stippling on the backing strip creates a slight gap between the rolled layers of the adhesive side of the tape. This gap allows for improved access of the collection/lysis buffer to the adhesive side of the tape while minimizing the volume of buffer needed to contact the tape. As a result, the DNA extraction efficiency is maximized and sample dilution is minimized.

Tests that were conducted using three different donors who deposited three replicates on four different types of tape produced usable Short Tandem Repeat (STR) profiles in 92%, 83%, and 50% of the samples (calculated by donor due to the variability in DNA deposition between the individual donors). When using a known amount of genomic control material (i.e., positive control applied to tape samples), DNA recoveries ranged from 15% to 34% across the four tape types and were twice as high as the gold standard method. For LP quality, Sears scores of 3 or 4 were observed for almost 90% of the donor samples, and 20+ minutia were observed in 72%.

The TAFFI™ approach has been demonstrated to reliably produce successful results when processing the same tape sample for both LP and DNA signatures. With this novel approach, the case triage process no longer requires the laboratory or investigator to pick between LP and DNA signatures when processing tape samples. Overall, the LP component of the TAFFI™ workflow performed comparable to the current gold standard methodologies, and the DNA component consistently showed higher DNA recoveries, higher average DNA yields, higher average peak heights, and more consistent results when compared to the current gold standard method.

Tape, Extraction, Adhesive

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