B94 Optimizing Collection, Shipping, and Storage of Forensic Biological Samples

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The goal of this presentation is to evaluate the stability of DNA stored at room temperature in SampleMatrix™.

This presentation will impact the forensic community by demonstrating reliable method for storing and shipping forensic source DNA at room temperature.

Reliable sample storage is of paramount importance in forensic, epidemiological, clinical and genetic laboratories. Sample stability after long-term storage is critical, particularly when the amount of DNA is limited. For example, forensic evidence samples collected from hair, teeth and sexual assault evidence may contain less than 100 pg of DNA. Advances in PCR technology have enabled successful analysis of minute quantities of these samples, including low quality and quantity DNA.

Forensic DNA sample analysis involves several steps, each of which can contribute to sample degradation, making reliable DNA storage an issue of significant concern in the forensic science community. First, the biological sample must be collected at the crime scene or obtained from the individual, and then transported back to the laboratory. Samples not immediately processed must be stored until the DNA can be isolated and purified. Amplification is routinely performed using a variety of techniques, followed by analysis and reporting of data. Finally, storage of the sample may or may not occur, depending on the jurisdiction and/or the standard operation procedure of the lab.

Sample stability after long-term storage is critical; especially when the amount of DNA is limited (*e.g*. trace evidence) and the sample must be re-tested. Sample re-testing is a vital component of forensic work, where trace evidence can lead to the exoneration of the innocent or identification of a suspect or victim. Unfortunately, inconsistent sample handling and storage is a common occurrence, particularly across jurisdictions, leading to highly variable and unreliable results. Thus, proper storage of samples containing small amounts of DNA is crucial for maintaining sample integrity over time. The objective of this study is to develop an efficient transport and long-term storage strategy for DNA samples. The current work focuses on forensic samples; however, this technology is applicable to all DNA laboratories.

Sample quality may be compromised due to degradation, UV exposure, temperature fluctuations, repeated freeze-thaw cycles, and other sub-optimal storage conditions, among other factors. To explore alternative methods of sample storage, an international consortium of forensic, academic and government laboratories has formed to evaluate the feasibility of using a novel technology (DNA-SampleMatrix®) that allows for the stable, dry storage of biological materials at ambient temperatures. Based on the natural principles of anhydrobiosis, the synthetic matrix forms a protective shield around the sample as it dries, preventing further damage and degradation over time.

Results will be presented from consortium studies evaluating the ability of DNA-SampleMatrix® to store and protect samples previously extracted and typed from proficiency tests, samples collected from crime scenes (blood, semen and buccal swabs), degraded DNA samples, DNA extracted from bones and teeth, low copy number samples, and samples shipped via USPS to evaluate protection during transport. Preliminary results from qPCR analysis indicate that sample integrity is maintained after dry storage as compared to conventional cold-stored control samples. Samples stored in the matrix were also amplified using a variety of STR multiplex systems. No detectable inhibition of amplification of STR multiplexes was observed even in the presence of high concentrations of DNA-SampleMatrix®.

The development of room temperature dry storage of forensic DNA samples will have a significant impact on forensic DNA analysis, as well as other fields of DNA research, if it can be found to eliminate some of the detrimental variables associated with sample collection, transport, and storage.

DNA, Forensic Sample, Room Temperature Storage

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