A37 Evaluation of SampleMatrix® for DNA Storage

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After attending this presentation, attendees will understand the benefits of using a non-freezing alternative for long term storage and transportation of DNA samples. Freezing is currently the most commonly used method for storing extracted DNA in many laboratories. Preserving good quality DNA for perpetuity is obligatory and mandatory by many forensic laboratory protocols in order to facilitate prospective and retrospective analyses. Storage requires a large number of freezers, maintenance and power costs, and back-up generators. An alternative to low temperature storage is the SampleMatrix®, commercially available as a synthetic polymer. Storage technology using SampleMatrix® mimics the natural molecular principles of anhydrobiosis by forming a thermo-stable barrier around the biological sample to protect it from degradation. The SampleMatrix® is widely used in academic institutions and is gaining acceptance by forensic laboratories.

This presentation will impact the forensic science community as the results of this study may provide a more environmental friendly and cost effective solution for storing aliquots of DNA samples. Previous studies that evaluated the efficacy of the SampleMatrix® to protect DNA extracts have utilized standard Combined DNA Index System (CODIS) Short Tandem Repeat polymorphisms (STR) primer sets to monitor DNA degradation. The original commercial multiplex CODIS STR kits amplified amplicon sizes ranging from 97-464 base pairs (bp).

Newer CODIS STR kits target even smaller amplicons (<300bp). Since DNA degradation is characterized by the fragmentation of larger DNA regions into smaller ones, it was hypothesized that monitoring for a decrease in the number of larger DNA fragments would be more informative while being easier than examining STRs. To test the hypothesis, DNA degradation was induced by storage of extracts in sealed tubes at high temperature and DNA decay was monitored by SYBR Green qPCR utilizing four primer sets designed to amplify amplicons of 92, 250, 500 and 970 base pairs in size. The samples were tested from day one through 135 at a weekly interval for the first month and every three weeks for the remainder of the time period. The DNA samples (1, 5, and 20ng/µL) with and without the SampleMatrix® were heated to 37ºC (equivalent to 1.046 years at room temperature for 135 days) or 50ºC (equivalent to 2.575 years at room temperature for 135 days) for fast aging of the DNA and to determine the efficacy of the SampleMatrix®. This experimental procedure is designed to mimic exposure of the purified DNA samples to high temperatures such as during transportation, which according to according to FedEx shipping guidelines can occur at temperatures as high as 60ºC, depending on the time of the year. Controls were maintained at -20 ºC for an accurate comparison.

Preliminary results indicate that the SampleMatrix® is useful in preventing the degradation of DNA at low concentrations (1 ng/µL). When using the 1ng/µL DNA samples, significant differences in the qPCR cycle threshold (Ct) values between the control and experimental samples were seen (F-Statistics, $p < 0.009$, for all primer sets and both temperatures). Even when held at 50ºC for 30 days, there were no significant (F-Statistics, $p > 0.05$) differences in the Ct values of the control versus the experimental samples at 5 and 20 ng/µL for all primer sets in this study.

Additional experiments include another high-heat study using lower concentrations of DNA (<1 ng/uL), similar to what is expected to be recovered as "touch DNA" evidence. In summary, the SampleMatrix® may be useful in forensic laboratories, since it may guarantee good quality DNA for cold cases by eliminating DNA degradation caused by repeated freeze thaw cycles and the need to handle DNA on ice during processing.

Long-Term DNA Storage, SampleMatrix®, DNAstable®

 ** Presenting Author*