Comparison of Room Temperature Forensic DNA Extract Sample Preservation Methods

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Abstract

Historically, forensic DNA has been stored dry and/or cold since these conditions reduce the rate of bacterial growth or degradation by DNases. This study evaluated three room temperature storage techniques which included; Whatman® Micro FTA cards, QIAsafe™ DNA Tubes, and sterile swabs. Swab samples were dried using the SafeSwab™ swab dryer.

Introduction

In most cases, only a portion of the entire DNA extract volume is consumed during forensic analysis. Once extracted, the remaining DNA is typically stored in a refrigerator at 4ºC, a freezer at -20ºC or at -70ºC for long-term storage to avoid sample degradation. While these are acceptable DNA storage methods, use of refrigerators and freezers may be viewed as costly when factoring in the individual cost to purchase, maintain, energy consumption, and space requirements. The potential loss or degradation of evidentiary samples when such systems fail must also be taken into consideration. For these reasons, alternative room temperature biological evidence storage systems and methods are of interest to most forensic DNA units.

Materials & Methods

Sample types tested included liquid blood, trace blood, hair, saliva, sweat, mock sexual assault, and touch DNA. All samples were extracted with Promega's DNA IQ™ system on the BIOMEK® 3000 Laboratory Automation Workstation, quantified with Applied Biosystems Quantifiler Duo® Quantification Kit on Applied Biosystems 7500 Sequence Detection System, and amplified using Promega's multiplex STR PowerPlex® 16 system and capillary electrophoresis run on ABI Prism® 3130*xl* Genetic Analyzer. Raw data was analyzed using Genemapper® ID v3.2.1. Samples were eluted in TE buffer and recovered at two weeks, six weeks, and finally six months. Each method was evaluated according to its ability to provide the highest recovery of DNA, as well as to provide a quality DNA profile.

Results

Table 1 Two Weeks Loci Observed

Sample Type	Initial	FTA	QIAsafe™	Swabs
Blood	16	0	16	10
Hair	16	0	16	2
E Fraction	16	0	11	1
S Fraction	16	0	13	13
S Fraction Diluted	16	0	13	5
Saliva	16	0	16	15
Sweat	16	0	16	0
Touch DNA	12	0	6	0
Trace Blood	16	0	8	0
Total	**140**	**0**	**115**	**46**

Table 2 Six Weeks Loci Observed

Sample Type	Initial	FTA	QIAsafe™	Swabs
Blood	16	4	16	0
Hair	16	11	16	0
E Fraction	16	0	9	0
S Fraction	16	9	14	13
S Fraction Diluted	16	2	13	0
Saliva	16	0	15	0
Sweat	16	0	6	0
Touch DNA	8	0	0	0
Trace Blood	16	0	3	0
Total	**136**	**26**	**92**	**13**

Table 3 Six Months Loci Observed

Sample Type	Initial	FTA	QIAsafe™	Swabs
Blood	16	0	16	4
Hair	16	0	12	0
E Fraction	16	0	4	0
S Fraction	16	1	16	10
S Fraction Diluted	16	0	11	1
Saliva	16	1	13	3
Sweat	16	0	0	0
Touch DNA	16	0	0	0
Trace Blood	16	0	0	0
Total	**144**	**2**	**72**	**18**

Note: Only loci that matched the initial profile exactly counted. For example, a locus was initially heterozygote and only one allele observed at recovery did not count.

Table 4 Cost per product

FTA	QIAsafe™	Swabs
100 for $265	50 for $174	1000 for $97.47
$2.65 per card	$3.48 per tube	~ $0.10 per swab

Discussion/Conclusions

QIAsafe™ DNA Tubes outperformed the other room temperature sample preservation methods In both quantification values (results not shown) and DNA profiles developed. This product also had the simplest recovery procedure. The other methods required washes, heat incubation, and centrifugation. While with QIAsafe™ just add TE, as in this study, or water and gently pipette up and down to re-suspend the sample, and it is ready for down stream analysis. FTA cards demonstrated an increase at six weeks due to a new recovery protocol received from Whatman®. None of the methods performed well with low template samples such as touch DNA, sweat, and trace blood. It should be noted that samples were distributed among three techniques for each recovery period which further diluted each sample and may have hindered optimal results. Such distribution would not be typical casework protocol. While samples will be initially diluted upon recovery with the addition of TE or water, samples can be concentrated post recovery. In this study all samples which quantified at 0.2 ng/µl or less were concentrated prior to amplification.

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