

Profiling Crime Stain Samples Using RapidHIT[®] ID and the New EXT Cartridge

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ABSTRACT

Processing forensic evidence from crime stains involves numerous steps and can be quite laborious. As a result, time to result is often more prolonged than desirable in the current crime fighting mindset. Since crime labs are often constrained by the finite nature of fiscal resources, relieving DNA laboratories of many of the manual steps of these routine samples will allow them to focus more resources on sample preparation and interpretation of results, allowing a higher sample throughput.

Rapid DNA systems have helped to reduce labor by moving the collection of routine arrestee samples out of the crime lab and into the booking station, or reducing the hands-on processing within the actual crime lab. Such systems are capable of running buccal swabs from sample to answer, and require no additional human input following the loading of the sample into a cartridge to produce a CODIS upload. The next goal of such Rapid DNA systems is to allow the full automation of an extracted and quantified crime stain sample, then subsequent upload to CODIS.

The RapidHIT ID (IntegenX) has been developed specifically for the needs of decentralized environments (Figure 1). It is a fully automated, sample-to-CODIS file system for STR-based human identification. The RapidHIT ID processes presumed single source samples in less than 90 minutes with less than one minute of hands-on time. Once an STR profile is generated, the RapidHIT ID transfers the data to a central computer operating RapidLINK[™] software for processing, including manual profile review (Figure 3) – enabling a decentralized network of DNA devices. In addition to the sample-to-answer RapidHIT ACE cartridge, IntegenX has also developed a second cartridge (RapidHIT EXT cartridge – Figure 2) that allows a user to also run a forensic DNA profile from extracted and quantified DNA in less than 90 minutes.



Figure 1: RapidHIT ID



Figure 2: RapidHIT EXT cartridge



Figure 3: RapidHIT ID and RapidLINK

In this poster, we describe selected studies from the data generated using GlobalFiler[®] Express RapidHIT EXT cartridge with extracted and quantified DNA.

RESULTS

SENSITIVITY, CONCORDANCE AND CARRYOVER

Human male DNA (BioChain Institute, Inc., Newark, CA) at different concentrations were tested on RapidHIT EXT cartridges with GlobalFiler Express chemistry (Thermo Fisher Scientific, Waltham, MA). Fifteen microliters were loaded into the cartridge. Genotype concordance was confirmed for all samples against reference profile generated using the standard bench method (PCR system 9700 and 3130xl Genetic Analyzer instruments). All alleles detected were concordant.

Carryover was evaluated using a checkerboard sequence of blank and DNA samples at high concentration (1 ng/μL). Blank samples were processed with one additional PCR cycle than the optimized cycles for DNA samples. The electropherograms of the blank samples were examined for peaks above the analytical threshold (AT). No carryover peaks were observed in the blank runs.

Similar results were obtained using AmpFLSTR[®] NGM Select[™] Express (Thermo Fisher Scientific) RapidHIT EXT cartridges (data not shown).

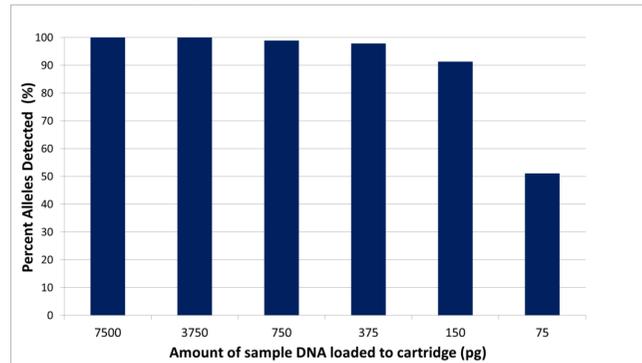


Figure 4: Sensitivity study using human male DNA

CRIME STAIN SAMPLES

DNA was extracted from different crime stain samples using PrepFiler[®] BTA Forensic DNA Extraction Kit (Thermo Fisher Scientific) and quantified using QuantiFiler[®] Trio DNA Quantification Kit (Thermo Fisher Scientific). Elution volume was 50 μL and 15 μL were loaded into the GlobalFiler Express RapidHIT EXT cartridges. All alleles detected were concordant.

Sample	DNA conc. (pg/μL)	Alleles Detected	Percent Alleles Detected (%)
Swab of phone face	7 pg/μL	39/46	85%
Cigarette butt	100 pg/μL	35/44	80%
Swab of cup lid	408 pg/μL	44/44	100%

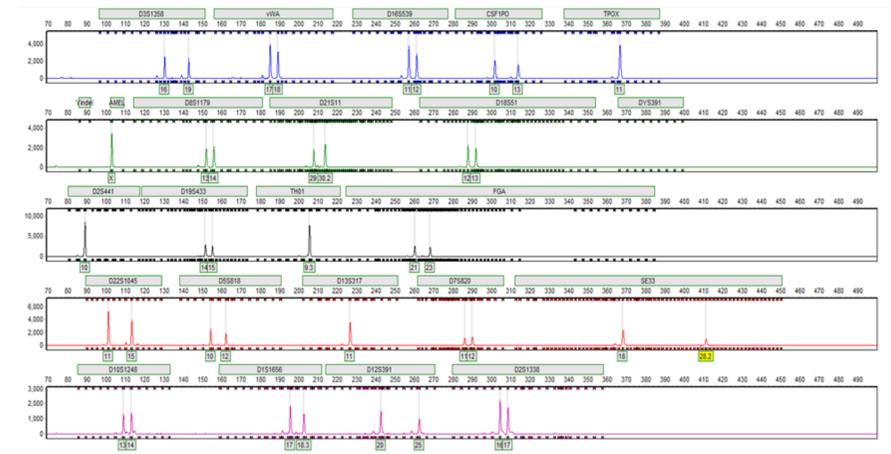


Figure 5: Swab of a cup lid, concentration 408 pg/μL.

CONCLUSIONS

The RapidHIT ID instrument and RapidHIT EXT cartridge were evaluated for evidence of contamination, concordance to standard genotyping methods and sensitivity. Results demonstrate that the RapidHIT EXT cartridge is able to generate fully concordant STR profiles from extracted and quantified DNA in less than 90 minutes that is comparable to standard bench top methods.

Furthermore, the data were robust enough that such profiles generated on the RapidHIT ID with GlobalFiler Express RapidHIT EXT cartridges by an independent lab were of sufficient rigor to be uploaded into CODIS following internal validation.

Results from the internal validation were concordant with genotypes produced using standard bench thermal cyclers and capillary electrophoresis platforms after sample extraction and DNA quantification using qPCR, RapidHIT ID and RapidHIT-200. The new RapidHIT EXT cartridge system is an accurate, reproducible alternative to typical bench methods providing a high degree of simplicity when compared to current lab methods.

For additional information on CODIS upload using the RapidHIT system at an independent forensic laboratory please visit poster "Validation of RapidHIT[®] ID and Assessment of the ACE and EXT Cartridges" by Grayson Amick from The Richland County Sheriff's Department (RCSD) forensic lab.