INNOQUANT® AS A TOOL TO DETERMINE PROFILE SUITABILITY AND IMPROVE PROFILE SUCCESS RATES FOR HIGH THROUGHPUT PROPERTY CRIME SPECIMENS

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Typical forensic casework DNA specimens may be degraded to varying degrees as a result of environmental insults, storage conditions, or age. These types of specimens may need to be excessively re-worked since their level of degradation may not be known until after amplification and detection, at which time adjustments may be made to the amount of input DNA in the amplification reaction in order to produce a more acceptable STR profile (*i.e.* gain more alleles from degraded amplicons). Next-generation kits for quantitation of human DNA aim to provide information on the extent of sample degradation prior to STR amplification in order to reduce rework, and associated reagent and processing costs, of degraded forensic DNA specimens. InnoGenomics Technologies, LLC has developed a new quantification system, InnoQuant®, which utilizes two independent genomic targets, a "short" Alu based target of 80 bp in size, and a "long" target from a separate retrotransposon of 207 bp in size, to provide an assessment of the level of degradation of a forensic sample. Use of a synthetic target as an Internal Positive Control (IPC) provides an additional assessment for the presence of PCR inhibitors in the test sample.

Currently, Cellmark Forensics utilizes the Quantifiler® Human DNA Quantification kit for quantification of forensic DNA specimens in the Biotracks™ high throughput property crime specimen analysis and local database searching. From forensic evidence specimens processed for use in BioTracks™, ~23% have quantifiable human DNA and result in a searchable STR profile and ~42% have no quantifiable human DNA and no resulting amplified STR data. The remaining ~35% of these specimens have quantifiable human DNA and result partial profiles insufficient for searching.

In this study 215 property crime samples were quantified with both Quantifiler® and InnoQuant® and typed with Identifiler® Plus. The input DNA used in the amplification reaction was determined by the Quantifiler® data. For samples that did not obtain any STR data, a quantification threshold was evaluated to determine how successfully each quantification assay could be used as a screening test to identify samples with insufficient DNA for STR profiling. Using the InnoQuant® threshold, 93% of true negatives were identified versus 65% from Quantifiler®. For samples that did obtain some STR data, the quantification values from each kit were compared with the number of STR loci successfully typed to see how well the quantification data correlated with STR profile success. The InnoQuant® quant data (R^2=0.80) correlated with profile success significantly better than Quantifiler® (R^2=0.61). Finally, samples that had sufficient DNA but did not yield profile data at all loci were re-amplified with different conditions based on the InnoQuant® data to determine if accounting for degradation can improve profile success. Additional loci were obtained from all of the samples demonstrating the utility of InnoQuant® to improve profile success. The study demonstrates that InnoQuant® can be a very effective tool in the processing of high throughput property crime specimens as a screening test to identify samples that will not produce DNA profiles and by providing more reliable quantification data to obtain optimal STR profiles.