AN AUTOMATED BENCH-TOP SYSTEM FOR EXTRACTION OF HIGH QUALITY DNA FROM BIOLOGICAL MATERIALS

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The technologies for forensic DNA analysis have improved to a great extent in the past decade, enabling the obtaining of short tandem repeat (STR) profiles from samples containing inhibitors of PCR, degraded DNA and small quantities of DNA. However, isolation of DNA from forensic evidence samples is still a challenging process that creates bottlenecks in the sample processing workflow. Factors like large variation in sample types and substrates, possible exposure of the samples to environmental insults, presence of PCR inhibitors and limited starting material increase the difficulty in obtaining DNA compatible for down stream processing. Therefore, it is important that the procedure used to isolate genomic DNA is efficient and delivers DNA in a highly purified form and from small quantities of starting material. In addition, the extraction reagents and steps of the protocol should be amenable to automation.

We developed an automated DNA purification system that enables the isolation of genomic DNA from a wide variety of forensic samples. Isolated DNA is compatible for downstream applications including real-time qPCR and genotyping. We have also designed and implemented a novel device for lysis and the separation of the lysate from the substrate that minimizes sample handling and maximizes lysate recovery. This automated extraction method employs a proprietary multi-component surface chemistry to isolate genomic DNA from forensic evidence samples. The reagents required for purification of DNA from the lysate are packaged into a disposable cartridge, which leads to consistent recovery. A total of 13 sample lysates can be processed for isolation of DNA simultaneously. The walk-away automated protocols are optimized and validated for extraction of DNA from a variety of sample types including blood stains on denim, cotton cloth, FTA® paper, samples spiked with PCR inhibitors, saliva on swabs, semen on cotton fabric, bones, tooth, chewing gum, cigarette butts, and tape lifts. The performance and ease of use of the developed automated benchtop DNA extraction system is better than or comparable to similar benchtop extraction systems for extraction of DNA from forensic samples. DNA obtained from these samples was free of detectable PCR inhibitors and resulting short tandem repeat (STR) profiles were complete, conclusive, and devoid of PCR artifacts.