Automated extraction of forensic samples using established spin column technology on the QIAcube

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Introduction
Spin-column-based kits have been widely established for the extraction of nucleic acid evidence. The use of spin columns allows laboratory processes to be standardized and accuracy to be improved for run-to-run consistency. The QIAcube platform is a novel system that provides hands-off automation of 2 to 12 samples per run. This platform allows forensic scientists to instantly translate their established spin-column-based manual processes into automated workflows.

Here, we present data showing the equivalence of the manual and automated procedures for purification of DNA from forensic samples as well as the cross-contamination safety provided by automated protocols.

Results — comparing manual and automated preps
Samples were processed manually or with the QIAcube using the following automated protocols:
- Blood spots, “FTA and Guthrie Cards” (12 manual and 36 automated samples)
- Buccal swabs, “Surface and Buccal Swabs” (6 samples each)
- Chewing gum (30 mg), “Casework sample” (4 samples each)

DNA was quantified photometrically (swabs) or with real-time PCR (blood and chewing gum).

Results — linearity and sensitivity
- Dilutions of blood, saliva, and cultured cells were processed on the QIAcube.
- DNA was quantified with real-time PCR.
- Eluates from 10 µl, 1 µl, and 0.1 µl saliva samples were used for STR profiling.

Automated protocols based on the workflow at the right are available for forensic sample types.

Small-volume blood or saliva samples:
- Up to 100 µl blood or saliva
- FTA and Guthrie Cards

Swabs:
- Surface, buccal, blood, etc.
- Onboard lysis

Casework samples:
- Cigarette butts, stains, paper, hair, chewing gum, etc.
- Onboard lysis

Materials and methods
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Risk of sample contamination is minimized:
- Tips carrying sample never travel over buffer positions.
- Tips are changed between samples in all critical steps.
- The QIAcube DNA Investigator Kit is QC validated.

Conclusions
- Automated processing of samples on the QIAcube results in similar DNA yield and quality as those obtained from manual processing.
- No sample carryover was detected when processing 100 µl whole blood and mock samples in the same run.
- Comparable extraction efficiency was achieved over a wide range of sample amounts.
- STR profiles of extracted DNA exhibit a high signal-to-noise ratio.

Sample & Assay Technologies