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

Helge Lubenow, Mario Scherer, and Dagmar Herold

R&D Department, QIAGEN GmbH, Hilden, Germany

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.

Materials and methods

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

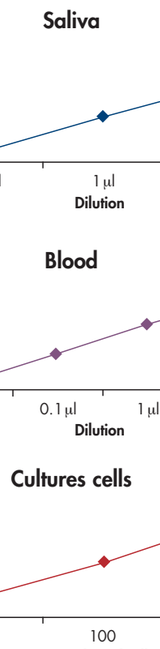
- Blood-spot cards
- Onboard lysis

Swabs

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

Casework samples

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

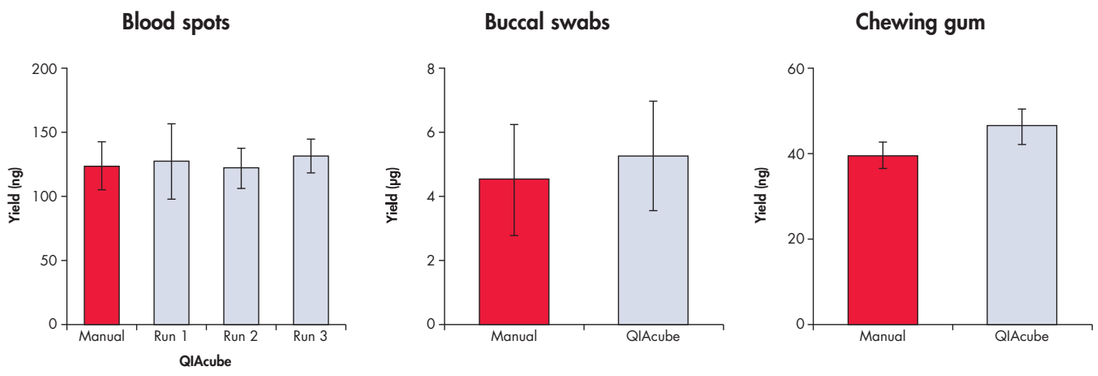


Results — comparing manual and automated preps

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)

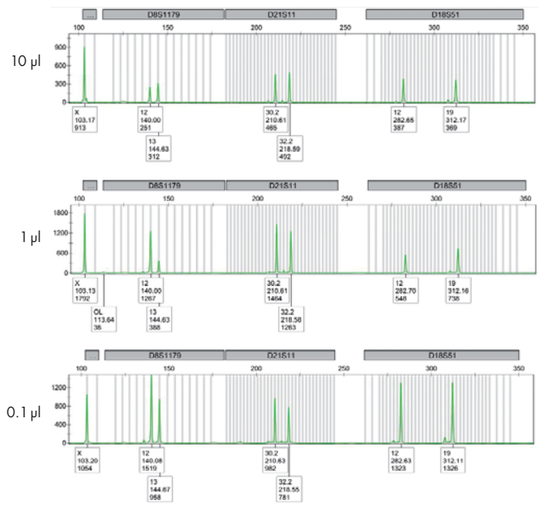
DNA was quantified photometrically (swabs) or with real-time PCR (blood and chewing gum).



Comparison of quantitative results.

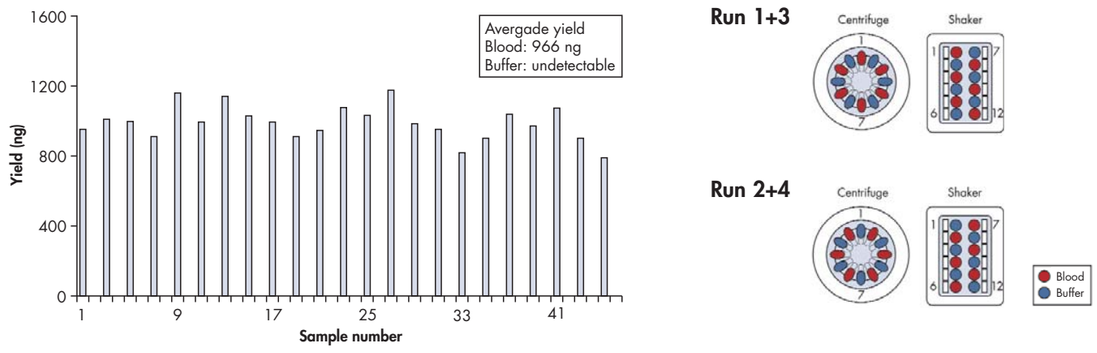
Results — linearity and sensitivity

- 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.



Quantification of dilution series. Purified DNA was quantified (left panel), and DNA profiles of saliva dilutions was performed (AmpFlSTR® SGMplus®, right panel).

Results — exclusion of sample carryover



Cross-contamination assay. Four runs with a total of 24 samples of 100 µl human whole blood alternating in a checkerboard pattern with 24 mock samples containing 100 µl buffer were purified on the QIAcube. DNA was quantified with real-time PCR.

Risk of sample contamination is minimized:

- Tips carrying sample never travel over buffer positions.
- Tips are changed between samples in all critical steps.
- The QIAamp 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.

1054218 09/2008