

NucleoMag® DNA Forensic

Rapid, high-throughput DNA purification from forensic samples using the Hamilton NIMBUS® Presto workstation

Introduction

The isolation of genomic DNA is an essential step for modern forensic analysis of casework samples. A very low amount of DNA, high amounts of inhibitory substances or even heavily weathered sample material are the typical challenges of forensic DNA analysis.

Therefore, the extraction of highly pure DNA from minimal traces of samples is the key to a successful downstream analysis.

The Hamilton NIMBUS Presto workstation combines the advantages of automated liquid handling and magnetic rod processing instruments. It eliminates time-consuming manual pre-filling of plates and thereby remarkably reduces hands-on time for nucleic acid purifications. At the same time, by using KingFisher™ technology, this system is able to conduct nucleic acid purifications from lysate to eluate within 70 minutes.

Together with Hamilton, MACHEREY NAGEL has established its NucleoMag® technology on the NIMBUS Presto system. Here, we demonstrate the utility and advantages of combining these technologies to fully automate your high-throughput DNA sample preparation from forensic samples.

Your advantages at a glance

- Proven NucleoMag® lysis and purification procedure suitable for casework samples
- Conformity with ISO 18385 for doubtless DNA profiling
- Automated plate prefilling and plate handling by the Hamilton NIMBUS liquid handling system
- High-speed nucleic acid purification by the integrated KingFisher™ Presto instrument
- Purification of ready-to-use DNA suitable for all common downstream applications (e.g. qPCR, STR analysis)

NucleoMag® DNA Forensic

Technology	Magnetic beads
Sample material	Blood spots, casework samples, cigarette filters, contact traces, swabs
Elution volume	25–50 µL
Typical yield	1–3 µg (from buccal swabs, depending on sample type and quality)
Preparation time	Approx. 70 min (excl. lysis) / 96 samples



The NIMBUS Presto workstation combines liquid handling and magnetic rod processing for fully automated, high-throughput nucleic acid extractions.

NIMBUS Presto workstation

Technology	Automated liquid handling platform (Hamilton NIMBUS) with integrated magnetic rod processing unit (KingFisher™ Presto)
Capacity	1 – 96 samples
Processable volume	50 – 5000 µL
Footprint	L 1359 mm W 709 mm H 889 mm

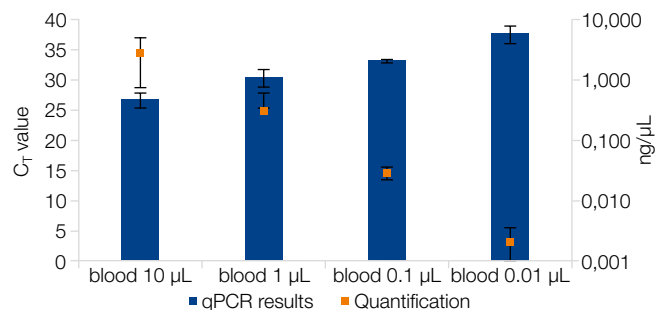
Material and methods

The isolation procedure is based on the reversible adsorption of nucleic acids to paramagnetic NucleoMag® F-Beads under appropriate buffer conditions. The DNA purification is performed by a KingFisher® Presto unit, which is integrated into the NIMBUS liquid handling system.

Samples are lysed at 56 °C in the presence of Proteinase K and lysis buffer FOL. Following on-deck lysis incubation, binding of DNA to the NucleoMag® F-Beads is achieved by the addition of Binding Buffer FOB.

We demonstrate this automated purification workflow for casework samples. The tailored protocol allows the flexible processing of up to 96 samples per run.

Application data



High recovery of gDNA

DNA was isolated in quadruplicates from different amounts of blood samples applied to swabs using the NIMBUS Presto systems. Human DNA was quantified using the Quantifiler® Human DNA Quantification kit: FAM™ dye for detecting the amplified human telomerase reverse transcriptase gene sequence VIC® dye for detecting the amplified Internal PCR Control (IPC) DNA.

	1	2	3	4	5	6	7	8	9	10	11	12
A	24.41	U	24.24	U	24.97	U	24.82	U	24.60	U	24.41	U
B	U	24.29	U	24.40	U	24.62	U	24.23	U	24.59	U	24.20
C	24.04	U	24.18	U	24.60	U	24.61	U	24.04	U	24.60	U
D	U	24.17	U	24.18	U	24.57	U	24.11	U	23.76	U	24.00
E	24.35	U	23.98	U	24.56	U	24.66	U	23.87	U	23.90	U
F	U	24.22	U	24.22	U	24.65	U	24.10	U	23.76	U	23.90
G	24.13	U	23.95	U	24.14	U	24.40	U	24.12	U	23.78	U
H	U	24.14	U	24.14	U	24.79	U	24.26	U	23.98	U	NTC

■ Sample (*C_T; NTC=negative control)

■ No sample (*C_T; undetermined)

No cross-contamination detected by qPCR assay

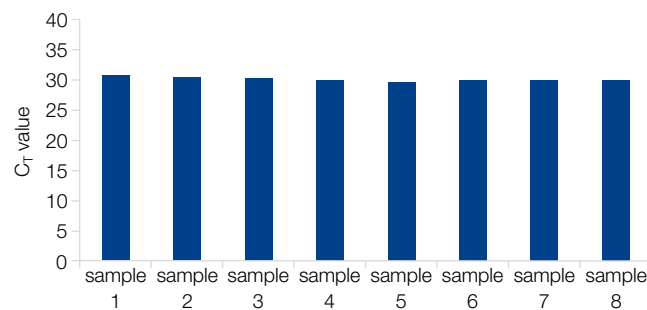
Genomic DNA and empty (no DNA) control samples (200 μL each) were arranged in a checkerboard pattern on a 96-well deepwell plate and subjected to the NucleoMag® DNA Forensic kit procedure on the NIMBUS Presto workstation. Presence of DNA in the eluates was examined by qPCR with a Taqman® PCR probe for a 250 bp β-Actin amplicon using the SensiFast™ Probe Lo-ROX kit from Bioline on an Applied Biosystems® 7500 Real-Time PCR System. Absence of qPCR signal (*C_T undetermined) in the empty control samples indicates a cross-contamination-free workflow.

Ordering information

Product	Specifications	Pack of	REF
NucleoMag® DNA Forensic	Magnetic bead-based kit for the isolation of genomic DNA from forensic traces; including NucleoMag® F-Beads, buffers, Proteinase K (Conformity with ISO 18385)	1 x 96 preps 4 x 96 preps	744660.1 744660.4
NIMBUS Presto	Automated liquid handling platform with 4 pipetting channels, a CO-RE Gripper, barcode scanner, and many additional features		Hamilton*

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* For more detailed information, please visit www.hamiltoncompany.com/robotics. To find a Hamilton subsidiary or distributor in your area, please visit www.hamiltoncompany.com/contacts.



Reliable DNA extraction from challenging sample material

Weathered bone material was subjected to sample preparation using the NucleoMag® DNA Forensic Bones Support protocol (prelysis of sample material including a prolonged heat incubation) followed by DNA purification on the NIMBUS Presto. DNA yields were determined by qPCR showing a consistent extraction and amplification of DNA, even from challenging sample material.

A rapid, fully automated solution for DNA purification from forensic or casework samples

MACHERY-NAGEL and Hamilton deliver a tailored solution for your automated isolation of DNA from forensic or casework samples. We have adapted the NucleoMag® DNA Forensic procedure on the NIMBUS Presto workstation to meet the requirements of high-throughput laboratories.

The powerful combination of the NucleoMag® technology and the NIMBUS Presto workstation has several advantages over standard nucleic acid purification procedures:

- Save hands-on time by using automated plate-prefilling and plate-handling performed by the NIMBUS workstation
- Benefit from the high-speed extraction procedure of the integrated KingFisher™ Presto unit
- Reliable recovery and performance in downstream assays
- Conformity with ISO 18385 for doubtless DNA profiling