# We Change the Way to Prep
## SmartExtraction

Smart Nucleic Acid Extraction

analytikjena
An Endress+Hauser Company

# SmartExtraction Kicks off a New Era

Developed by Analytik Jena, the technology is the first of its kind in the world to facilitate simple automation with conventional liquid-handling systems, as well as requiring minimal equipment when running manual processes.

## SmartExtraction is setting new benchmarks

More than 35 years after silica-based DNA and RNA isolation was first published,[1] Analytik Jena is launching a global innovation in nucleic acid extraction. SmartExtraction significantly accelerates and considerably simplifies the entire procedure. Most notably, the technology accommodates the trend towards maximum process automation.

In order to provide users with maximum freedom when selecting materials, SmartExtraction was designed to be platform-independent. The technology can be used with all of Analytik Jena's pipetting systems, including InnuPure C16 & C96 and CyBio FeliX, and is simple to adapt for use with any liquid handling system.[2] The required laboratory equipment is reduced to a thermal shaker and a magnetrack for manual applications.

In addition to simplifying procedures, SmartExtraction is also superior to other technologies in terms of yield, DNA quality, and efficiency criteria: Thanks to high binding capacities, large amounts of high-molecular DNA can be extracted with the appropriate starting materials.

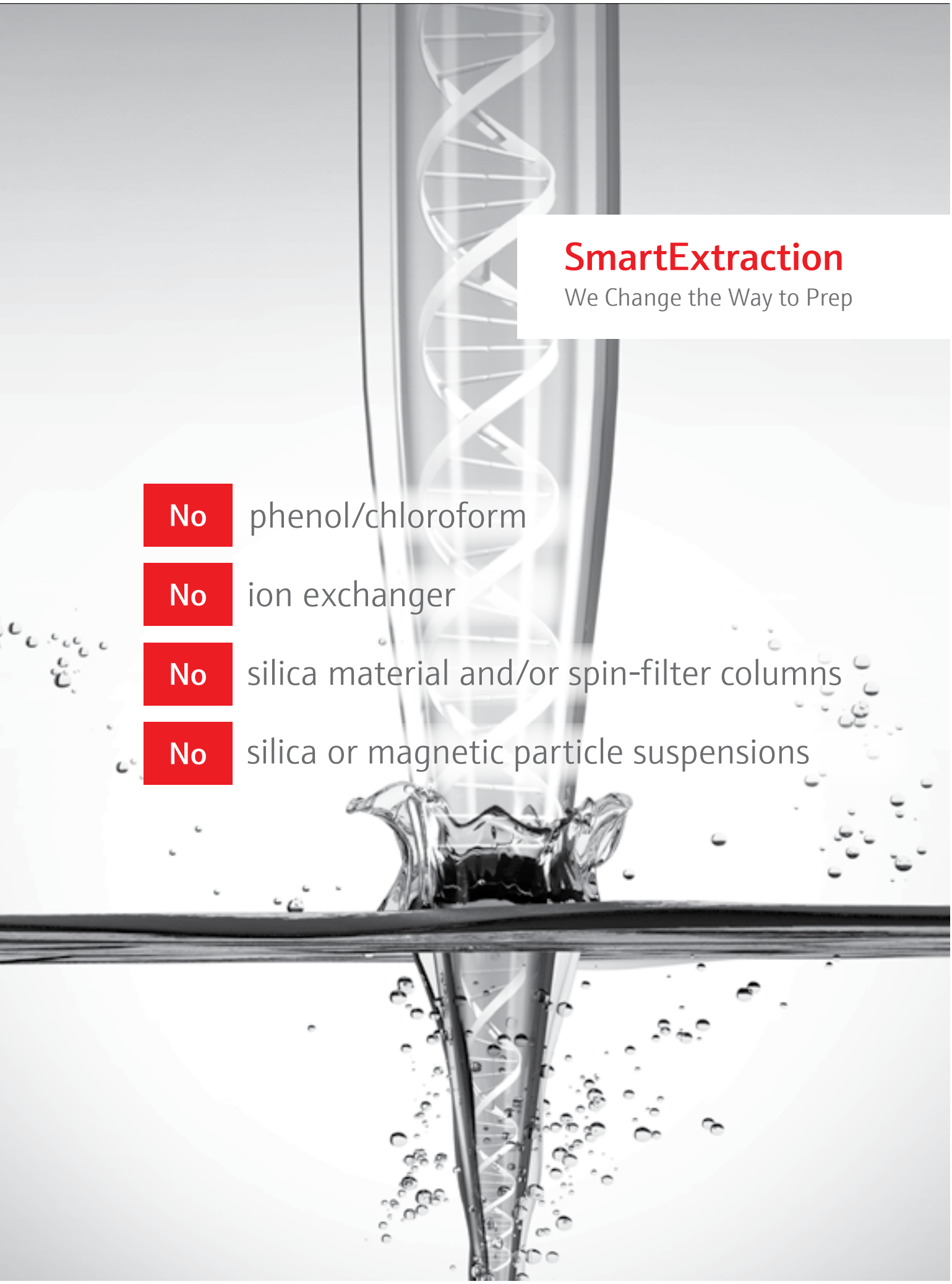
Compared with magnetic particle technology used in conjunction with automated pipetting extraction systems, the new technology significantly increases the amount of extracted nucleic acids in many applications, while substantially reducing the processing time required.

**That's not optimization – that's a quantum leap!**


NEW Product Award
SmartExtraction

[1] Bert Vogelstein, David Gillespie; „Preparative and analytical purification of DNA from agarose" Proc. Natl. Acad. Sci. USA; Vol. 76, No. 2, page 615619, February 1979; Biochemistry

[2] Pipetting systems with 1 mL pipetting heads



# SmartExtraction

We Change the Way to Prep

**No** phenol/chloroform

**No** ion exchanger

**No** silica material and/or spin-filter columns

**No** silica or magnetic particle suspensions

# SmartExtraction Combines the Best of Both Worlds

Analytik Jena's patented extraction chemistry (DC-Technology) convinces with an intelligent, modified surface material for the binding of nucleic acids. Other solid phases such as filter materials, magnetic nano- or micro-particles, and silica with all of their disadvantages are superfluous.

**DC-Technology meets Smart Surfaces**

- No phenol/chloroform
- No ion exchanger
- No silica material and/or spin-filter columns
- No silica or magnetic particle suspensions

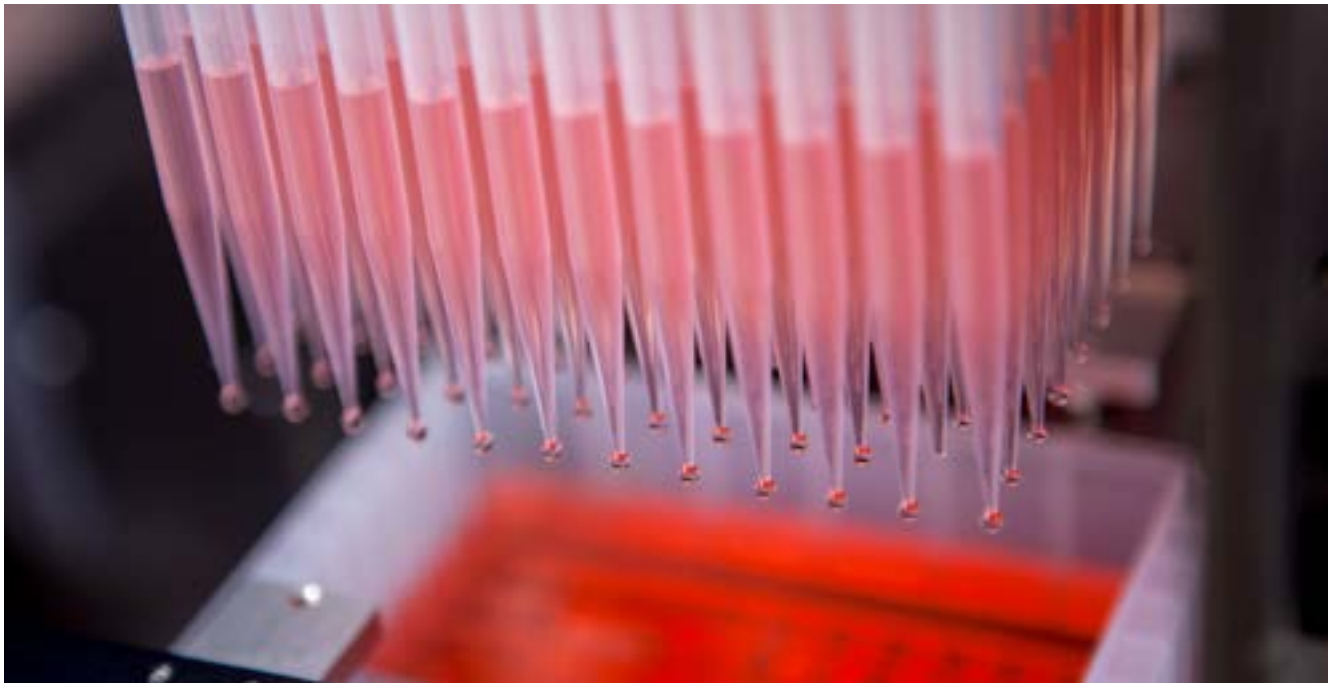
The core of the extraction chemistry (DC-Technology) - as basis for SmartExtraction - is the combination of chaotropic and non-chaotropic salts with low ionic strengths, which enables the development of efficient lysis and binding buffers.

The Smart Modified Surface selectively binds the desired nucleic acids and then elutes them with high efficiency.

**We're revolutionizing the process of nucleic acid extraction!**

**Your Benefits**

- Exceptional yield, quality, and quantity
- Extraction of high-molecular weight DNA
- No centrifugation: optimal handling
- No carryover of magnetic particles: eluted nucleic acids of maximum quality
- No silica materials: optimized binding capacity for nucleic acids



# Minimal Effort for Maximum Efficiency

The entire purification process is limited to simple pipetting and incubation steps. There's no need to bind the DNA to magnetic particles or silica materials, nor is there any need for subsequent handling.

## Automated SmartExtraction – concentrating on what is important

SmartExtraction has revolutionized the process of isolating and purifying nucleic acids, for instance, by making a number of steps, additional materials, and special equipment superfluous.

Developed by experts, the Smart Modified Surface ensures that the entire extraction process occurs in the pipette tip.

Using existing workflows as an example, that means that none of the steps, from lysis to DNA desorption, require special materials or equipment such as magnets, vacuum stations, or centrifuges.The entire analysis process is limited to simply pipetting up and down. There's no need to bind the DNA to magnetic particles or silica materials, thus eliminating time-consuming steps such as resuspension, separation, and centrifugation.

**Your Benefits**

- Special equipment and materials are superfluous
- Simple procedure, exceptionally easy to automate
- Can be used in liquid handling systems of all kinds[2]
- Optimized, ready-to-use kits for InnuPure extraction systems and the CyBio FeliX liquid handling systems
- Smart Modified Surface for simple extraction in the pipette tip

## Manual SmartExtraction – the solution for small sample batches

The unique SmartExtraction technology does not just achieve excellent results on automated platforms.
It simplifies the manual extraction of genomic DNA from various starting materials – requiring much less equipment than conventional solutions: Instead of a centrifuge, only a thermal shaker is needed.

Analytik Jena offers ready-to-use kits, including SmartExtraction tubes and granulates with Smart Modified Surfaces for a variety of application areas.

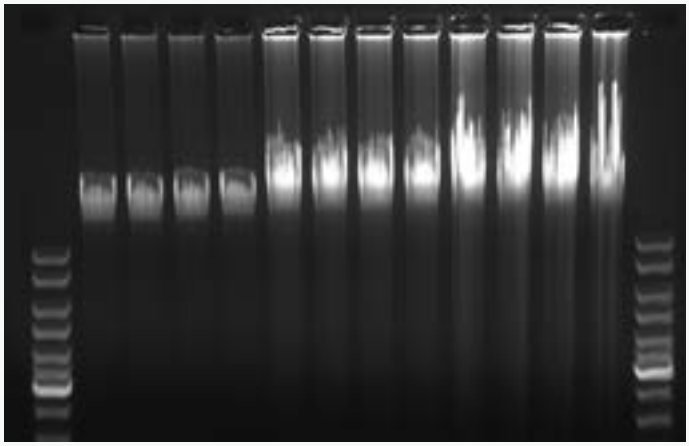
**Your Benefits**

- Reduction of the required laboratory equipment
- Nucleic acid extraction in a thermal shaker
- Granulates with Smart Modified Surfaces in a SmartExtraction tube
- Quick, simple routines for the manual isolation of nucleic acids

[2] Pipetting systems with 1 mL pipetting heads

# The Results Speak for Themselves

In addition to a range of different starting materials, SmartExtraction is also suitable for samples with a high initial volume or high application amount in particular. All automated protocols are prepared in such a way that they don't require vacuum stations or magnetic adapters to work directly on pipetting platforms with a 1 mL filter tip.



**Lane 1 and 14:**
DNA ladder (100 – 5000 bp)
**Lane 2 – 5:**
DNA extraction from the nucleated cells of 1 mL whole blood
**Lane 6 – 9:**
DNA extraction from the nucleated cells of 2 mL whole blood
**Lane 10 – 13:**
DNA extraction from the nucleated cells of 3 mL whole blood

The smart Blood DNA Midi prep (a) was used in fourfold determination for preparing 1 mL, 2 mL, and 3 mL whole blood samples. Following red blood cell lysis, the nucleated cells were pelleted and then resuspended in phospate-buffered saline (PBS). All additional steps of DNA extraction were automated with InnuPure C16.

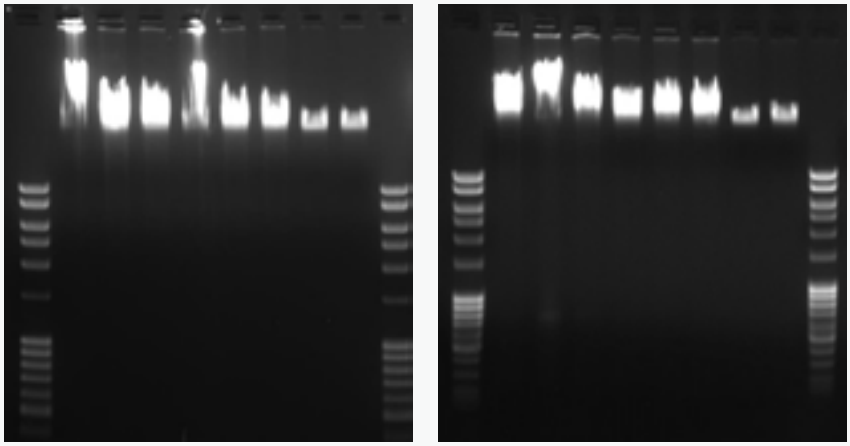
## Results table

| Sample | Amount of whole blood [mL]* | Concentration [ng/µL] | Yield [µg] | $A_{260}$:$A_{280}$ | $A_{260}$:$A_{230}$ |
|---|---|---|---|---|---|
| **1** | 1 mL | 79 | 23.7 | 1.9 | 2.2 |
| **2** | 1 mL | 71 | 21.3 | 1.9 | 2.2 |
| **3** | 1 mL | 68 | 20.4 | 1.9 | 2.2 |
| **4** | 1 mL | 63 | 18.9 | 1.9 | 2.2 |
| **5** | 2 mL | 150 | 45.0 | 1.9 | 2.2 |
| **6** | 2 mL | 156 | 46.8 | 1.9 | 2.2 |
| **7** | 2 mL | 143 | 42.9 | 1.9 | 2.2 |
| **8** | 2 mL | 147 | 44.1 | 1.9 | 2.3 |
| **9** | 3 mL | 216 | 64.8 | 1.8 | 2.3 |
| **10** | 3 mL | 234 | 70.2 | 1.9 | 2.3 |
| **11** | 3 mL | 228 | 68.4 | 1.9 | 2.3 |
| **12** | 3 mL | 240 | 72.0 | 1.9 | 2.3 |

* The resulting nucleated cells

With a comparable purity, the yield of the nucleic acid almost increases linearly with the amount of nucleated blood cells used. The gel image also clearly shows the exceptional quality of the high-molecular DNA extracted.

In a comparative experiment, genomic DNA was isolated from whole blood, including internal lysis. Based on the SmartExtraction technology, the extraction was performed on two different liquid handling systems in parallel.



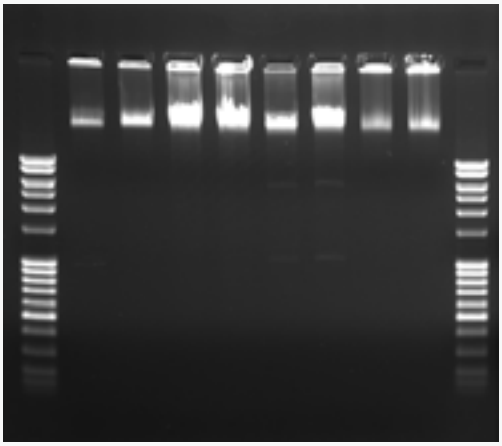
smart Blood DNA Midi Direct prep kits were used for direct automated isolation of DNA from whole blood using the InnuPure C16 *touch* and CyBio FeliX.

Order of blood volumes in duplicates are 1000 µL, 600 µL, 500 µL and 200 µL. The first and last lane show the DNA ladders with fragment bands of 100 – 5000 bp.

| Device | Starting material [µL] | Concentration [ng/µL] | Yield [µg] |
|---|---|---|---|
| InnuPure C16 *touch* | 1000 | 139.0 | 27.8 |
| | 600 | 79.3 | 15.9 |
| | 500 | 75.0 | 15.0 |
| | 200 | 21.8 | 4.4 |
| CyBio FeliX | 1000 | 152.5 | 30.5 |
| | 600 | 89.3 | 17.9 |
| | 500 | 75.8 | 15.2 |
| | 200 | 22.3 | 4.5 |

Regardless of the pipetting platform used, the extraction of genomic DNA from blood cells on the basis of SmartExtraction provides best results with high yields. The gel images also show a high quality of high-molecular DNA.

By the SmartExtraction tubes, the genomic DNA from different strains of gram- and gram+ bacteria were isolated in highly-efficient, manual processes.



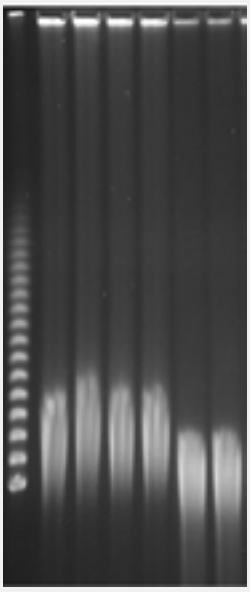
**Lane 1 and 10:**
DNA ladders (100 – 5000 bp)
**Lane 2 - 9**
DNA extracted from different bacterial strains using SmartExtraction (each in double determination)

## Results table

| Lane | Description | Concentration [ng/µL] | $A_{260}$:$A_{280}$ | $A_{260}$:$A_{230}$ | Yield [µg] |
|---|---|---|---|---|---|
| 1 | *Klebsiella pneumoniae* DSM 25721 (gram-) | 99.5 | 2.0 | 1.6 | 29.9 |
| 2 | | 102.0 | 2.0 | 2.1 | 30.6 |
| 3 | *Escherichia coli* DSM 498 (gram-) | 685.0 | 2.0 | 2.0 | 205.5 |
| 4 | | 686.0 | 2.0 | 2.0 | 205.8 |
| 5 | *Enterococcus faecalis* DSM 20478 (gram+) | 240.0 | 2.0 | 1.9 | 72.0 |
| 6 | | 338.0 | 2.0 | 2.0 | 101.4 |
| 7 | *Staphylococcus aureus* BK916 (gram+) | 144.0 | 1.9 | 1.6 | 43.2 |
| 8 | | 134.0 | 1.9 | 1.9 | 40.2 |

The manual application of SmartExtraction technology also enables a very high yield of macromolecular DNA from both gram- and gram+ bacterial strains. The quality of the extracted DNA is excellent with regard to $A_{260}$:$A_{280}$ and $A_{260}$:$A_{230}$ assessment.

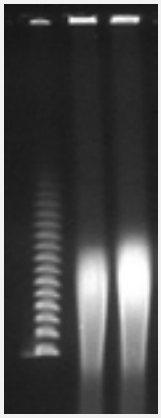
SmartExtraction technology delivers eluates of high-molecular DNA and thus offers the best prerequisites for subsequent applications.



The quality of automatically extracted DNA from 200 µL blood by InnuPure C16 *touch* on the basis of SmartExtraction was compared to the manual extraction via anion exchanger. The Rotaphor system (PFGE - Pulsed Field Gel Electrophoresis) shows the superior high-molecular weight of DNA extracts obtained by SmartExtraction.

**Lane 1**: DNA ladder (48.5 kbp to 727.5 kbp)
**Lane 2 – 5**: DNA SmartExtraction from blood by InnuPure C16 *touch*
**Lane 6 – 7**: Manual DNA extraction based on anion exchanger

| Sample | Concentration [ng/µL] | $A_{260}$:$A_{280}$ | $A_{260}$:$A_{230}$ | Yield [µg] |
|---|---|---|---|---|
| SmartExtraction | 29.5 | 2.6 | 1.5 | 5.9 |
| | 29.5 | 2.7 | 1.3 | 5.9 |
| | 28.5 | 2.7 | 1.7 | 5.7 |
| | 32.5 | 2.6 | 1.3 | 6.5 |
| Anion Exchanger | 21.0 | 1.9 | 1.8 | 4.2 |
| | 22.5 | 1.9 | 2.1 | 4.5 |



The genomic DNA from $10^6$ NiH3T3 cells was extracted using the smart DNA prep (a) and InnuPure C16 *touch*. The Rotaphor system (PFGE - Pulsed Field Gel Electrophoresis) shows resulting high-molecular weight DNA of up to 450 kbp.

**Lane 1**: DNA ladder (48.5 kbp to 727.5 kbp)
**Lane 2 – 3**: Extracted DNA from NiH3T3 cells via smart DNA prep (a) by InnuPure C16 *touch*

| Sample | Concentration [ng/µL] | $A_{260}$:$A_{280}$ | $A_{260}$:$A_{230}$ | Yield [µg] |
|---|---|---|---|---|
| Smart DNA prep | 185.0 | 2.0 | 2.8 | 27.8 |
| InnuPure C16 touch | 206.0 | 2.0 | 2.7 | 30.9 |

The unique SmartExtraction technology is clearly superior to other extraction technologies. Not only with regards to delivering best yields especially in case of starting materials of high contents of nucleic acids - with respect to fragment size this gentle method is invincable, too.

# All on One View

SmartExtraction includes a number of ready-to-use kits for automated systems (a) / (a96)/ (a96) - FX as well as for manual (m) preparation of different starting materials.

| | smart Blood DNA Midi prep (m) | smart Blood DNA Midi prep (a)<br>smart Blood DNA Midi prep (a96)<br>smart Blood DNA Midi prep (a96)-FX | smart Blood DNA Midi Direct prep (a)<br>smart Blood DNA Midi Direct prep (a96)<br>smart Blood DNA Midi Direct prep (a96)-FX | smart DNA prep (m) | smart DNA prep (a)<br>smart DNA prep (a96)<br>smart DNA prep (a96)-FX |
|---|---|---|---|---|---|
| Starting material | | | | | |
| Whole Blood | | | | | |
| Up to 1 mL | ✔ | ✔ | ✔ | | |
| Up to 3 mL | ✔ | ✔ | | | |
| Up to 10 mL | ✔ | | | | |
| Tissue | | | | ✔ | ✔ |
| Rodent tail pieces | | | | ✔ | ✔ |
| Mouse tail pieces | | | | ✔ | ✔ |
| Rat tail pieces | | | | ✔ | ✔ |
| Eukaryotic cells | | | | ✔ | ✔ |
| Bacteria (gram+ and gram-) | | | | ✔ | ✔ |
| Yeast cells | | | | ✔ | ✔ |

# Order Information

## smart Blood DNA Midi prep

| Suffix | Order number | Description | Compatible Analytik Jena devices |
|---|---|---|---|
| (m) | 845-KS-8100010 | 10 reactions | n.a./ manual extraction |
| | 845-KS-8100050 | 50 reactions | n.a./ manual extraction |
| (a) | 845-ASS-1208016 | 16 reactions, Reagent Strips, 1 reaction per Strip | InnuPure C16, InnuPure C16 *touch* |
| | 845-ASS-1208096 | 96 reactions, Reagent Strips, 1 reaction per Strip | InnuPure C16, InnuPure C16 *touch* |
| | 845-ASP-1208016 | 16 reactions, Reagent Plates, 8 reactions per Plate | InnuPure C16, InnuPure C16 *touch* |
| | 845-ASP-1208096 | 96 reactions, Reagent Plates, 8 reactions per Plate | InnuPure C16, InnuPure C16 *touch* |
| (a96) | 845-ASP-1296096 | 1 x 96 reactions, Reagent Plates | InnuPure C96 |
| (a96) - FX | 845-FX-4196096 | 96 reactions, non-filled | CyBio FeliX |
| | 845-FX-4196480 | 480 reactions, non-filled | CyBio FeliX |
| | 845-PFX-4196096 | 96 reactions, pre-filled | CyBio FeliX |

## smart Blood DNA Midi Direct prep

| Suffix | Order number | Description | Compatible Analytik Jena devices |
|---|---|---|---|
| (a) | 845-ASS-3008016 | 16 reactions, Reagent Strips, 1 reaction per Strip | InnuPure C16, InnuPure C16 *touch* |
| | 845-ASS-3008096 | 96 reactions, Reagent Strips, 1 reaction per Strip | InnuPure C16, InnuPure C16 *touch* |
| | 845-ASP-3008016 | 16 reactions, Reagent Plates, 8 reactions per Plate | InnuPure C16, InnuPure C16 *touch* |
| | 845-ASP-3008096 | 96 reactions, Reagent Plates, 8 reactions per Plate | InnuPure C16, InnuPure C16 *touch* |
| (a96) | 845-ASP-3096096 | 1 x 96 reactions, Reagent Plates | InnuPure C96 |
| (a96) - FX | 845-FX-4096096 | 96 reactions, non-filled | CyBio FeliX |
| | 845-FX-4096480 | 480 reactions, non-filled | CyBio FeliX |
| | 845-PFX-4096096 | 96 reactions, pre-filled | CyBio FeliX |

## smart DNA prep

| Suffix | Order number | Description | Compatible Analytik Jena devices |
|---|---|---|---|
| (m) | 845-KS-8000010 | 10 reactions | n.a./ manual extraction |
| | 845-KS-8000050 | 50 reactions | n.a./ manual extraction |
| (a) | 845-ASS-2008016 | 16 reactions, Reagent Strips, 1 reaction per Strip | InnuPure C16, InnuPure C16 *touch* |
| | 845-ASS-2008096 | 96 reactions, Reagent Strips, 1 reaction per Strip | InnuPure C16, InnuPure C16 *touch* |
| | 845-ASP-2008016 | 16 reactions, Reagent Plates, 8 reactions per Plate | InnuPure C16, InnuPure C16 *touch* |
| | 845-ASP-2008096 | 96 reactions, Reagent Plates, 8 reactions per Plate | InnuPure C16, InnuPure C16 *touch* |
| (a96) | 845-ASP-2096096 | 1 x 96 reactions, Reagent Plates | InnuPure C96 |
| (a96) - FX | 845-FX-4296096 | 96 reactions, non-filled | CyBio FeliX |
| | 845-FX-4296480 | 480 reactions, non-filled | CyBio FeliX |
| | 845-PFX-4296096 | 96 reactions, pre-filled | CyBio FeliX |

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