Blood and Cell DNA Extraction Kits Comparison:

Yield, Quality, Downstream Application Performance, and Scalability

Galenvs offers blood and cell nucleic extraction using magnetic bead-based reagents optimized through machine learning approaches to ensure consistent high yield and quality.

The Galenvs ***magnetiQ* Blood & Cell DNA Extraction Kit** enables a rapid and efficient method of nucleic acid isolation from whole blood samples, as well as cell suspensions. Extraction of DNA is achieved through single-step magnetic bead-based lysis and capture of DNA from cells in blood, tissue, or cell culture samples. The *magnetiQ* Blood & Cell DNA Extraction Kit enables highly efficient capture/elution of nucleic acids yielding purified solutions with minimal protein and salt contamination for downstream applications such as PCR and sequencing.

Galenvs kit performance was evaluated through yield and quality assessment of nucleic acid preparations - from both blood and cell suspension samples - compared to popular kits from Qiagen and Invitrogen.

Comparison Parameters

Two industry leading kits for Blood and Cell DNA purification were selected:

- DNeasy Blood & Tissue Kit from QIAGEN, hereinafter referred to as **Qiagen**
- Invitrogen PureLink™ Genomic DNA Purification Kit from ThermoFisher, hereinafter referred to as **Invitrogen**

Compared with:

- *magnetiQ* Blood & Cell DNA Extraction Kit from Galenvs Sciences, hereinafter referred to as **Galenvs**

Sample Type: Cell Suspension

To evaluate nucleic acid extraction from cell suspensions, HeLa cells cultured to confluence on T75 flasks were selected. The cells were harvested and resuspended in 100 µL of PBS at 2 different quantities: 100,000 and 500,000 cells.

Qiagen and Invitrogen protocols were followed according to manufacturer specifications, including steps involving centrifugation, heating, and vortexing, as well

as proteinase K addition. In contrast, the Galenvs kit does not require any centrifugation, heating, sample vortexing, or proteinase K – only a standard magnetic rack for liquid manipulation.

Yield and quality were evaluated using spectrophotometric measurements for quantification at A260, as well as organic contamination using A260/A280 and A260/A230 ratios. Gel electrophoresis was also performed to evaluate nucleic acid shearing and quality.

Sample Type: Whole Blood (Human)

For nucleic acid extraction from whole blood, a 100 µL undiluted sample was used for the Galenvs kit. The equivalent volume was also used for both Qiagen and Invitrogen with manufacturer recommended dilutions. All kits under evaluation necessitated the addition of proteinase K to the sample, while the Galenvs kit again did not require any heating, vortexing, or centrifugation as is needed for Qiagen and Invitrogen.

As with the evaluation of extracted nucleic acids from cell suspensions, yield and quality were measured using spectrophotometry for quantification at A260, as well as contamination using A260/A280 and A260/A230 ratios. Gel electrophoresis was also performed to evaluate genomic DNA (gDNA) band intensity and any adverse sample preparation effects such as shearing. In addition, qPCR analysis was performed using GAPDH house-keeping gene to further evaluate downstream process applicability as well as quantitative analysis of gene expression.

Results

Cell Suspension

Table 1 shows a summary of spectrophometric analysis of extracted nucleic acids from both 100,000 and 500,000 HeLa cells suspended in PBS buffer. All experiments were performed in triplicate. At both cell quantities, the Galenvs kit produces a higher yield of extracted nucleic acid that is scalable and repeatable.

Table 1: Spectrophometric analysis of purified nucleic acids from HeLa cell suspensions

	100K Cells			500K Cells		
	Quantity (ng/µL)	A260/A280	A260/A230	Quantity (ng/µL)	A2680/A280	A260/A230
Galenvs	23.10 ± 1.65	2.27 ± 0.05	2.14 ± 0.07	108.57 ± 0.95	2.09 ± 0.01	2.20 ± 0.03
Qiagen	15.53 ± 1.47	1.82 ± 0.04	0.85 ± 0.21	62.77 ± 31.24	2.00 ± 0.01	1.80 ± 0.24
Invitrogen	16.53 ± 2.39	1.91 ± 0.14	1.92 ± 0.22	89.03 ± 20.12	1.97 ± 0.02	2.13 ± 0.04

Figures 1 and 2 show a graphical representation of extracted nucleic acid quantity as well as eluted sample purity. It is important to note the Galenvs consistency in extraction efficiency between replicates for both yield and quality.

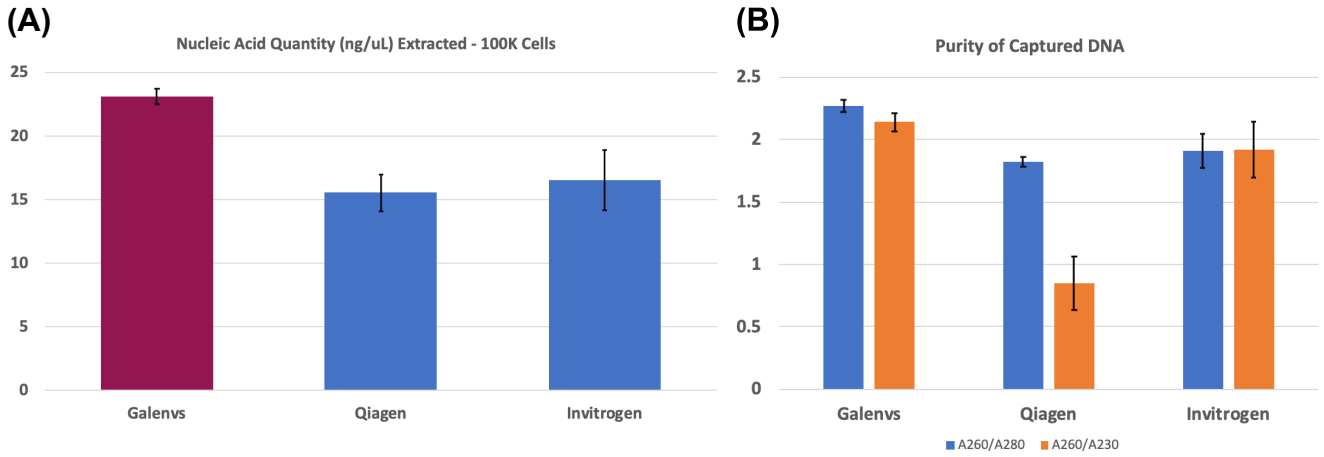

Figure 1 - Nucleic acid extraction quantity (A) and purity (B) for 100,000 HeLa cell suspension

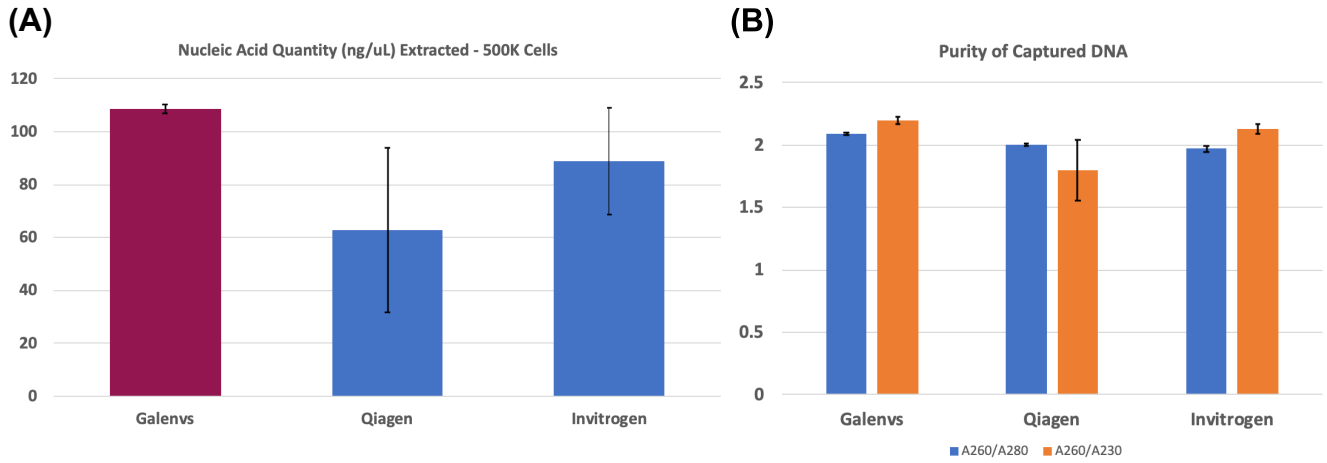

Figure 2 - Nucleic acid extraction quantity (A) and purity (B) for 500,000 HeLa cell suspension

Finally, gel electrophoresis of the extracted samples is shown in Figure 3 for both starting cell quantities. Total nucleic acid extraction from the Galenvs kit shows very intense and unsheared DNA and RNA bands, while both Qiagen and Invitrogen show weaker band intensities for both DNA and RNA, with visible smears indicated shearing and/or degradation.

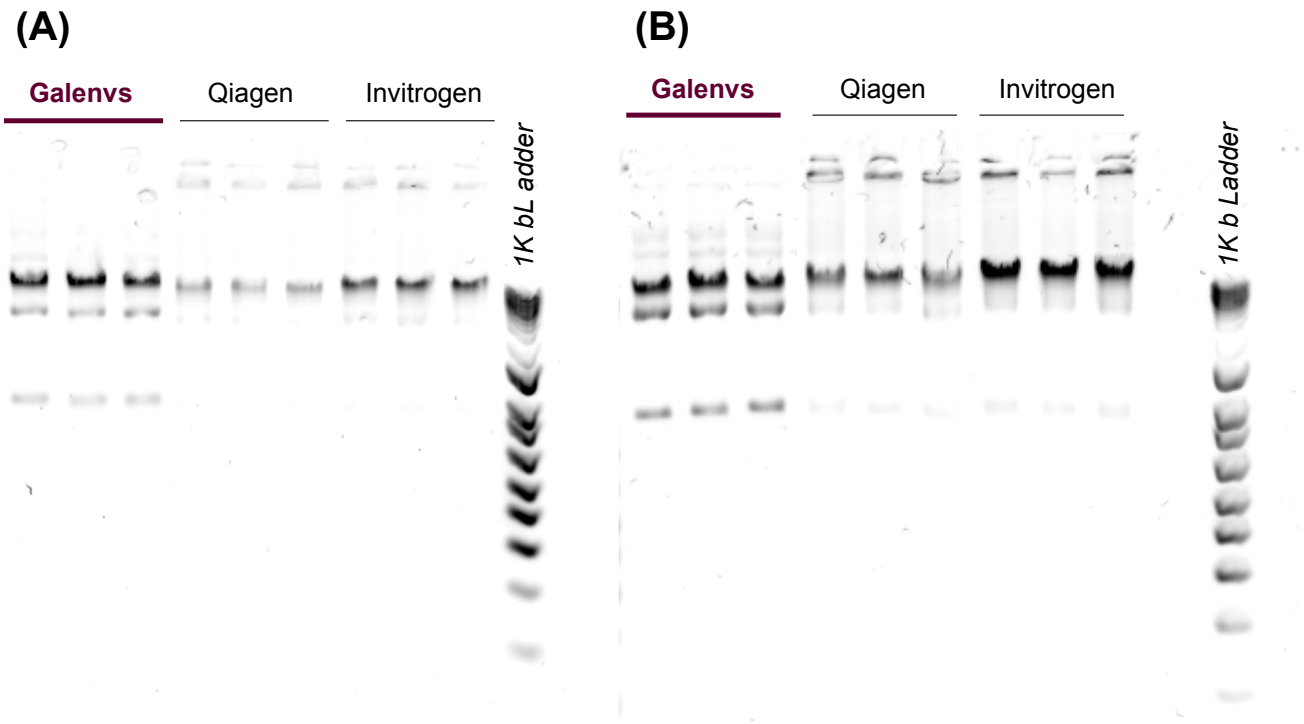

Figure 3 - Gel electrophoresis of extracted nucleic acid from (A) 100,000 and (B) 500,000 HeLa cell suspensions

Whole Blood

Table 2 shows the spectrophotometric analysis of gDNA extracted from 100 µL whole blood. All experiments were conducted in triplicate. Quantity of isolated gDNA using the Galenvs kit was significantly higher devoid of organic and protein contamination indicated by the A260/A280 and A260/A230 ratios.

Table 2: Spectrophometric analysis of gDNA extracted from whole blood

	Quantity (ng/µL)	A260/A280	A260/A230
Galenvs	41.55 ± 1.17	1.84 ± 0.07	1.67 ± 0.18
Qiagen	21.00 ± 1.04	1.87 ± 0.12	1.84 ± 0.74
Invitrogen	23.27 ± 2.60	1.88 ± 0.08	1.80 ± 0.47

A graphical summary in Figure 4, clearly demonstrates the reproducibility of the gDNA yield obtained by Galenvs, with minimal variation in purity ratios compared to Qiagen and Invitrogen.

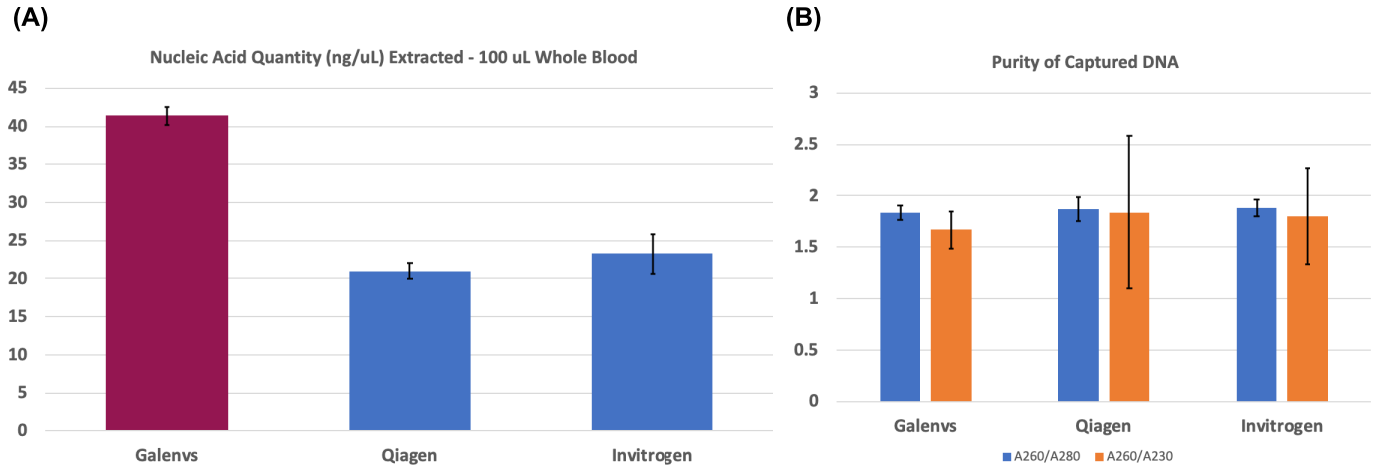

Figure 4 - Quantity and purity of gDNA extracted from 100 µL whole blood sample

Gel electrophoresis in Figure 5 shows the greater intensity of the gDNA bands from the Galenvs extraction as well as lack of smears associated with shearing and degradation. gDNA bands from Invitrogen and Qiagen preparations are less intense and lighter in weight than those extracted with Galenvs.

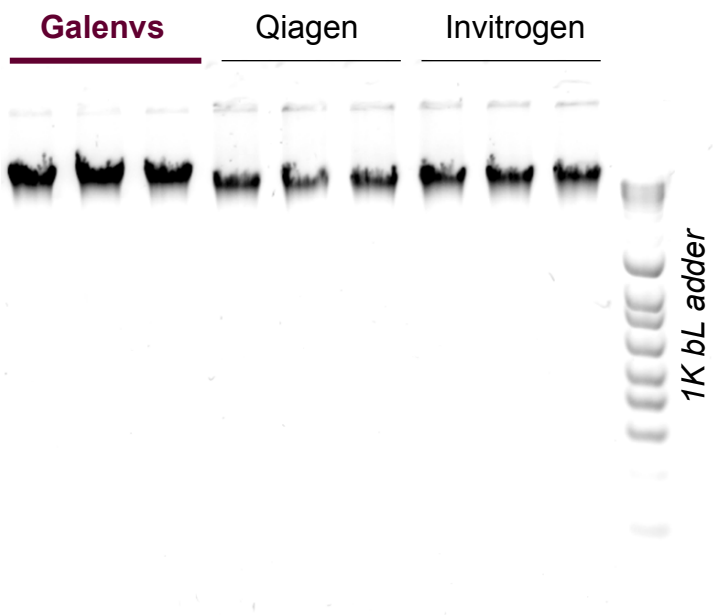

Figure 5 - Gel electrophoresis analysis of gDNA extracted from 100 µL whole blood

Finally qPCR analysis is shown in Figure 6 to further evaluate downstream process applicability. Extracted gDNA was evaluated using eluted sample, as well as 1/10 and 1/100 dilutions in the same kit-supplied elution buffer. GAPDH gene amplification using Galenvs extractions showed a significantly lower cycle threshold (CT) value. This correlates with spectrophometric and gel electrophoresis analysis, indicating a higher yield and sample quality for downstream PCR applications.

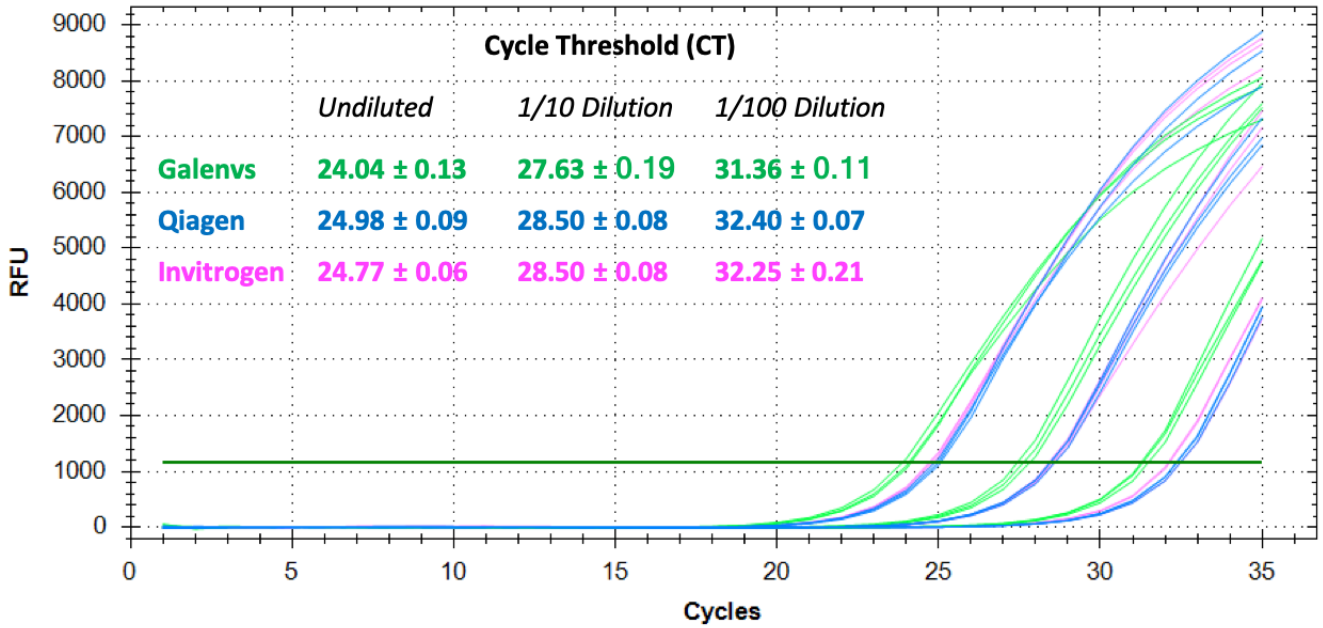

Figure 6 - qPCR analysis of extracted gDNA from whole blood using SYBR green for GAPDH amplification

Conclusions

The Galenvs *magnetiQ* Blood & Cell DNA Extraction Kit alleviates the need for separate lysis and binding, heating, or centrifugation steps. Furthermore, the purified sample can be concentrated in volumes as low as 25 µL, in contrast to column-based kits which often necessitate larger elution volumes. The *magnetiQ* Blood & Cell DNA Extraction Kit displays superior performance in comparison to leading commercially available column-based kits. As shown above, higher quantity of DNA was extracted from cell suspension using the Galenvs *magnetiQ* Blood & Cell DNA Extraction Kit, resulting in a lower CT value for GAPDH gene.

The Galenvs *magnetiQ* Blood & Cell DNA Extraction Kit also provides a cleaner, less contaminated eluted nucleic acid preparations from 100 µL whole blood or cell suspension samples. As demonstrated above, A260/A230 ratios obtained using spectrophotometry showed very pure and high yield nucleic acid elute (ratio between 1.8-2.2) with high reproducibility using the Galenvs *magnetiQ* Blood & Cell DNA Extraction Kit. This is in contrast to the Qiagen and Invitrogen column-based benchmarks, giving variable yield and quality ratios that adversely affect downstream applications.

Speed & Scalability

Functionalized magnetic beads – coupled with machine-learning approaches for protocol development and reagent formulation – are at the core of the Galenvs *magnetiQ* Blood & Cell DNA Extraction Kit, which comprise AI-optimized buffers for blood or cell lysis and DNA binding, washing and elution. Samples are processed manually in under 15 mins, requiring only the use of a magnetic rack and standard pipettes.

- Galenvs *magnetiQ* Blood & Cell DNA Extraction Kit is most amenable to high-throughput methods, including automation
- Faster and simpler magnetic collection and resuspension steps with Galenvs *magnetiQ* Blood & Cell DNA Extraction Kit
- Concern for clogging is reduced with Galenvs *magnetiQ* Blood & Cell DNA Extraction Kit non-filter method
- No organic solvent hazardous waste with Galenvs *magnetiQ* Blood & Cell DNA Extraction Kit

Galenvs *magnetiQ* Blood & Cell DNA Extraction Kit

Features

- High DNA recovery and quality
- Short and scalable protocol
- Cost effective extractions
- Non-toxic chemicals
- Automatable on open liquid handling systems

Applications

- Next Generation Sequencing (NGS)
- PCR and qPCR gene amplification
- DNA methylation studies
- Copy number variation (CNV) studies

Comparative analysis performed by the National Research Council of Canada.

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