TECHNICAL BULLETIN

Achieve Scalable, High-Quality Nucleic Acid Extractions with the EasySep™ Total Nucleic Acid Extraction Kit

Nucleic acid purification is a critical step in cellular and molecular biology, enabling researchers to isolate high-quality RNA and DNA for a wide range of applications, including gene expression analysis, sequencing, and biomarker discovery. It plays a critical role in fields such as immunology and cancer research, where precise molecular insights are essential for understanding disease mechanisms, identifying therapeutic targets, and developing personalized treatments.

However, commonly used nucleic acid purification methods—such as spin column-based techniques or phenol-chloroform extraction—have several challenges. These include time-consuming workflows, inconsistent yields, the use of hazardous chemicals, and difficulties in scaling for high-throughput applications. Moreover, traditional methods often involve multiple centrifugation steps, which can introduce variability and increase the risk of sample loss or degradation, particularly when working with low-input samples.

Designed with easy-to-use, scalable protocols, the EasySep™ Total Nucleic Acid Extraction Kit uses magnetic bead technology to eliminate the need for spin columns or toxic reagents—offering a fast, gentle method for purifying total nucleic acids from a wide range of sample types. This overview introduces how the kit addresses common challenges of traditional extraction methods and highlights its flexible protocols, broad sample compatibility, and support for both RNA and DNA purification.

Why Use EasySep™ Magnetic Bead-Based Extraction to Isolate Nucleic Acids?

HIGHER PURITY & YIELD. Efficient binding and washing steps reduce inhibitor carryover for cleaner DNA and RNA, ready for downstream applications.

SCALABLE & FLEXIBLE. Customize input amounts and elution volumes to suit a wide range of experimental needs.

GENTLE ON SAMPLES. No harsh centrifugation helps preserve the integrity of RNA and high molecular weight DNA.

VERSATILE. Compatible with diverse sample types—including whole blood, tissues, organoids, and adherent cells—with no columns or clogging.

RELIABLE & CLEAN RESULTS. Consistent yields and effective contaminant removal for dependable downstream performance.

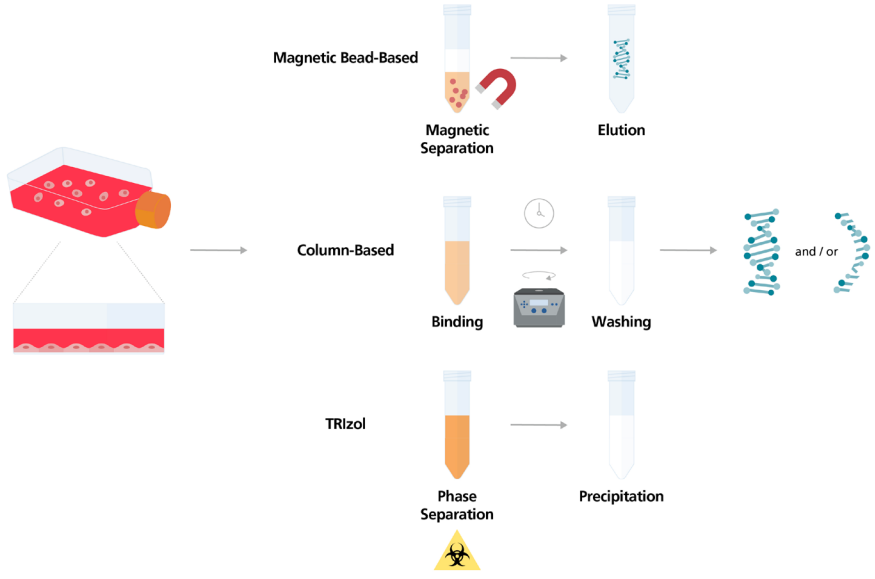

Figure 1. Overview of Methods for Total Nucleic Acid (DNA and RNA) Extraction

Examples of commonly used nucleic acid extraction methods include magnetic bead-based, column-based, and TRIzol-based approaches. Magnetic bead-based methods use magnetic particles to bind nucleic acids, allowing for efficient washing and elution without centrifugation or columns. Column-based methods use silica spin columns to bind DNA and RNA by multiple centrifugation steps. TRIzol is a phenol-chloroform-based method, involving hazardous reagents, that separates RNA, DNA, and proteins into distinct phases, followed by alcohol precipitation.

How the EasySep™ Total Nucleic Acid Extraction Kit Works

The EasySep™ Total Nucleic Acid Extraction Kit uses magnetic bead-based technology to isolate high-purity DNA and RNA without spin columns or harsh reagents. Its streamlined, scalable workflow minimizes sample handling and centrifugation, helping preserve nucleic acid integrity and improve consistency. The kit is compatible with a variety of sample types—including whole blood, cell suspensions (e.g. PBMCs, hPSCs, cultured cells), EasySep™-isolated cells, and 3D organoids. With this kit, you can efficiently extract total nucleic acids (DNA and RNA) using 1.7 mL microcentrifuge tubes and the ErythroClear™ Magnet. Or, to scale up your extractions, process samples in 96-well PCR plates with the 96-Well PCR Microplate Magnet. Nucleic acids extracted with this kit are highly pure and can be used in downstream applications such as qPCR, RNA-seq, and whole genome sequencing—helping you move from sample to discovery with ease.

The EasySep™ Total Nucleic Acid Extraction Kit targets nucleic acids from samples containing up to 1 x 10^6 cells (≤ 5 x 10^6 cells/mL). Following sample lysis, nucleic acids are captured by silica-coated, diluted EasySep™ Total Nucleic Acid Concentrated RapidSpheres™ and separated using either the ErythroClear™ Magnet for standard and whole blood preparations, or the 96-Well PCR Microplate Magnet for preparations in a 96-well format. Residual proteins and cell components are removed by washing the separated nucleic acids with 70% ethanol, which are then released from the RapidSpheres™ using an elution buffer. This approach enables a fast, column-free workflow that improves nucleic acid recovery and minimizes sample loss, as demonstrated in Figures 2 and 3. The final isolated fraction contains purified nucleic acids that are immediately available for direct quantification with NanoDrop™ spectrophotometer, additional purification (e.g. DNA removal), or for use in downstream applications.

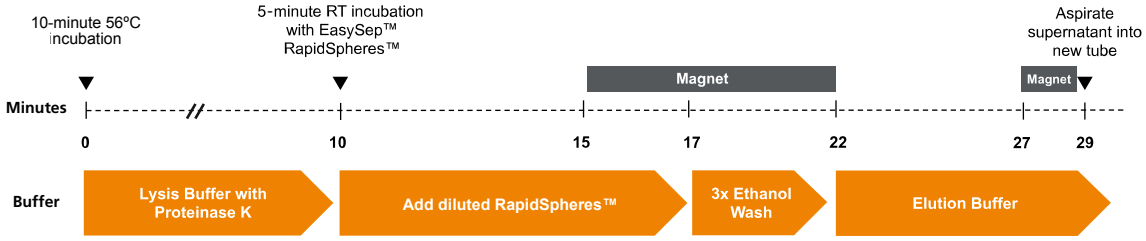

Figure 2. EasySep™ Total Nucleic Acid Extraction Kit Workflow

Diagram of the standard nucleic acid extraction workflow. Time points at which samples must be placed in the magnet are indicated with gray boxes. EasySep™ Lysis Buffer and Proteinase K are added to the sample and incubated at 56°C for 10 minutes. Diluted EasySep™ Nucleic Acid RapidSpheres™ are added to the sample and incubated at room temperature (RT) for 5 minutes, then placed in the magnet for 2 minutes. While in the magnet, the sample is washed three times with a 70% ethanol wash solution, and the supernatant is removed. The pellet is resuspended with the elution buffer while the tube is removed from the magnet, and the sample is incubated at room temperature for 5 minutes. The sample is then placed in the magnet for 2 minutes before the supernatant is aspirated to a new tube to obtain the extracted nucleic acids.

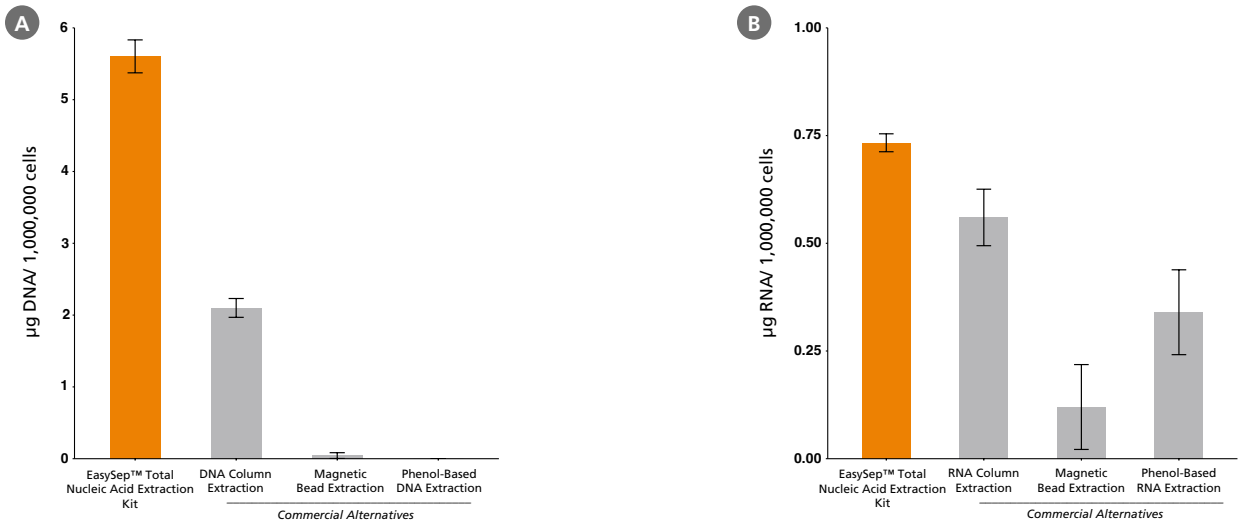

Figure 3. EasySep™ Total Nucleic Acid Extraction Kit Shows Improved DNA and RNA Recovery Relative to Other Commonly Used Methods

DNA and RNA were extracted from PBMC samples (n = 3) using the EasySep™ Total Nucleic Acid Extraction Kit and other commercially available methods. Recovery was normalized (µg per 1 × 10^6 cells) and measured separately using the Qubit™ Fluorometer for (A) DNA and (B) RNA. The EasySep™ kit showed improved nucleic acid recovery relative to other commonly used extraction methods. Error bars represent ±1 standard deviation.

Flexible Protocols to Support Research Needs

The EasySep™ Total Nucleic Acid Extraction Kit is engineered to adapt to a range of sample types, input volumes, and throughput requirements. Its modular, scalable design enables high-purity nucleic acid isolation across various research settings—from routine extractions to specialized DNA or RNA workflows.

Broad Compatibility Across Sample Types

To support a wide range of experimental needs, the EasySep™ kit has been validated with both human and mouse-derived inputs—including whole blood, dissociated tissues, organoids, and cultured cells. Whether using the standard, 96-well, or whole blood-specific protocol, the kit delivers consistent performance and high-purity nucleic acids across diverse biological systems.

The table below summarizes the compatible sample types and the recommended protocols for each, helping researchers confidently apply the kit across various research applications.

Table 1. Summary of Compatible Input Samples and Workflows Used*

Sample Type	Protocol(s)	Optimal Purity	Comments
Human pluripotent stem cells (hPSCs)	Standard, 96-well	✓	Validated across 7 hPSC lines.
PBMCs	Standard, 96-well	✓	
Whole Blood	Whole blood	✓	Whole blood processed directly into workflow; no red blood cell (RBC) lysis required.
PBMCs isolated using EasySep™ PBMC Selection Kit (STEMCELL Technologies)	Standard	✓	
Human bronchial epithelial cells	Standard	✓	Primary cells isolated from whole cadaveric lung, grown into airway epithelia using PneumaCult™-Ex Plus.
3D hepatic organoids	Standard	✓	Extracted from 1 - 3 Matrigel® domes per extraction. Approximately 1000 organoid fragments per dome.
3D pancreatic organoids	Standard	✓	Extracted from 1 - 3 Matrigel® domes per extraction.
3D intestinal organoids	Standard	✓	Extracted from 1 - 3 Matrigel® domes per extraction.
Dorsal forebrain organoids	Standard	✓	Extracted from singular Day 28 organoids cultured in STEMdiff™ Dorsal Forebrain Organoid Differentiation Kit.
Microglia	Standard	✓	
Mouse spleen cells (Processed with STEMprep™ Tissue Dissociator)	Standard	✓	
Mouse lung cells (Processed with STEMprep™ Tissue Dissociator)	Standard	✓	
Mouse brain cells (Processed with STEMprep™ Tissue Dissociator)	Standard	✓	

Standard = General protocol for a wide range of sample types using the ErythroClear™ Magnet

96-well = High-throughput version using the 96-Well PCR Microplate Magnet

Whole Blood = Specialized protocol for direct-from-blood extractions (with no pre-processing step: e.g. RBC lysis)

*All sample inputs are also compatible with the DNA- or RNA-specific workflow (see detailed protocols below)

DNA- or RNA-Specific Workflows

To support species-specific nucleic acid isolation, the EasySep™ Total Nucleic Acid Extraction Kit includes integrated options for enzymatic digestion directly within the extraction workflow. An optional RNase A treatment can be applied in the Standard ErythroClear™ Magnet, 96-Well PCR Microplate Magnet, and Whole Blood Protocols (Table 1) to selectively remove RNA and isolate high-purity genomic DNA. For RNA-focused workflows, the RNA Protocol includes a built-in DNase I digestion step to eliminate genomic DNA, ensuring clean RNA extracts for sensitive downstream applications.

These integrated workflows offer several advantages:

- Saves time by eliminating the need for post-extraction digestion and cleanup steps
- Reduces costs by minimizing the use of additional reagents and consumables
- Ensures purity by preventing DNA/RNA co-isolation—unlike column-based methods—yielding truly species-specific nucleic acid samples ready for downstream use

Note: *Protocols supporting DNA- or RNA-specific workflows are available. Refer to the updated Product Information Sheets (PISs) on the product page for step-by-step guidance.*

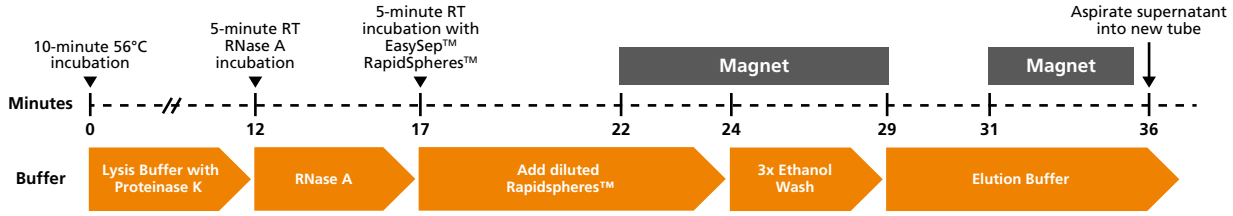

Figure 4. EasySep™ Total Nucleic Acid Extraction Kit DNA Workflow

By performing an RNase A treatment immediately after the lysis step, RNA is enzymatically degraded, resulting in a high-purity DNA extract with the EasySep™ Total Nucleic Acid Extraction Kit. RT = room temperature

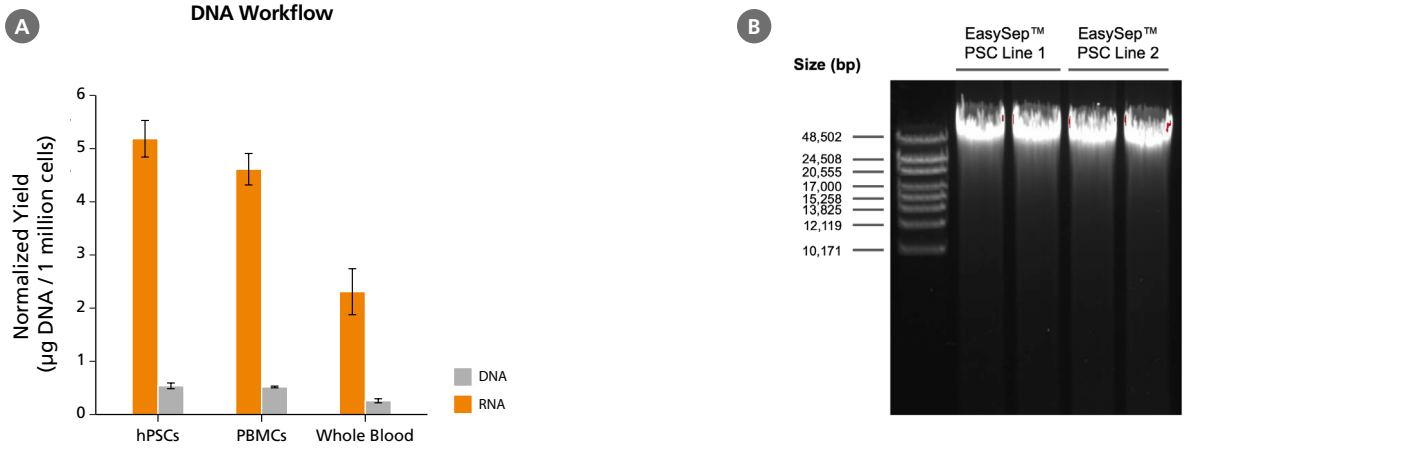

Figure 5. The EasySep™ Total Nucleic Acid Extraction Kit DNA Workflow with Integrated RNase A Digestion Step Enables Extraction of High-Quality gDNA

(A) DNA and residual RNA yield from human pluripotent stem cells (hPSCs), peripheral blood mononuclear cells (PBMCs), and whole blood using the DNA workflow with optional RNase A treatment. Extractions were performed according to the protocols from the EasySep™ Total Nucleic Acid Extraction Kit Product Information Sheet (PIS): 1 × 10^6 cells for hPSCs/PBMCs and 200 µL for whole blood, using the ErythroClear™ Magnet. DNA and RNA concentrations were measured using a Qubit™ Fluorometer. Bars show the mean of 3 replicates ± standard deviation. (B) DNA extracted from two human pluripotent stem cell (hPSC) lines using the EasySep™ Total Nucleic Acid Extraction Kit with integrated RNase A treatment was analyzed by gel electrophoresis (0.4% agarose, TAE buffer, 30V, 20 hours). The resulting bands show intact DNA, with the majority of fragments exceeding 48 kb, demonstrating the kit's ability to preserve high molecular weight DNA, which is essential for long-read sequencing, optical genome mapping, and structural variant analysis.

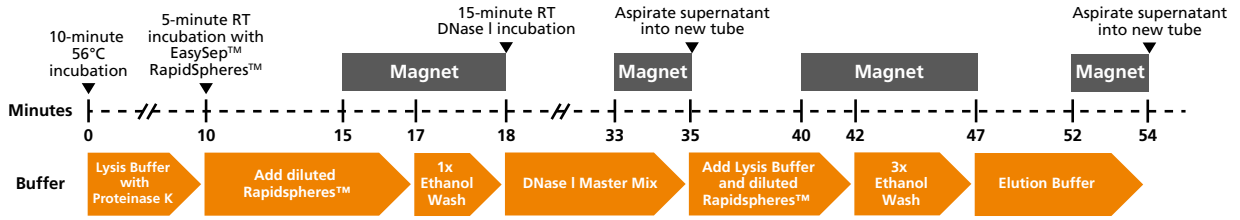

Figure 6. EasySep™ Total Nucleic Acid Extraction Kit RNA Workflow

By performing a DNase I treatment and an additional separation step into the EasySep™ Total Nucleic Acid Extraction Kit protocol, genomic DNA is effectively removed, yielding a high-purity RNA extract suitable for downstream applications. RT = room temperature

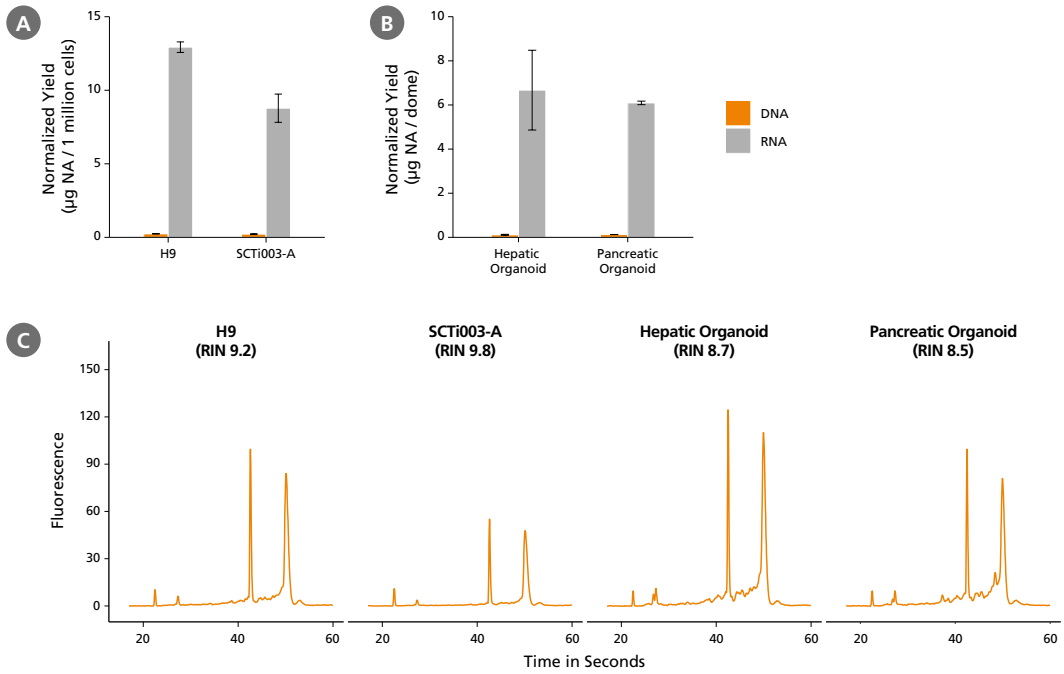

Figure 7. The EasySep™ Total Nucleic Acid Extraction Kit RNA Workflow with Integrated DNase I Digestion Step Enables Extraction of High-Integrity RNA

The EasySep™ Total Nucleic Acid Extraction Kit with integrated DNase I digestion step was used to extract RNA from a range of cell lines and organoids. (A) Normalized recovery of nucleic acids per 1 million cells across two human pluripotent stem cell (hPSC) lines (H9, SCTi003-A). Three extraction replicates were used per condition. Error bars represent ± 1 standard deviation. (B) Normalized recovery of nucleic acids per 30 µL Matrigel® dome across two organoid lines (hepatic, pancreatic). Two extraction replicates were used per condition. Error bars represent ± 1 standard deviation. (C) Agilent RNA 6000 Nano RNA Bioanalyzer traces showing optimal RNA integrity number (RIN) scores across each sample type.

Reagent Scaling for Higher Cell Inputs

To ensure high yields and purity when working with larger cell inputs, the EasySep™ Total Nucleic Acid Extraction Kit reagent volumes can be scaled up while maintaining a constant 200 µL input volume:

- 1.5X Reagent Scaling: For inputs above 2 × 10^6 cells per extraction, increase all reagent volumes by 1.5X to ensure efficient nucleic acid recovery.
- 2X Reagent Scaling: For inputs above 4 × 10^6 cells per extraction, increase reagent volumes by 2X to maintain high yield and purity.
- Consistent Input Volume: Despite reagent scaling, the 200 µL sample input volume remains unchanged, ensuring workflow consistency.
- Flexible Elution Volumes: Users can still adjust elution volumes to generate highly concentrated nucleic acid samples.

Note: *1.5X and 2X reagent scaling applies to the 1.5 mL microcentrifuge format only.*

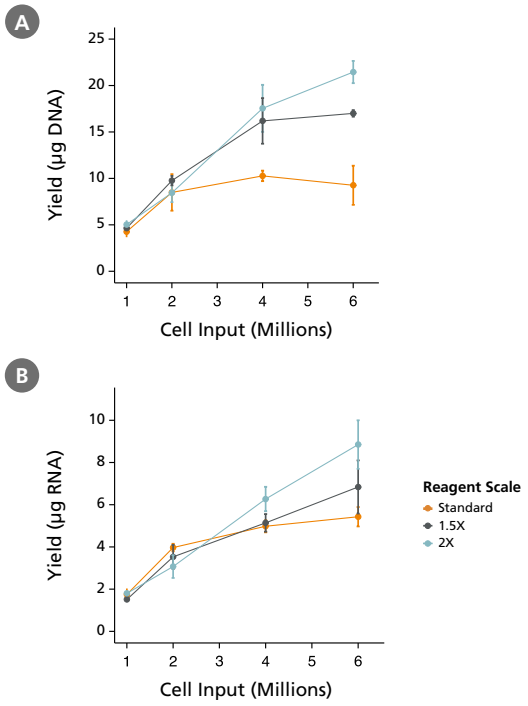

Figure 8. The Scalable Workflow of the EasySep™ Total Nucleic Acid Extraction Kit Allows for Increased Recovery of Nucleic Acids from Larger Inputs

Scalability of the EasySep™ kit is demonstrated by total nucleic acid (DNA and RNA) yields using standard (1X), 1.5X, and 2X reagent volumes. In the 1.5 mL microcentrifuge format, 1.5X scaling is recommended for inputs >2 × 10^6 cells, and 2X scaling for >4 × 10^6 cells, while maintaining a constant 200 µL sample input volume. Elution volumes remain adjustable to concentrate final yields. (A) DNA yield and (B) RNA yield from peripheral blood mononuclear cells (PBMCs). Error bars represent ±1 standard deviation; n = 2 extractions per condition.

Flexible Elution Volumes

To support a range of downstream applications that require more concentrated nucleic acid samples, the kit also allows adjustable elution volumes:

- Elution can be performed in volumes as low as 20 µL in the ErythroClear™ Magnet and 5 µL in the 96-Well PCR Microplate Magnet, enhancing nucleic acid concentration without compromising yield.
- Total yields remain consistent across tested elution volumes, providing flexibility for diverse experimental needs.

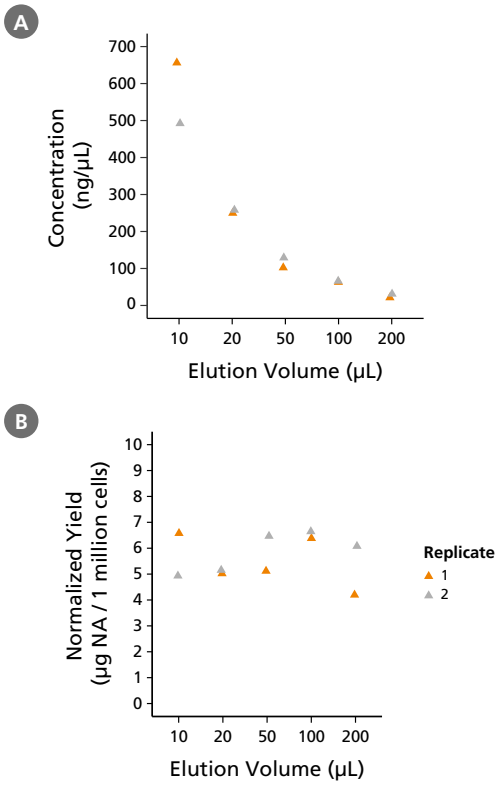

Figure 9. The EasySep™ Total Nucleic Extraction Kit Enables Flexible Elution Volumes While Maintaining Optimum Yields

(A) Elution volumes tested from 200 µL down to 10 µL in the standard format on the ErythroClear™ Magnet show a strong relationship between elution volume and concentration. (B) Normalized yield (measured as µg of nucleic acid per 1 million cells) shows consistency of total yields across elution volumes. Sample source: peripheral blood mononuclear cells (PBMCs); 2 extraction replicates per condition. NA = nucleic acid

Downstream Assay Compatibility

With reliable performance across diverse sample types, the EasySep™ Total Nucleic Acid Extraction Kit delivers high-purity RNA and DNA suitable for a wide range of molecular biology applications. From genomic and transcriptomic analyses to data-intensive sequencing workflows, the DNA and RNA isolated with this kit meet the performance requirements for sensitive and reproducible results.

High-quality DNA isolated using the EasySep™ Total Nucleic Acid Extraction Kit from the Healthy Control Human iPSC Line, Male (SCTi004-A) was successfully used for whole exome sequencing, enabling detailed genomic characterization.

See the full data here.

Applications and Compatible Techniques

The purified nucleic acids are well-suited for a variety of analytical workflows:

Application Types	Common Uses	Compatible Techniques
DNA Applications	Mutation detection Genotyping Copy number variation analysis	PCR, qPCR, whole genome sequencing, microarray, Southern blotting
RNA Applications	Gene expression studies Cell type identification	RT-qPCR, RNA sequencing, microarray, northern blotting

Summary

Here, we describe an easy-to-use, column-free kit for scalable, high-yield extraction of total nucleic acids. This magnetic bead-based workflow enables efficient isolation of both DNA and RNA across a wide range of sample types, while preserving molecular integrity and supporting scalability. Compared to traditional methods, the EasySep™ Total Nucleic Acid Extraction Kit offers improved nucleic acid recovery, reduced sample handling, and greater flexibility for high-throughput or low-input workflows. This kit also provides optional integrated RNase A or DNase I digestion protocols, allowing for selective isolation of RNA or DNA. The resulting nucleic acids are suitable for downstream applications such as PCR, RNA-seq, and whole genome sequencing.

Product Listing

Product Name	Catalog #
EasySep™ Total Nucleic Acid Extraction Kit	100-1079
ErythroClear™ Magnet	01737
96-Well PCR Microplate Magnet	100-1304

Educational Resources

- Optimized Capture and Purification of Nucleic Acid Using the EasySep™ Total Nucleic Acid Extraction Kit, A Robust Magnetic Particle-Based Extraction System
- Streamline Your Tissue Processing Using the Automated STEMprep™ Tissue Dissociator
- Tools for Your Immunology Research

Copyright © 2025 by STEMCELL Technologies Inc. All rights reserved including graphics and images. STEMCELL Technologies & Design, STEMCELL Shield Design, Scientists Helping Scientists, and EasySep , ErythroClear, STEMprep, PneumaCult, STEMdiff, and RapidSpheres are trademarks of STEMCELL Technologies Canada Inc. All other trademarks are the property of their respective holders. While STEMCELL has made all reasonable efforts to ensure that the information provided by STEMCELL and its suppliers is correct, it makes no warranties or representations as to the accuracy or completeness of such information.

UNLESS OTHERWISE STATED, PRODUCTS ARE FOR RESEARCH USE ONLY AND NOT INTENDED FOR HUMAN OR ANIMAL DIAGNOSTIC OR THERAPEUTIC USES. FOR PRODUCT-SPECIFIC COMPLIANCE AND INTENDED USE INFORMATION, REFER TO THE PRODUCT INFORMATION SHEET. GENERAL INFORMATION ON QUALITY AT STEMCELL MAY BE FOUND AT WWW.STEMCELL.COM/COMPLIANCE.