Bioptic Inc.

A Global Leader in Capillary Electrophoresis Technology

01 | **Sample Preparation**

02 | **Fragment Analysis**
Qsep Series Bio-fragment Analyzer

03 | **Automatic Report Generation**

CONTENT

Wide Range of Applications

Qsep Series Bio-Fragment Analyzers offer a comprehensive solution tailored for academic institutions in the field of life sciences, the biotechnology industry, and clinical facilities. These analyzers are highly versatile, capable of handling a wide range of DNA, RNA, and protein samples.

For DNA analysis, they furnish both the qualitative and quantitative results, enabling users to evaluate the size and concentration of their DNA samples. In RNA applications, the Qsep platform assesses the quality of RNA samples, providing valuable metrics to determine their suitability for downstream applications.

In protein-related studies, Qsep series provides users with critical information regarding protein sample size, purity, and profiles. These results find applications in academic research and the pharmaceutical industry, contributing to advancements in various fields of science and medicine.

DNA

- Genomic/plasmid DNA
- NGS Library QC
- Multiplex PCR
- CRISPER
- cfDNA
- SNP
- RFLP
- MDx

RNA

- Total RNA QC
- RNA Fragment Analysis
- Low Concentration of RNA

PROTEIN

- Protein Profiling
- Antibody Purity Analysis

Qsep Series to Meet Your Needs

We offer a variety of automated capillary electrophoresis instruments designed to enhance the advanced quality assessment of nucleic acid or protein samples. Whether you're processing a few samples or hundreds daily, our Qsep series offers adaptable solutions tailored to your requirements.

Please refer to the graphic below to identify the most suitable model and embark on a journey toward obtaining reliable results.

How to choose your Qsep series instrument?

SAMPLE CAPACITY

4-96

Qsep$_{400}$

4- channel
4~96 sample capacity
For NGS library QC: 96 sample in 1.5 hours

Qsep$_{100}$

Qsep$_{100}$ Advance

1-96 ------- Single channel
1~96 sample capacity

Qsep$_1$ - Plus

1-16 ------- Single channel
1~16 sample capacity

Qsep$_1$ - Lite

Qsep$_1$

1-8 ------- Single channel
1~8 sample capacity

THROUGHPUT

Qsep Series Bio-Fragment Analyzers

Qsep Series Bio-Fragment Analyzers employ capillary electrophoresis technology, featuring a unique gel matrix composition that replaces traditional gel molecules. This innovative approach creates a specialized "sieve" within the capillary, enabling the precise separation and analysis of biomolecule fragments. With Qsep, you can individually analyze DNA, RNA, proteins, and glycans using a range of disposable pen-shaped capillary gel cartridges, each formulated for specific applications, all managed through the intuitive Q-Analyzer software and database. This fully automated instrument, combined with ready-to-use cartridges, streamlines the setup process, allowing you to commence analysis within minutes.

Starting your analysis in 3 easy steps

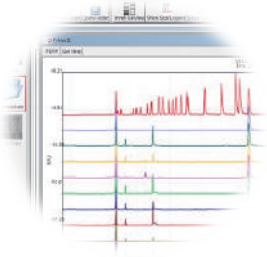
1

▲ Insert the cartridge ▲

2

▲ Load your samples and buffers ▲

3



▲ Click 'Run' to do the analysis ▲
and receive results in just 2-7 mins

Key highlights of *Qsep* system

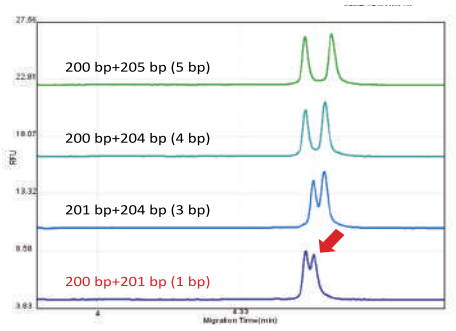
- User-Friendly
- High Sensitivity
- High Resolution
- Ready-to-Use Gel Cartridge
- Cost-Effective
- Sample Flexibility
- Minimal Sample Consumption
- Ideal for NGS QC

Key Performance Features of *Qsep* Series

High Resolution

Qsep series platform can resolve DNA samples with as little as a 1bp difference.

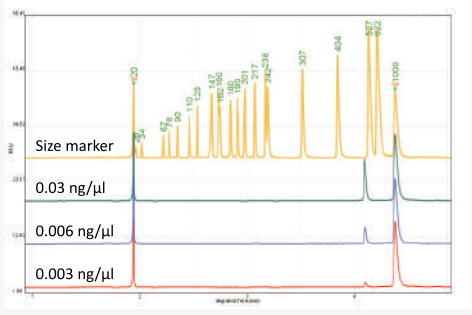
Qsep series, equipped with the customized C1 cartridge, excels at separating fragment mixtures, successfully resolving known sizes such as 200/205 bp, 200/204 bp, 201/204 bp, and 200/201 bp, each differing by 5 bp, 4 bp, 3 bp, and 1 bp, respectively.



High Sensitivity

Qsep series system is capable of analyzing samples at extremely low concentrations, down to picogram level.

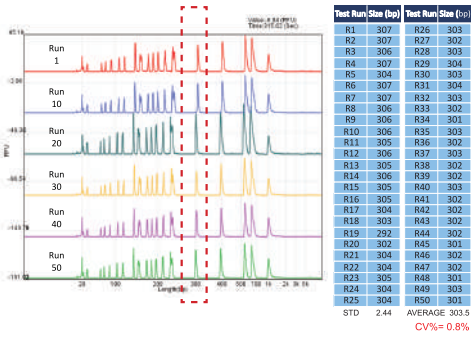
Qsep series offers a wide detection range, spanning from the nanogram level down to the picogram level. When utilizing the High Sensitivity Cartridge, it can achieve a detection limit of below 5 pg/µl. This exceptional sensitivity makes it particularly adept at detecting low-concentration samples, including cell-free DNA.



High Reproducibility

Qsep series provides consistently reliable sizing results.

The results consistently demonstrate high reproducibility when performing repetitive tests using size markers on Qsep series systems. The 307 bp fragment within the size marker exhibits an impressive precision value, boasting a minimal coefficient of variation (CV) of just 0.8% across 50 repeat runs.



Test Run	Size (bp)	Test Run	Size (bp)
R1	307	R26	303
R2	307	R27	302
R3	306	R28	303
R4	307	R29	304
R5	304	R30	303
R6	307	R31	304
R7	307	R32	303
R8	306	R33	302
R9	306	R34	301
R10	306	R35	303
R11	305	R36	302
R12	306	R37	303
R13	305	R38	302
R14	306	R39	302
R15	305	R40	303
R16	305	R41	302
R17	304	R42	302
R18	303	R43	302
R19	292	R44	302
R20	302	R45	301
R21	304	R46	302
R22	304	R47	302
R23	305	R48	301
R24	304	R49	303
R25	304	R50	301
STD	2.44	AVERAGE	303.5
		CV%=	0.8%

Specification

	Qsep $_1$-Lite	*Qsep* $_1$	*Qsep* $_1$ -Plus	*Qsep* $_{100}$	*Qsep* $_{100}$ Advance	*Qsep* $_{400}$
Separation Voltage	1~8 kV	1~8 kV	1~8 kV	1~15 kV	1~15 kV	1~15 kV
Connection	Cable	Wi-Fi & Cable	Wi-Fi & Cable	USB	USB	USB
Power Source	AC 100-240 V	AC 100-240 V	AC 100-240 V	AC 100-240 V	AC 100-240 V	AC 100-240 V
Power	80 W	80 W	80 W	30 W	30 W	60 W
System Weight	5.5 kgs	5.5 kgs	5.5 kgs	15 kgs	15 kgs	26 kgs
Dimension	24×21×30 cm	24×21×30 cm	24×21×30 cm	38x30x40 cm	38x30x40 cm	54x40x36 cm
System Type	1-Channel Portable System	1-Channel Portable System	1-Channel Portable System	1-Channel Standard System	1-Channel Standard System	4-Channel System
Automated Sampling	1~8 samples	1~8 samples	1~16 samples	1~96 samples	1~96 samples	4~96 samples
Minimum Sample Volume	10 µL (0.1 mL tube), 20 uL (0.2 mL Tube)	2 µL (Micro-vial), 10 µL (0.1 mL Tube), 20 µL (0.2 mL Tube)	2 µL (Micro-vial), 10 µL (0.1 mL Tube & 16+3 well sample Tube), 20 µL (0.2 mL Tube)	2 µL (Micro-vial), 10 µL (0.1 mL Tube), 20 µL (0.2 mL Tube)	2 µL (Micro-vial), 10 µL (0.1 mL Tube), 20 µL (0.2 mL Tube)	2 µL (Micro-vial), 10 µL (0.1 mL Tube), 20 µL (0.2 mL Tube)

Qsep$_1$ Series Bio-Fragment Analyzers

The Qsep1 series presents a portable capillary electrophoresis system suitable for diverse application fields, including research labs, clinical facilities, and on-site testing scenarios. If your laboratory handles a lower volume of samples, the Qsep1 series instrument offers an ideal solution, combining efficiency and flexibility in fragment analysis.

Key Features of *Qsep*$_1$ Series

- User-Friendly Operation
- High Sample Flexibility
- Compact and Portable Capillary Electrophoresis System
- Capability for On-Site Detection when paired with ***Qamp***$_{mini}$ (a palm-sized PCR machine)

Ideal Occasions or Applications for the *Qsep*$_1$ Series

- Handling Few Samples Per Day
- Small-Scale Clinics, University Laboratories, and Research Institutes
- On-Site Testing (Point of Care Testing - POCT)
- Next-Generation Sequencing Quality Control (NGS QC)

Meet *Qsep*$_1$ System

Qsep $_1$ -Lite

Each cartridge is paired with a method and is easy to operate

Qsep $_1$

Wide Range of Applications

Qsep $_1$ -Plus

Extended application capability with increased sample capacity

	Qsep $_1$ -Lite	*Qsep* $_1$	*Qsep* $_1$ -Plus
System	Entry-level portable CE system	Professional portable CE	Advanced portable CE system
Capacity	1-8 samples	1-8 samples	1-16 samples
Sensitivity	★ ★ ★	★ ★ ★ ★ ★	★ ★ ★ ★ ★

Simplified Software Mode

$Qsep_{100}$ Series Bio-Fragment Analyzers

Qsep100 is the standard-sized automated Bio-Fragment Analyzer and represents the classic model within the Qsep series. Its single-channel design allows user to analyze 1 to 96 samples without unnecessary consumable waste. This instrument offers high sample flexibility, makes it well-suited for laboratories, biotechnology companies, and research centers with medium-throughput sample requirements. Qsep100 supports a diverse range of applications, including DNA and RNA quality and quantity assessment in NGS workflow, rapid screening of PCR products using high voltage analytic methods, and protein sizing and profiling.

Key Features of $Qsep_{100}$ Series

- User-Friendly Operation
- High Sample Flexibility: Analyze 1-96 samples per run
- Versatile Application Support Across Various Fields

Ideal Occasions or Applications for $Qsep_{100}$ Series

- Handling Less Than 200 Samples Per Day
- Biotechnology Companies
- Protein Sizing and Purity Assessment
- Next-Generation Sequencing Quality Control (NGS QC)
- General Research and Clinical Labs with a Focus on Molecular Biology

Meet $Qsep_{100}$ system

$Qsep_{100}$

Ideal for DNA and RNA Analysis

Rapid Analysis: 2~7 mins per sample

$Qsep_{100}$ Advance

Perfect for DNA, RNA, and Protein Analysis

	$Qsep_{100}$	$Qsep_{100}$ Advance
Capacity	1-96 samples	1-96 samples
Sensitivity		
★★★★★	S Series and RNA Cartridge	★★★★
★★★★★	N Series Cartridge	★★
★★★	P Series Cartridge (compatible dyes)	★★★★★ (alexa488)

$Qsep_{400}$ Series Bio-Fragment Analyzer

Qsep400 stands out as the high-throughput instrument within the Qsep Series Bio-Fragment Analyzer lineup. It boasts a 4-channel cartridge chamber, allowing users to simultaneously analyze 4 samples, thereby accelerating the analysis time by a factor of 4 (2-7 minutes for 4 samples).

Key Features of $Qsep_{400}$

- User-Friendly Operation
- Integrated PC and Touch Screen
- Rapid and Automatic System: Achieve results in 2-7 minutes for 4 samples
- Exceptional SampleFlexibility: Analyze 4-96 samples
- Ideal for NGS Library QC: 96 samples in 1.5 hours

Ideal Occasions or Applications for $Qsep_{400}$

- Analyzing More Than 96 Samples
- High-Throughput Requirements
- Clinical or Research Centers
- NGS Service Centers
- Customized Integration API Service

Meet $Qsep_{400}$ System

$Qsep_{400}$

System

Professional portable CE

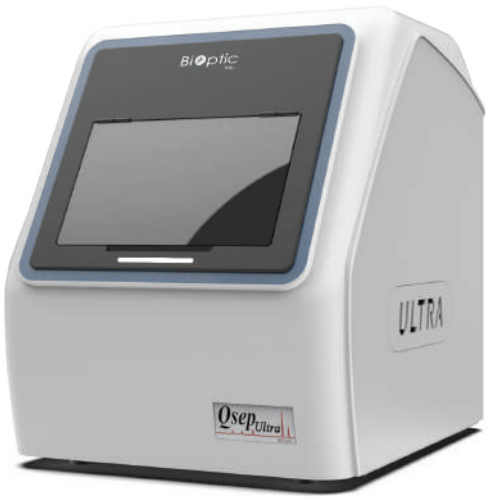
An Integrated PC and User-Friendly Touch Screen Interface

Wide Range of Applications

NEW

ONE FOR ALL **Qsep$_{Ultra}$**

Bio-fragment Analyzers



1. Sample Collection

2. PCR Amplification & Capillary Electrophoresis

Highlights

- Streamlined Molecular Diagnosis Solution in Just Two Steps
- Integration of PCR Amplification and Capillary Electrophoresis within a Single System
- Qualitative and Quantitative Analysis in a Single Analysis
- High Resolution, Sensitivity, and Reproducibility
- Export Reports in PDF, Word, or Excel Formats
- Zero Toxic Contact Risk
- Eliminates the Need for Gel Preparation

Mutiple Applications

- PCR Product Screening
- Restriction Fragment Length Polymorphism (RFLP)
- CRISPR QC
- Genomic DNA Analysis
- Plasmid DNA QC
- High Molecular Weight DNA Analysis
- Cell-Free DNA QC
- Total RNA QC
- RNA analysis

Specifications of Qsep$_{Ultra}$

- Separation Voltage: 2-8 kV
- Connection: Wi-Fi & Cable
- Power Source: AC 100-240 V
- Maximum Power: 160 W
- System Weight: 13 kg
- Dimension: 34.6* 27.0* 36.2 cm
- System Type: 1 Channel Portable System
- Automated Sampling: 1~8 samples

Cartridge Specifications #1

Choose the right cartridge to get the perfect results.

Application Type	DNA Qualitative Cartridge Kit					
Cartridge Name	Standard Cartridge (S2)	High Resolution Cartridge (S1)	Fast Cartridge (F3)	High Sensitivity Cartridge (N1)	Kilobase Cartridge (S3)	High Sensitivity Kilobase Cartridge (N3)
Cat. No.	C105101 (1 pc) C105201 (2 pcs) C105801 (8 pcs) **C405101	C105102 (1 pc) C105202 (2 pcs) C105802 (8 pcs) **C405102	C105103 (1 pc) C105203 (2 pcs) C105803 (8 pcs) **C405103	C105105 (1 pc) C105205 (2 pcs) **C405105	C105106 (1 pc) C105206 (2 pcs) C105806 (8 pcs) **C405106	C105153 (1 pc) C105253 (2 pcs) **C405153
Size Range	10-5000 bp	10-5000 bp	10-5000 bp	10-5000 bp	10-60000 bp Detection Range: 10bp~165kbp	10-60000 bp Detection Range: 10bp~165kbp
L.O.D	0.1 ng/µL* 2 pg/µL in water*	0.1 ng/µL* 2 pg/µL in water*	0.1 ng/µL* 2 pg/µL in water*	5 pg/µL* 1 pg/µL in water*	0.1 ng/µL* 2 pg/µL in water*	20 pg/µL* 1 pg/µL in water*
Best Resolution***	4~10 bp	1~4 bp	10 bp	1~4 bp	4~10 bp	4~10 bp
Analysis Time (per sample)	2-3 mins	3-5 mins	1-2 mins	2-3 mins	9-21 mins 5 mins (below 1 kb)	9-25 mins 3 mins (below 1 kb)
Sample Number (per cartridge)	200 runs	200 runs	300 runs	100 runs	200 runs	100 runs
Sample Consumption (per run)	<0.1 µL	<0.1 µL	<0.1 µL	<0.1 µL	<0.1 µL	<0.1 µL
Recommended Sample Volume	0.1 mL tube: 10 µL 0.2 mL tube: 20 µL Micro-vial: 2 µL[Δ]	0.1 mL tube: 10 µL 0.2 mL tube: 20 µL Micro-vial: 2 µL[Δ]	0.1 mL tube: 10 µL 0.2 mL tube: 20 µL Micro-vial: 2 µL[Δ]	0.1 mL tube: 10 µL 0.2 mL tube: 20 µL Micro-vial: 2 µL[Δ]	0.1 mL tube: 10 µL 0.2 mL tube: 20 µL Micro-vial: 2 µL[Δ]	0.1 mL tube: 10 µL 0.2 mL tube: 20 µL Micro-vial: 2 µL[Δ]
Guaranteed Shelf Life	6 months	6 months	4 months	4 months	6 months	4 months

L.O.D.: 2 pg/ µL (If diluted in the water)

*Determined by the DNA ladder (15-622 DNA size marker: C109200)

**Cat. No. of 4-channel cartridge

***Best Resolution: when the target fragments < 500 bps, it can meet this speification

Δ Micro-vial (Cat. No. C104250)

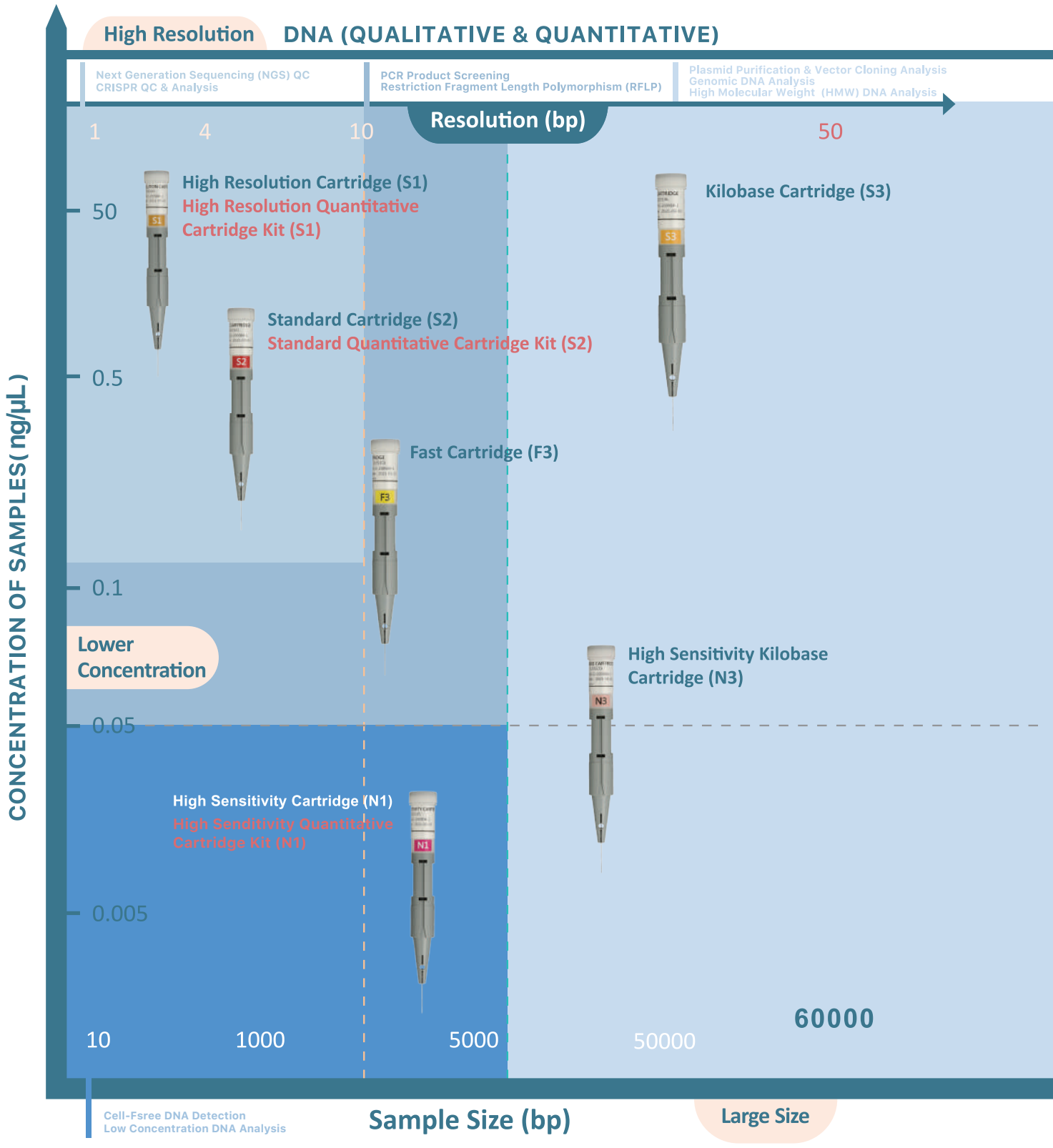
Cartridge Specifications #2

Choose the right cartridge to get the perfect results.

Application Type	DNA Quantitative Cartridge Kit			RNA Cartridge Kit		Protein Cartridge Kit
Cartridge Name	Standard Quantitative Cartridge (S2)	High Resolution Quantitative Cartridge (S1)	High Sensitivity Quantitative Cartridge (N1)	RNA Cartridge (R1)	High Sensitivity RNA Cartridge (NR1)	Protein Cartridge (P2)
Cat. No.	C105201- Q (2 pcs) **C405101- Q	C105202- Q (2 pcs) **C405102- Q	C105105- Q (1 pc) C105205- Q (2 pcs)	C105110 (1 pc) C105210 (2 pcs) C105810 (8 pcs) **C405110	C105111 (1 pc) C105211 (2 pcs) **C405111	C105121 (1 pc) C105221 (2 pcs) **C405121
Size Range	10~5000 bp	10~1500 bp	10~5000 bp	10~6000 nt	10~6000 nt	11~155 kDa Detection Range: 11~660 kDa
L.O.D	0.1 ng/μL* 2 pg/μL in water*	0.1 ng/μL* 2 pg/μL in water*	5 pg/μL* 1 pg/μL in water*	5 ng/μL* 1 ng/μL in water*	1 ng/μL* 0.2 ng/μL in water*	0.5 ng/μL (BSA)
Best Resolution	4~10 bp	1~4 bp	1~4 bp	N/A	N/A	N/A
Analysis Time (per sample)	2~3 mins	3~5 mins	2~3 mins	5~8 mins	5~8 mins	6 mins (BSA) 10 mins (IgG)
Sample Number (per cartridge)	200 runs	200 runs	100 runs	100 runs	100 runs	100 runs
Sample Consumption (per run)	<0.1 μL	<0.1 μL	<0.1 μL	<0.1 μL	<0.1 μL	<0.1 μL
Recommended Sample Volume	0.1 mL tube: 10 μL 0.2 mL tube: 20 μL Micro vial: 2 μL[Δ]	0.1 mL tube: 10 μL 0.2 mL tube: 20 μL Micro vial: 2 μL[Δ]	0.1 mL tube: 10 μL 0.2 mL tube: 20 μL Micro vial: 2 μL[Δ]	0.1 mL tube: 10 μL 0.2 mL tube: 20 μL Micro vial: 2 μL[Δ]	0.1 mL tube: 10 μL 0.2 mL tube: 20 μL Micro vial: 2 μL[Δ]	0.1 mL tube: 10 μL 0.2 mL tube: 20 μL Micro vial: 2 μL[Δ]
Guaranteed Shelf Life	6 months	6 months	4 months	4 months	4 months	4 months

Map of Various Cartridges

Size vs Concentration — #DNA



Map of Various Cartridges

Size vs Concentration **#RNA#Protein**

RNA | Protein

RNA Cartridge (R1)

Total RNA QC
mRNA QC
CRISPR QC Analysis

Protein Cartidge (SDS) (P2)

Sample Size Rang: 11-155 kDa
Replace
SDS-PAGE IgG purity test

5 ng/μL
(1 ng/μL in water)

High Sensitivity RNA Catridge (NR1)

Low concentration RNA sample
CRISPR QC Analysis

1 ng/μL
(0.2 ng/μL in water)

Choose the Correct Cartridges to Get Perfect Results

#DNA

	Standard Cartridge (S2)	High Resolution Cartridge (S1)	Kilobase Cartridge (S3)	Fast Cartridge (F3)	High Sensitivity Cartridge (N1)	High Sensitivity Kilobase Cartridge (N3)
PCR Product Screening	✓	✓		✓		
Restrictio Fragment Length Polymorphism (RFLP)	✓	✓		✓		
Plasmid Purification& Vector Cloning Analysis			✓			✓
Next Generation Sequencing (NGS) QC	✓					
Genomic DNA Analysis			✓			✓
High Molecular Weight (HMW) DNA Analysis			✓			✓
Cell- free DNA Detection					✓	
Low Concentration DNA Analysis					✓	✓
Total RNA QC						
mRNA QC						
Low Concentration RNA Analysis						
CRISPR QC & Analysis	✓	✓				
Protein Analysis						
Protein Purity Check						

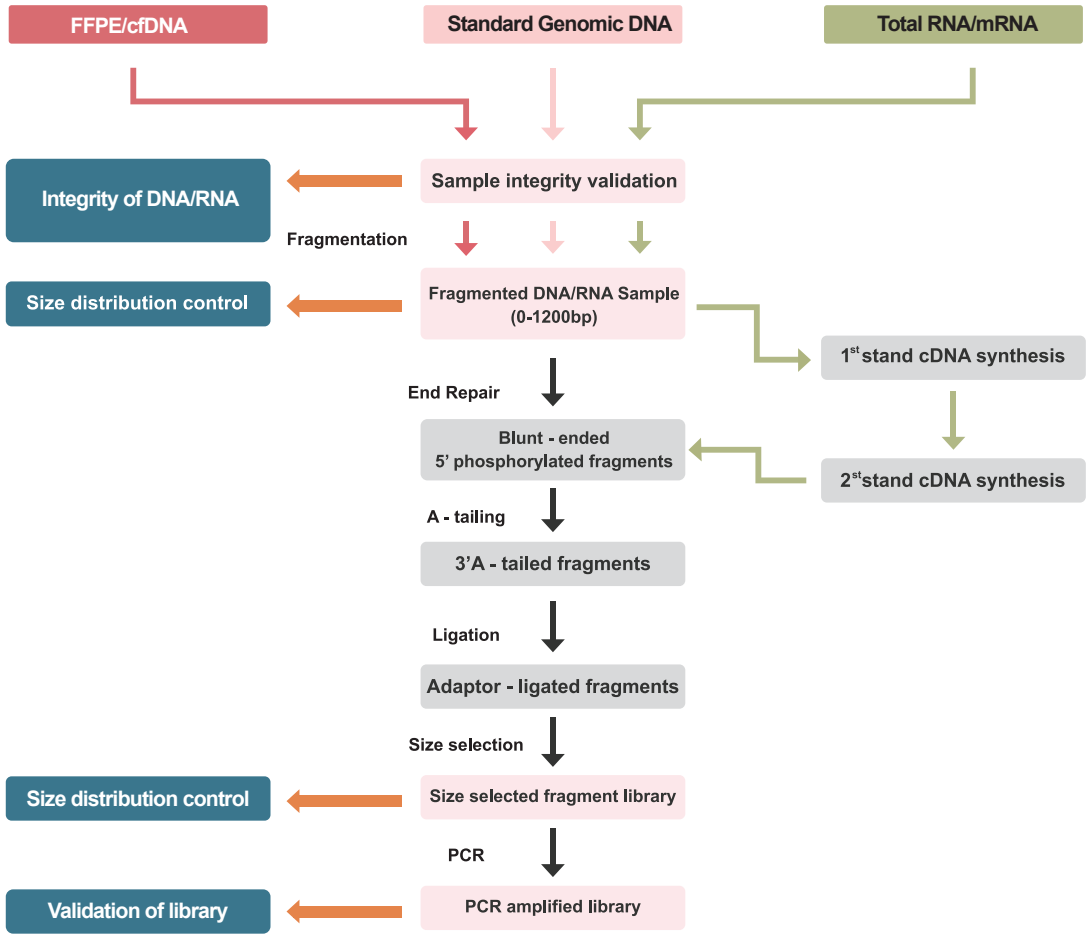
Choose the Correct Cartridges to Get Perfect Results

#RNA #Protein

	RNA Cartridge (R1)	High Sensitivity RNA Cartridge (NR1)	Protein Cartridge (P2)
PCR Product Screening			
Restrictio Fragment Length Polymorphism (RFLP)			
Plasmid Purification& Vector Cloning Analysis			
Next Generation Sequencing (NGS) QC			
Genomic DNA Analysis			
High Molecular Weight (HMW) DNA Analysis			
Cell- free DNA Detection			
Low Concentration DNA Analysis			
Total RNA QC	✓	✓	
mRNA QC	✓	✓	
Low Concentration RNA Analysis		✓	
CRISPR QC & Analysis	✓	✓	
Protein Analysis			✓
Protein Purity Check			✓

Next Generation Sequencing (NGS)

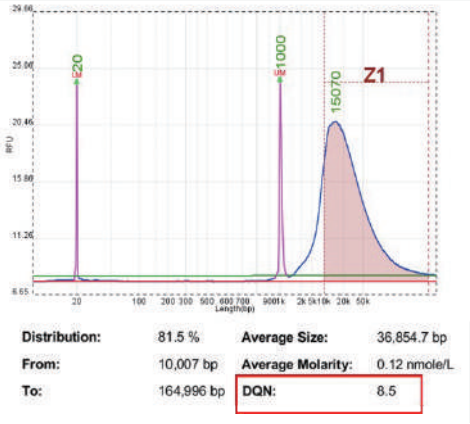
Next Generation Sequencing (NGS) has become widespread use in diverse domains such as research, biotech industry, and clinical diagnostics. As NGS technology continues to advance rapidly, numerous commercial NGS platforms have been introduced. While these NGS platforms are based on distinct principles, the sample preparation stage remains pivotal across all of them. Quality control of sample preparation for NGS is essential to ensure the attainment of reliable sequencing results. There are several checkpoints in library preparation workflow (below image). Qsep Series Systems provides an ideal quality control platform for DNA/RNA sample integrity check, size distribution control, and library validation. For users with different throughput needs, BiOptic provides various types of instruments (Qsep1, Qsep100, Qsep400) meeting the end users requirements. Throughputs of 1-to-96 samples can be analyzed utilizing the Qsep Series Products improving efficiency and lowering cost.



Key Highlights

- Ideal QC Platform: Encompasses all NGS QC steps from upstream gDNA and total RNA to the final library sample.
- All-in-One: Simultaneously acquires size and concentration data within a single run for your library sample.
- High Flexibility: Eliminates the need for sample collection, enhancing workflow efficiency.
- Reliable Standard: Equips the NGS quality control process with standardized tools, such as DQN and RQN, ensuring consistent and dependable results.

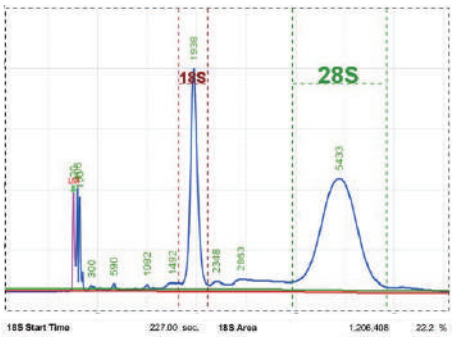
Quality Control (QC) Steps in NGS Workflow Utilizing Qsep Series Instruments



Distribution:	81.5 %	Average Size:	36,854.7 bp
From:	10,007 bp	Average Molarity:	0.12 nmole/L
To:	164,996 bp	DQN:	8.5

Genomic DNA (gDNA) Integrity Check

Utilizing Kilobase and High Sensitivity Kilobase Cartridge (S3 & N3), distinguishing between intact and degraded gDNA becomes seamless. Q-Analyzer software augments by furnishing a DNA Quality Number (DQN) calculated from a user-defined threshold, which aids in determining the quality of gDNA samples. Example: An gDNA sample analyzed using the S3 cartridge with a 10K threshold, yields a DQN of 8.5.

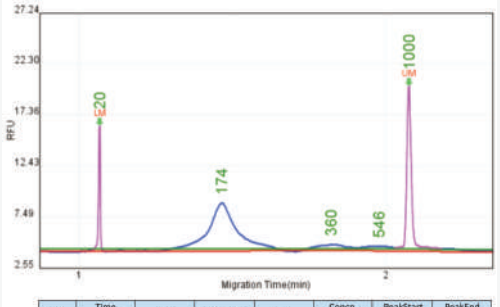


18S Start Time	227.00 sec.	18S Area	1,206,408 22.2 %
18S End Time	244.60 sec.	28S Area	3,145,641 58.0 %
28S Start Time	292.00 sec.	Ratio (28S / 18S)	2.61
28S End Time	354.60 sec.	RNA Quality Number	9.84
Total Peak Area	5,423,216	DV200	98.3 %

Total RNA Quality Control

Employing RNA cartridges (R1 & NR1) facilitates RNA sample quality assessment. Q-Analyzer software automatically designates the 18S/28S region and furnishes the RNA Quality Number (RQN), allowing swift determination of suitable samples for downstream applications. Additionally, DV200 serves as an indicator for FFPE RNA samples.

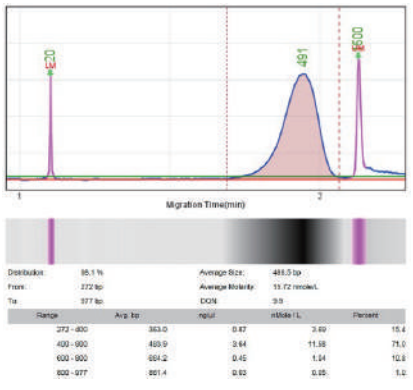
* 50 ng/µL total RNA sample analyzed by R1 cartridge



No	Time (sec.)	RFU	PeakArea	bp	Concn. (pg/µl)	PeakStart (sec.)	PeakEnd (sec.)
1	64.04	12.10	109,640	20	N/A	62.68	64.64
2	87.96	4.63	782,171	174	70.91	75.00	102.24
3	109.36	0.58	99,318	360	7.01	102.60	114.32
4	118.68	0.47	71,608	546	5.07	114.36	121.72
5	124.56	15.93	462,608	1000	N/A	121.72	131.16

Cell-Free DNA (cfDNA) Quality Control

Qsep series systems along with High Sensitivity Cartridge (N1) yield reliable size and purity results of cfDNA within approximately 2-3 minutes. Even low concentration cfDNA, down to 5pg/µl, can be detected, and potential contamination within gDNA sample can be efficiently resolved. Example: cfDNA in 0.5X Dilution Buffer analyzed with N1 cartridge.



Fragmented and Library Sample Validation

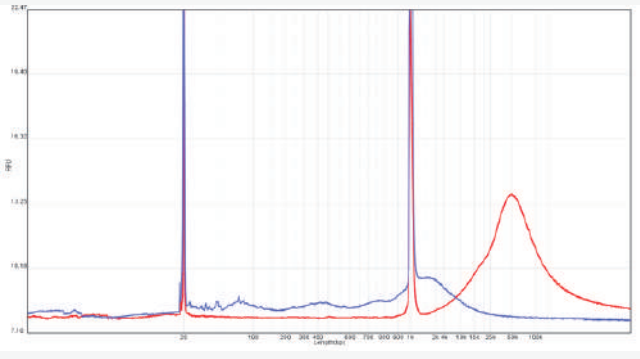
The size distribution and concentration are two pivotal metrics for determining the quality of fragmented or library samples. The Quantitative Standard Cartridge (S2) Kit empowers the swift provision of dependable qualification and quantification results in 2-3 minutes.

Quality Control of the Third-Generation Sequencing Library

Presently, the most widely embraced third-generation sequencing technologies encompass Single-Molecule Real-Time Sequencing (SMRT) by Pac Bioscience and Nanopore sequencing by Oxford Nanopore Technologies. Third-generation sequencing holds the capacity to deliver long reads (≥ 10 kb) suitable for high-quality genome assembly. However, to ensure qualified reads post-sequencing, library construction and quality check are important for third-generation sequencing.

Qsep series platforms offer sizing information up to 60 kb, proving to be powerful tools for quality checks during library construction. Furthermore, Qsep series exhibits high sensitivity and reproducibility, granting scientists the ability to generate reliable and high-quality results even when utilizing limited sample amounts. This capability is particularly valuable for third-generation sequencing, where the availability of long reads and quality library construction are fundamental for accurate and insightful genetic analyses.

Workflow of third-generation sequencing library construction: The process of constructing libraries for third-generation sequencing entails several steps, with main quality checkpoints highlighted in light green.



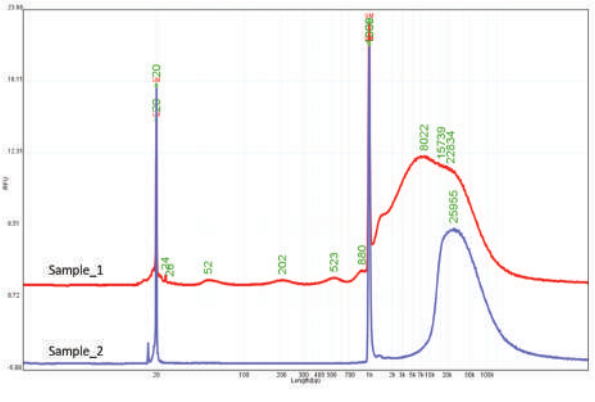
gDNA-1

Distribution	81.7 %
From	1,372 bps
To	164,955 bps
Average Size	52,707.2 bps
Average Mplarity	0.06 nmole/ L
DQN	9.9

gDNA-2

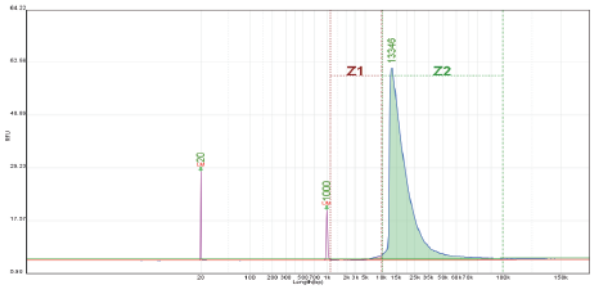
Distribution	43.2 %
From	1,341 bps
To	164,829 bps
Average Size	12,771.2 bps
Average Mplarity	0.07 nmole/ L
DQN	5.2

Two genomic DNA samples undergo analysis using S3 cartridge (Kilobase Cartridge) on Qsep100 after extraction. The first sample (gDNA-1) exhibits an average size of 52,707 bp and showcases high integrity (DNA Quality Number, DQN= 9.9). In contrast, the second sample (gDNA-2) shows partial degradation (DQN= 5.2).



The genomic DNA is sheared using the Covaris® g-TUBE® to prepare for 10 kb library construction.

The sheared DNA is then analyzed by S3 cartridge (Kilobase Cartridge) on Qsep100 before (Sample_1) and after (Sample_2) purification.



Zone1		Zone2	
Distribution	1.5%	Distribution	97.6%
From:	1,147 bp	From:	10,006 bp
To:	9,991 bp	To:	99,993 bp
Average Size:	6,793 bp	Average Size:	20,761 bp
Average Molarity:	6,116.35 nmole/L	Average Molarity:	248,407.50 nmole/L

The electropherogram of DNA library, which is being readied for SMRT sequencing by PacBio SMRTbell 10 kb Template Preparation Kit, is present on Qsep100. The library showcases a distinct cut-off pattern on Qsep100. Notably, the distribution of fragments over 10 kb accounts for 97.8% (Z2 region).

Quality Control of High Molecular Weight DNA (HMW DNA)

In the continually evolving biotechnology industry, advancements enable the isolation of progressively longer segments of DNA with high molecular weight (HMW DNA), greatly benefiting genome research. The quality of HMW DNA holds significant importance for downstream applications like third-generation sequencing. The utilization of Kilobase Cartridge Kits (S3, C105206) or High Sensitivity Kilobase Cartridge Kits (N3, C105253) with Qsep series instrument introduces a novel biomolecule analysis platform that offers a rapid, user-friendly, and reliable solution for HMW DNA quality control.

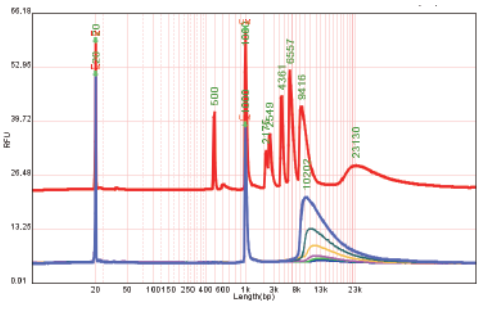
Features

- Extensive Sizing Range: Up to 60 kb
- High Sensitivity: Limit of detection (LOD) as low as 50 pg/μl
- Rapid Analysis: 4 samples/10 minutes
- High Stability: Coefficient of variation (CV%) ≤ 2.0%
- User-Friendly: Initiate analysis in just 3 steps

Applications

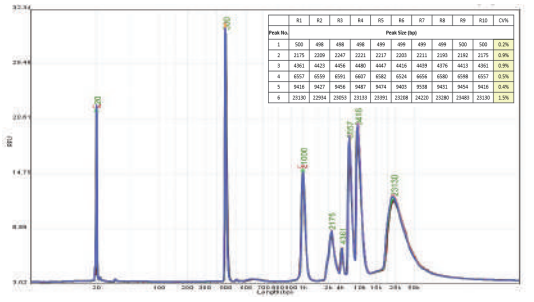
- ✓ Plasmid Quality Control (QC)
- ✓ Genomic DNA QC
- ✓ Third-Generation Library QC

High Sensitivity



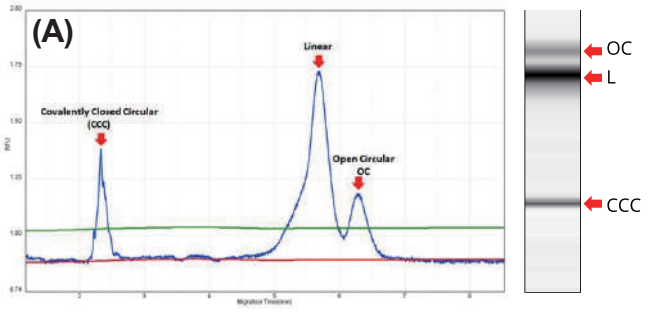
A 10 kb library is serially diluted and analyzed using High Sensitivity Kilobase Cartridge, N3, on Qsep100 instrument. The limit of detection (LOD) reaches 32.75 pg/μL.

High Reproducibility



Using the S3 cartridge on Qsep100, a 500 bp – 23 kb size marker (C109700) is repeatedly tested, demonstrating remarkable reproducibility in sizing results. The coefficient of variation (CV%) remains below 2.0% for each peak.

• Plasmid QC

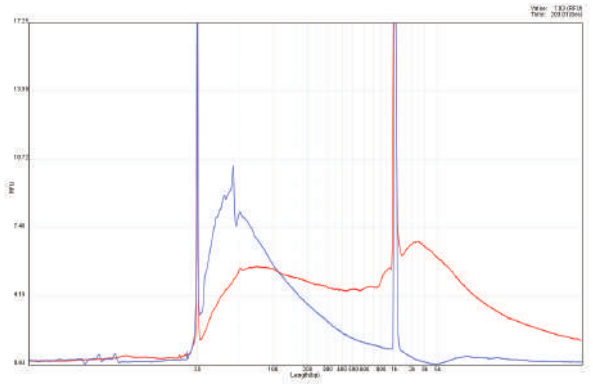


Electropherograms of purified plasmid DNA are analyzed using S3 cartridge on Qsep100. A) The plasmid DNA exhibits 3 characteristic structures: covalently closed circular (CCC), liner (L), and open circular (OC) forms. B) Plasmid digestion by a restriction enzyme generates 2 fragments, 15 kb and 42 kb.

Analysis of Samples Extracted From Tissues Preserved in Formalin-fixed, Paraffin-embedded (FFPE) Form

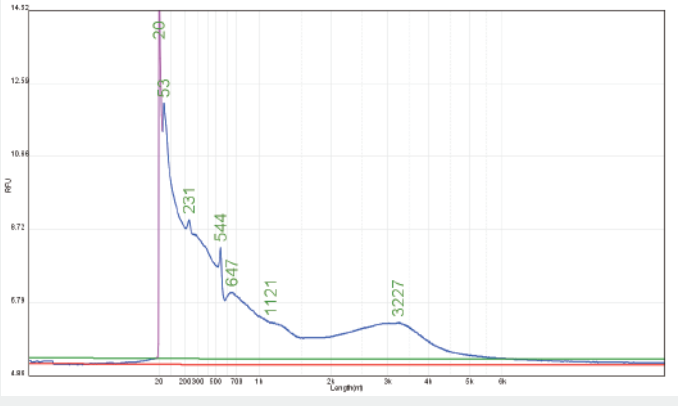
The use of formalin-fixed, paraffin-embedded (FFPE) tissues for pathological diagnosis provides invaluable opportunities to profile gene expression and explore various diseases. Storing FFPE blocks at room temperature over extended periods is more economically advantageous compared to the storage of frozen tissues at extremely low temperatures due to considerations involving maintenance, spatial requirements, and labor expenses. In the current study, FFPE tissues serve as a reservoir of DNA, RNA, and proteins sourced from archived and well-documented materials. The quality of FFPE tissue plays a pivotal role in this type of investigation, given that even meticulously preserved tissue will exhibit some degree of DNA and RNA degradation, along with generally inactive proteins.

The evaluation of DNA or RNA quality extracted from FFPE samples is conducted using Qsep Series instruments, which enable clear visualization of DNA integrity. Many FFPE samples exhibit noticeable patterns even after being diluted tenfold. Through the "Smear" function, users can establish a threshold, prompting the system to automatically generate a value known as the "DNA Quality Number" (DQN). This value signifies the proportion of DNA surpassing the designated threshold, and it ranges from 0 to 10. A higher score correlates with a greater proportion of high-quality DNA.



	Sample_1	Sample_2
Distribution	67.7 %	18.9 %
From	200 bp	200 bp
To	29,067 bp	29,992 bp
Average Size	6,195 bp	2,592 bp
DQN	6.8	1.9

Two FFPE samples are analyzed by using S3 cartridge on Qsep100. The DNA Quality Number (DQN) of sample1 (Red) surpasses that of Sample2 (Blue), indicating the greater DNA integrity of sample1.



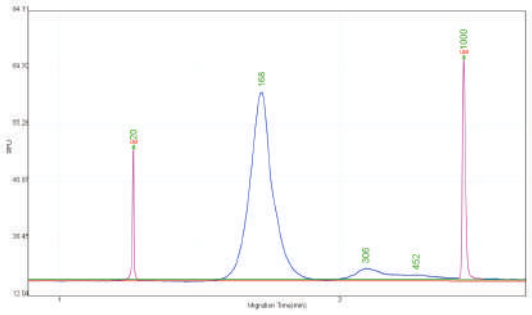
Total Peak Area	100.0 %
18S Area	0.6 %
28S Area	0.4 %
Ratio (28S/18S)	0.59
RNA Qualiity Number	1.00
DV200	56.5 %

Q-Analyzer automatically calculates the DV200 value post-analysis, reflecting the percentage of fragments exceeding 200 nucleotides.

Quality Control of Cell-Free DNA

Cell-free DNA (cfDNA) is known to circulate in both healthy and pathological conditions, appearing in various bodily fluids such as plasma, serum, cerebral spinal fluid, and saliva. Its significance has surged, particularly in Non-Invasive Prenatal testing (NIPT) and Liquid Biopsy for cancer diagnosis, where it serves as a target for detecting circulating tumor DNA (ctDNA). The efficacy of downstream applications heavily relies on the quality of cfDNA samples, underscoring the importance of an evaluation method.

For cfDNA analysis, we offer High Sensitivity Cartridge (N1 Cartridge) capable of detecting samples even at the picogram level, a crucial attribute due to low concentration of cfDNA (ranging from 1 to 100 ng/mL of plasma). The Qsep series facilitates rapid, reliable determination of cfDNA size and purity within 2-3 minutes.

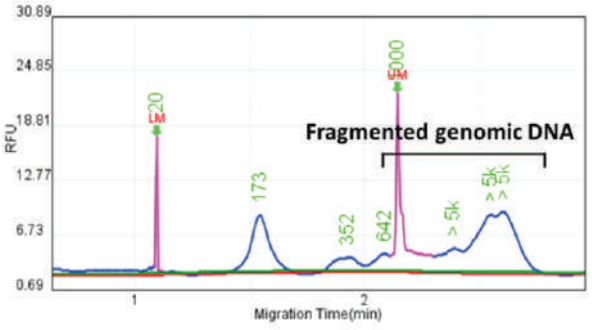


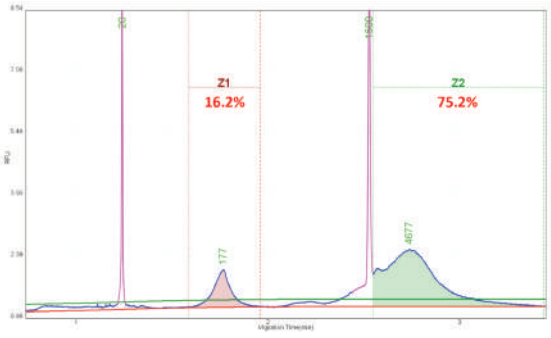
Quality control of cfDNA
cfDNA sample extracted from 1 mL of whole blood using CatchGene's iCatcher were analyzed on Qsep100 with High Sensitivity Cartridge (N1).

Size Assessment: cfDNA typically exhibits a common fragment size of approximately 160 to 200 bp.
Purity Check: Verify the existence of carrier RNA or genomic DNA within cfDNA sample.

Contamination of the cfDNA Sample with Genomic DNA (gDNA)

Qsep is proficient in detecting not only genomic DNA (gDNA) contamination via pattern recognition, but it also provides the percentage of target cfDNA in the samples. This aids users in determining whether the quality of cfDNA aligns with the requirements of downstream experiments. Here is an illustrative scenario: cfDNA has been readied for Next Generation Sequencing (NGS); however, an inspection reveals a presence of approximately 80% genomic DNA (gDNA) contamination. This high level of gDNA contamination carries the potential to disrupt the following NGS library construction process.





Zone 1	
Distribution:	16.2 %
From:	120 bp
To:	241 bp
Average Size:	175 bp

Zone 2	
Distribution:	75.2 %
From:	1,679 bp
To:	44,966 bp
Average Size:	6,465.7 bp

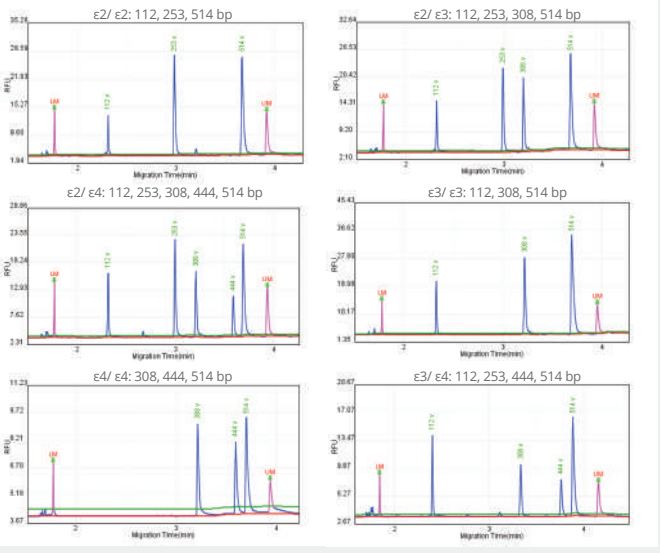
Key Highlights

- Fast Analysis: Results obtained in 2 to 3 minutes.
- High Sensitivity: cfDNA samples can be qualified as low as 5 pg/ µL.
- Impurity Detection: Capable of identifying genomic DNA contamination and residual carrier RNA.

PCR Fragment Application

PCR is a widely used biotechniquie in laboratories for amplifying specific fragments using a small amount of biological material in a short period of time. The characteristic makes PCR applicable to various fields such as genetic identification, forensics, quality control in the bioindusty, and in vitro diagonostics. Qsep series is a fully automatic system that detects DNA fragments after PCR amplification. It employs precast gel catridges, which offer rapid analysis and effectively reduce human errors during operation. Additionally, it provides accurate sizing with high resolution and reproducible results. Furthermore, Qsep's dedicated software, Q-Analyzer, generates reports automatically without the need for manual interpretation and streamlines the PCR detection workflow.

APOE Genotyping

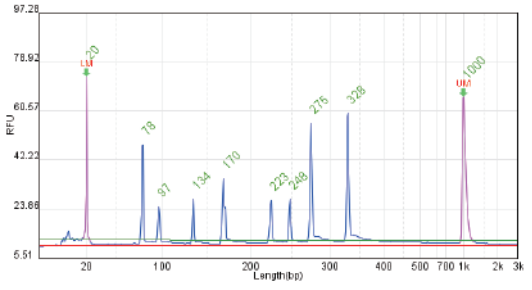


The Qexp-MDx APOE Genotyping Kit, along with S1 High Resolution Cartridge (S1, C105202), is used to analyze the APOE genome type. Qsep series detects the different genome type products by providing the precise sizing results. Q-Analyzer software, equipped with the peak calling function, automatically detects and distinguishes those different types, eliminating the need for manual interpretation of results using agarose gel.

Pathogen Identification

Rapid identification of pathogen species is crucial to physicians to provide accurate treatments. The accompanying figure shows that S1 High Resolution Cartridge (S1, C105202) is employed to run on Qsep100 Bio-Fragment Analyzer to achieve this goal. The peak calling function in Q-Analyzer software is utilized to automatically identify the pathogen species and generate reports. This feature enables users to swiftly analyze data, reduces reliance on manual interpretation, and minimizes the occurrence of errors.

Pathogen Detection

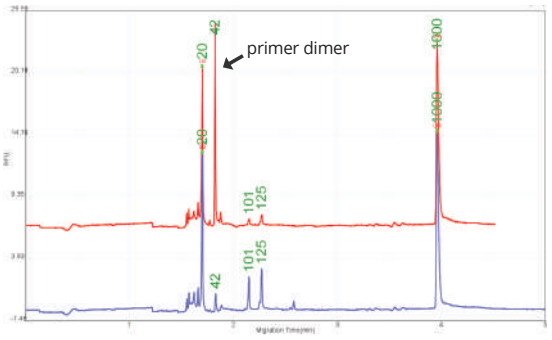


Peak Calling Report

No	Legend	Flag
1	Internal control	+
2	Staphylococcus aureus	+
3	Streptococcus pyogenes	+
4	Alcaligenes faecalis	+
5	Acinetobacter baumannii	+
6	Enterococcus faecium	+
7	Proteus vulgaris	+
8	Streptococcus agalactiae	+

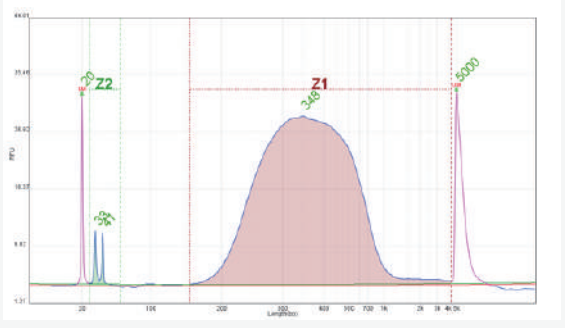
PCR Purity Check: Automating Impurity Detection

The utilization of the S1 High Resolution Cartridge (S1, C105201) with Qsep100 Bio-Fragment Analyzer allows users to easily identify primer dimers or impurities and optimize the PCR process. The Q-Analyzer software provides sizing results to confirm the size of the product and primer dimer.



Genome Typing – Primer Dimer

The accompanying figure demonstrates the user's primer design for genome typing, which leads to the presence of primer dimers (highlighted by red lines) in the PCR product. These primer dimers have a significant impact on the efficiency of PCR. However, after adjusting the PCR workflow, the occurrence of primer dimers greatly decreases (highlighted by blue lines).

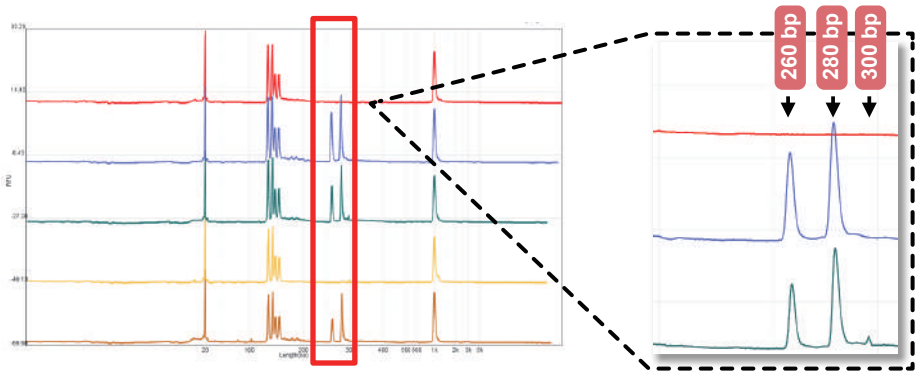


Library DNA – Primer Residue

The figure provided illustrates the presence of primer residue in the library sample preparation process. Such samples can have significant impacts on subsequent NGS analysis. Therefore, it is advisable to remove these samples in advance or employ alternative procedures to eliminate the residual primers.

SSRs/Microsatellites

The integration of BiOptic's Qsep Series Bio-Fragment Analyzers, which offer high-throughput and high-accuracy DNA fragment analysis technologies, can enhance the workflows of SSR/microsatellite marker libraries. The figure provided demonstrates the identification of different type of human SSRs, where the red and green peaks distinguish these strains from the other peaks. The identification of strains was accomplished using the S1 High Resolution Cartridge (S1, C105202) on Qsep100 Bio-Fragment Analyzer. The figure shows the successful identification of different type of Human SSRs.

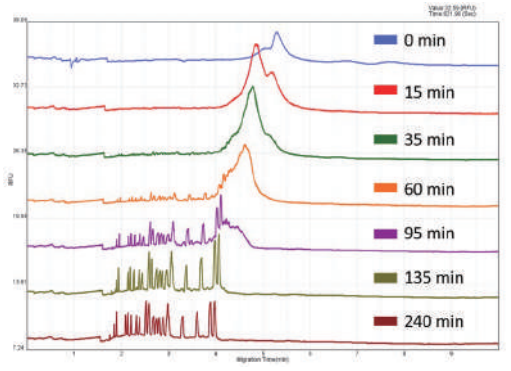


Restriction Digest Analysis

Restriction digestion is a widely used process in molecular biology that cleaves DNA into smaller fragments using specific enzymes called restriction enzymes. These enzymes recognize DNA sequences known as restriction sites and cleave the DNA at or near these sites.

The resulting DNA fragments are then separated using gel electrophoresis in a technique called Restriction Fragment Length Polymorphism (RFLP) analysis. By comparing the observed fragment sizes to the expected sizes based on known restriction sites, researchers can determine if the enzyme has cleaved as anticipated.

Unexpected fragment sizes indicate the presence of mutations or variations in the restriction sites. Mutations can create or abolish recognition sites, preventing the enzyme from cleaving as expected. This information is valuable for genetic mapping, identifying single nucleotide polymorphisms (SNPs), and analyzing DNA fingerprints.

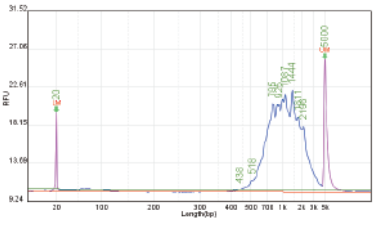


Plasmid DNA pBR322 Under Enzymatic Process at Different Time Points by Restriction Enzyme MspI.

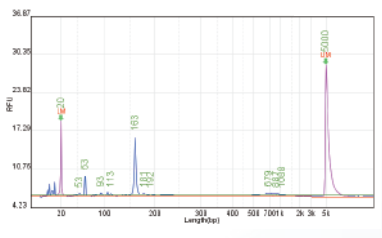
Quality Control of cDNA

Complementary DNA (cDNA) is an artificially synthesized DNA that is created by transcribing a specific mRNA using the enzyme reverse transcriptase. It serves as a reflection of the structure and genetic information present in the mRNA. The synthesis of cDNA is an essential initial step in various molecular applications and finds widespread use in next-generation sequencing (NGS), gene expression analysis, pathogen identification, and more. Consequently, ensuring the high quality of cDNA is crucial as it directly impacts the success of downstream applications.

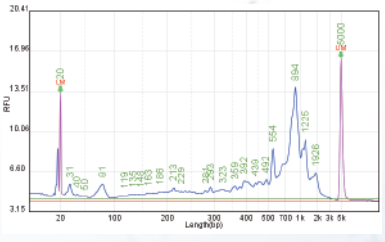
A



B



C



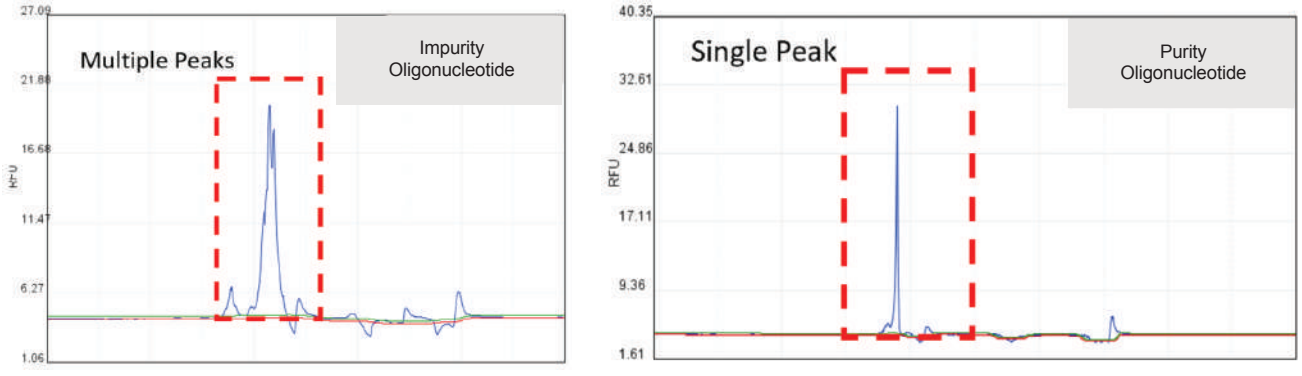
The Qsep platform offers a convenient and transparent solution for assessing the quality of cDNA. It provides clear and intuitive results, allowing for the easy determination of both the integrity and purity of the cDNA sample.

Single-Stranded Oligonucleotide QC

Single-stranded oligonucleotides have become a favored therapeutic approach in precision medicine and targeted therapeutics. It is essential to ensure precision in the production process of oligonucleotides.

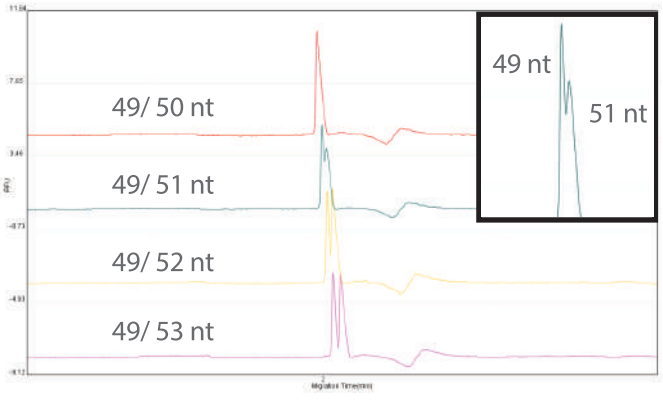
The Qsep series system provides an optimal quality control solution, offering a platform with high sensitivity and resolution of up to 2 bp. This platform assists users in evaluating outcomes and making necessary adjustments to the production process efficiently.

Oligonucleotide Purity Check



In the manufacturing of oligonucleotides, purification is a crucial stage that must be carried out to ensure the purity and absence of contaminants in the final product. The utilization of the N1 High Sensitivity Cartridge (N1, C105105) allows users to confirm the purity of the single-stranded nucleotides and detect any unexpected products that may be present.

High Resolution – Synthesis Oligonucleotide



By employing the S1 High Resolution Cartridge (S1, C105202), users can validate the synthesis result. The accompanying figure shows a resolution of 2 nt, enabling users to easily verify the presence of any non-specific products.

Quality Control of RNA Sample

Preserving the quality of RNA samples poses challenges due to the widespread presence of RNase, an enzyme that degrades RNA. RNase-induced degradation is a leading cause of experiment failures. Consequently, assessing RNA quality becomes pivotal for subsequent experiments, notably for tasks like checking NGS library quality.

To address this, we offer RNA Cartridge (R1), enabling the evaluation of total RNA quality. The Qsep series bio-fragment analyzers come with Q-Analyzer software, featuring the RNA Quality Number (RQN) as a quality metric. The software examines the entire electropherogram, encompassing the fast region and the 28S/18S ratio, to compute the RQN. Furthermore, our High Sensitivity RNA Cartridge (NR1) is tailored for low-concentration RNA samples, preserving/reducing precious RNA sample consumption while ensuring efficient operations.

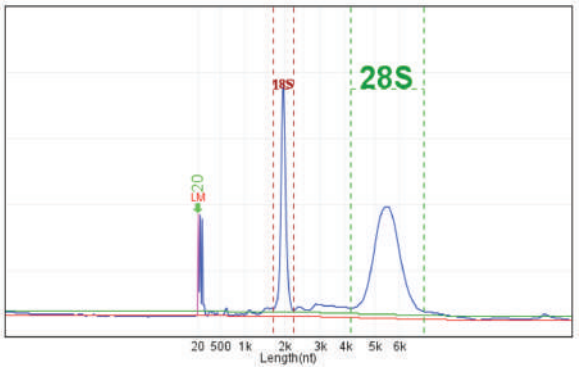
Features

- Two RNA cartridge types catering to diverse sample concentrations
- Minimal sample requirement: 2 µl
- Automated assignment of RQN and DV200 by the Q-Analyzer Software

Applications

- Assessment of total RNA quality
- RQN algorithm for determining RNA quality
- DV200 assessment for FFPE RNA sample analysis

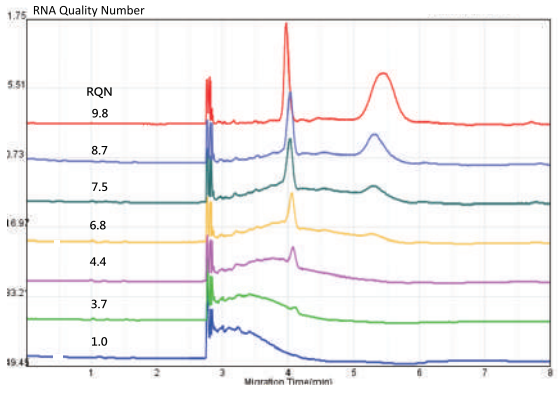
Automatic 18S/28S Assignment



Total Peak Area	100.0 %
18S Area	21.9 %
28S Area	57.2 %
Ratio (28S /18S)	2.01
RNA Quality Number	9.84

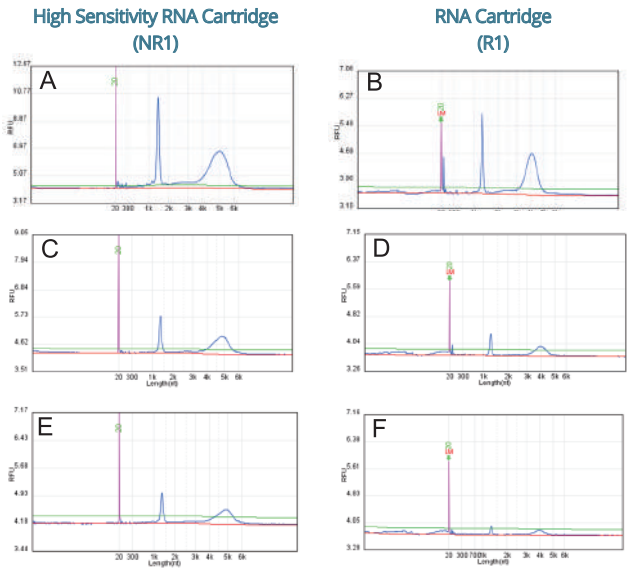
The result table automatically designates 18S and 28S rRNA peaks. Supplementary RNA data, including the 28S/18S ratio and individual percentage of 18S and 28S relative to the total peak area, are displayed. The DV200 value is derived from the percentage of fragments exceeding 200 nucleotides.

RNA Quality Number (RQN)



RNA quality and integrity significantly influence downstream experiments like real-time PCR. The Qsep series bio-fragment analyzers are adept at detecting even subtle total RNA degradation. The Q-Analyzer software promptly provides the RNA quality number (RQN) to aid users in assessing RNA sample integrity. The RQN of 10 indicates intact RNA, while the RQN of 1 signifies complete RNA degradation.

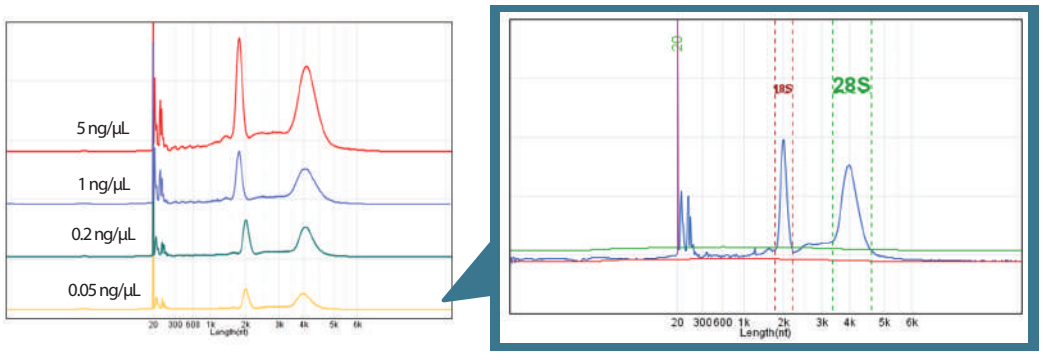
High Sensitivity RNA Cartridge for Ultra-Low Concentrations



The left figure illustrates the detection ranges of two sensitivity RNA cartridges (A-C; D-F : 5, 1, 0.5 ng/μL). The NR1 cartridge detects as low as 0.5 ng/μL, while the R1 cartridge can detect as low as 1 ng/μL. This versatile solution accommodates end-user by allowing cartridge selection based on RNA concentration. The table below specifies the appropriate detection ranges for NR1 and R1 cartridges.

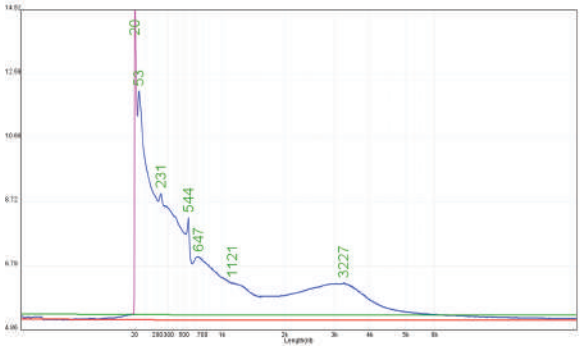
	NR1	R1
RNA Conc.	1~20 ng/μL	5~100 ng/μL
Runs	100	100
Shelf Life	4 months	4 months

*Dilute with 1x dilution buffer (in DNase/RNase-free water)



The High Sensitivity RNA Cartridge (NR1) capably detects ultra-low concentration total RNA sample (50 pg/μL diluted with d2H2O), with an 18S rRNA signal to noise value (S/N) of 104.26.

RNA Analysis in Formalin-Fixed, Paraffin-Embedded (FFPE) Tissues



Total Peak Area	100.0 %
18S Area	1.6 %
28S Area	0.5 %
Ratio (28S/18S)	0.32
RNA Quality Number	1.17
DV200	56.5 %

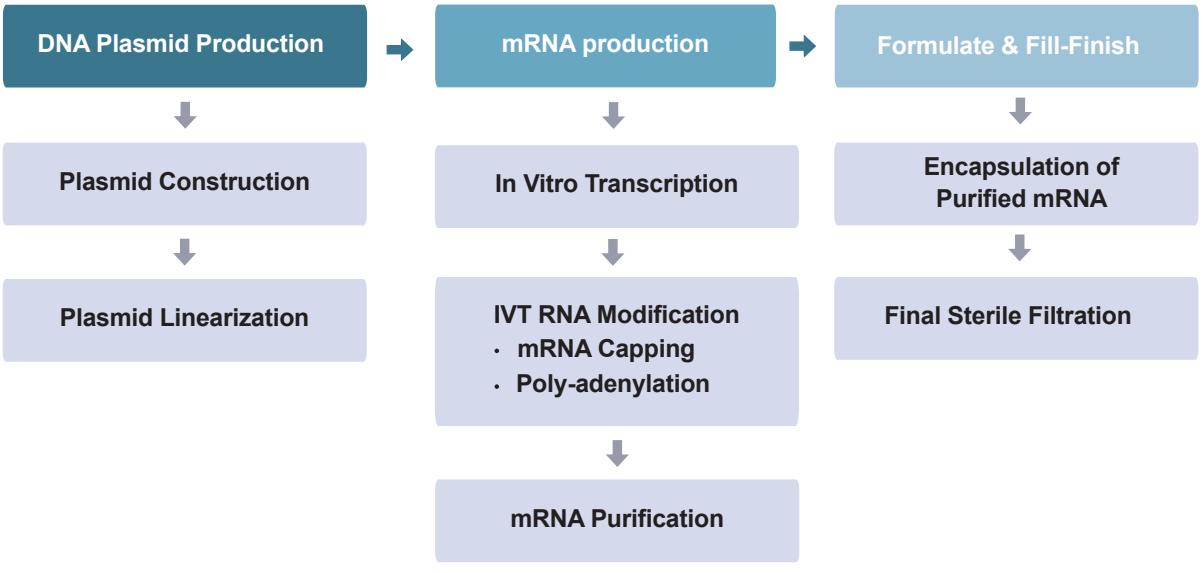
In RNA analysis of sample from formalin-fixed, paraffin-embedded (FFPE) tissues, DV200 indicates the percentage of fragments over 200 nucleotides. For further details, refer to the FFPE

mRNA Analysis (Quality Control of mRNA Vaccine)

The process of producing mRNA therapeutics and vaccines typically involves starting with a plasmid DNA template and using RNA polymerase to transcribe the desired mRNA. To ensure stability and prevent degradation by exonucleases, mature mRNA requires a 5' cap structure and a 3' poly(A) tail. Lipid nanoparticles (LNPs) are commonly employed for mRNA delivery, as they can encapsulate and protect the mRNA from degradation while facilitating its entry into cells through endocytosis. Subsequently, the mRNA is translated by ribosomes into peptide chains, which then fold into proteins.

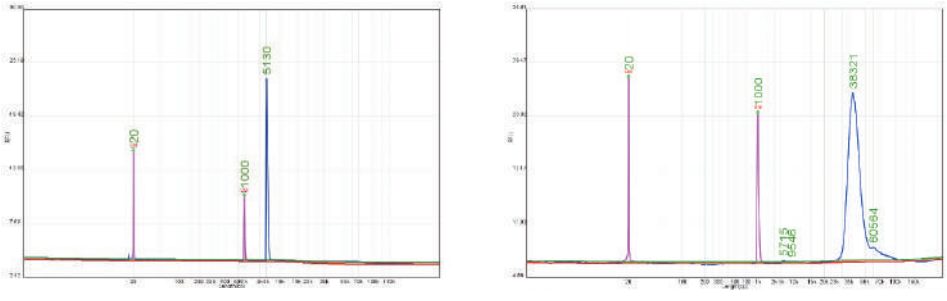
The quality of mRNA is influenced by various factors during its development and manufacturing process. To assess its quality, five aspects are considered: the accuracy of the mRNA sequence, purity, concentration, integrity, and safety. These criteria play a crucial role in determining the overall quality of the mRNA.

Checkpoints in mRNA Vaccine on *Qsep* System



Quality Control of Plasmid Linearization

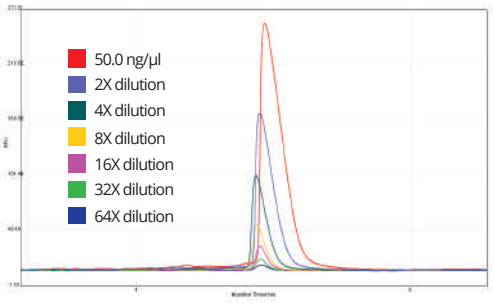
In assessing mRNA quality, the presence of a high-quality template is crucial for ensuring successful initiation and achieving the correct size and purity, whether it involves linearized plasmid DNA or PCR-amplified products. The exceptional sensitivity and resolution capabilities of Qsep capillary electrophoresis make it an excellent tool for precisely detecting the length and purity of DNA templates.



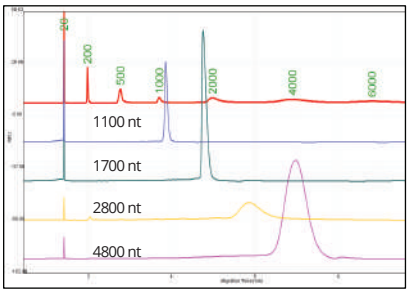
Qsep offers Kilobase Cartridge (S3, C105206) that can differentiate between different plasmid DNA configurations, including linear and open circular forms, as depicted in this figure.

Quality control of IVT RNA

Qsep platform can assess the quality of in vitro transcriptional RNA, providing high-sensitivity analytical measurements and sizing calculations, serving as a valuable template for subsequent mRNA vaccine development.



Starting from 50 ng/µL, a serial dilution was performed to obtain a range of concentrations for further analysis.

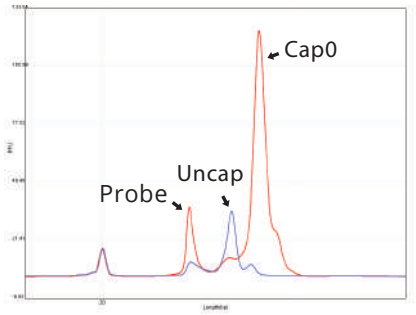


The R1 RNA Cartridge (R1, C105110) enables users to accurately determine the sizes of various RNA fragments, providing valuable size confirmation data.

Assessment of IVT RNA Modifications

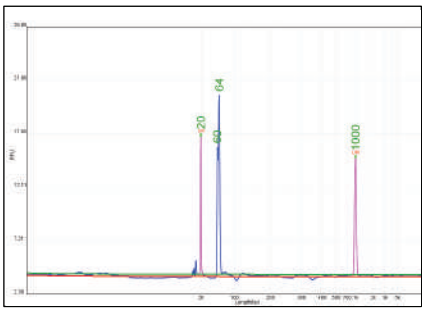
The Qsep series provides an efficient means of assessing mRNA capping and poly(A) tailing, as demonstrated in the figures below. Qsep excels in distinguishing between uncapped and capped signals in just 2 minutes, while also verifying the length of the mRNA poly(A) tail to ensure it matches the expected length. This standardized detection approach significantly reduces testing time.

A



(A) Electropherogram depicting the differentiation between mRNA capping processes, with blue indicating uncapped (Uncap) and red indicating capped (Cap0) molecules.

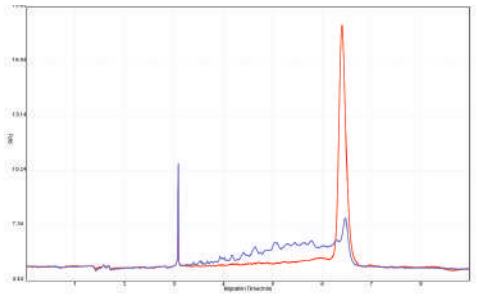
B



(B) Confirmation of a poly(A) tail with an expected length of approximately 60-65 nucleotides.

Evaluation of mRNA Purification Process

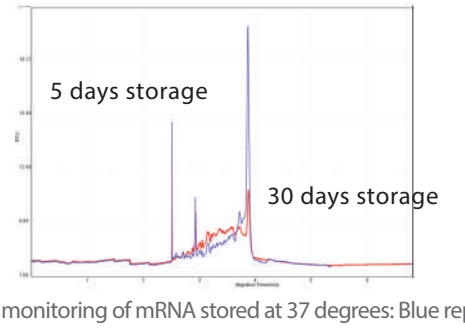
Qsep facilitates the assessment of mRNA integrity post-purificaton by analyzing the area under the signal peak ratio. This measurement offers insights into the degree of mRNA degradation and purification.



The Qsep platform effectively visualizes variations in mRNA integrity, providing valuable insights into the quality of transcribed mRNA and the effectiveness of the purification process.

Assessment of mRNA Encapsulation Quality in LNPs

The Qsep series represents a fully automated capillary electrophoresis system that can analyze mRNA encapsulation in lipid nanoparticles (LNP). LNP serves as a prevalent carrier for mRNA vaccines, offering protection against degradation. With the Qsep series, quality monitoring of mRNA within LNP can be effectively performed.



Quality monitoring of mRNA stored at 37 degrees: Blue represents five days of storage, while red signifies thirty days of storage.

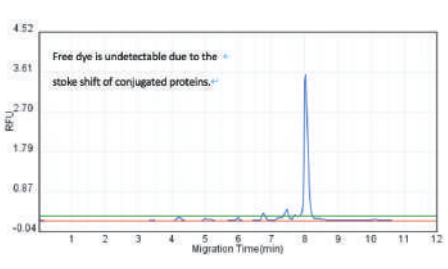
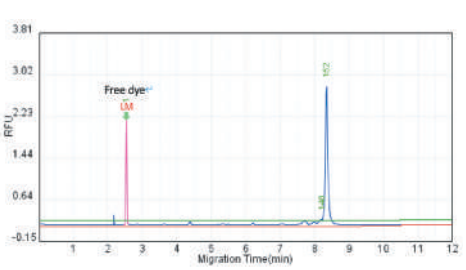
Biochemical characterization and quality control of proteins

Sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) has been contributed to biochemical study for more than half-century. However, due to its troublesome limitations including intensive laborious preparation, time-consuming analysis and hands-on experiment as well. BiOptic Inc. has dedicated in transforming the traditional slab gel into cutting-edge capillary electrophoresis.

Currently, a user-friendly platform coupled with capillary gel electrophoresis (SDS-CGE) system for quick protein assay has been developed, including a series of in-house synthesized polymers mimicking native biomolecules. The platform equipped with standardized methodology, data processing software and sensitive detection system for fluorescently labeled proteins.

According to the end-users' needs, continuously refining SDS-CGE system of both copolymer formulations and standardized methodologies adaptation has been designed to characterize the biochemical properties of various proteins and to monitor the quality control for biosimilars. Qsep series products offer hands-free chemistry of high resolution and sensitivity, on-column detection, automation, and being capable of protein profiling and molecular weight determination.

Fluorescent Protein Labeling

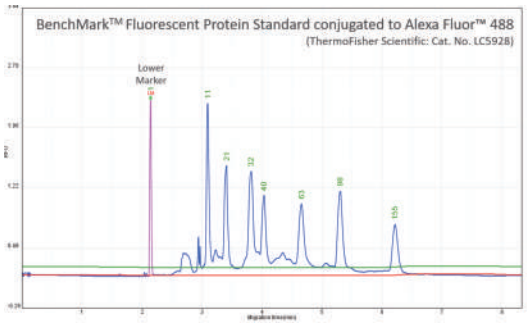
	Qsep$_{100}$	*Qsep*$_{100}$ Advance
Dyes in usage	Chromeo™ P503	Alexa Fluor™ 488/ FITC
Fluorescent Spectrum	Ex: 503 nm, Em: 600 nm (conjugated)	Ex: 493 nm, Em: 516 nm
Resolution	Good	Better resolution and sharper peak
Application	Protein profile and purity check	Protein profile and purity check M.W. calculation by commercialized ladder
Profile (Intact IgG)	Chormeo P503 labeled IgG on Qsep100 	Alexa Fluor 488 labeled IgG on Qsep100 Advance 

1 BenchMark Fluorescent Protein Standard (Cat. No. LC5928, ThermoFisher Scienctific)

Comprehensive Protein Profiling Using the P2 Cartridge

One of important fingerprints for biological samples is protein profiling.

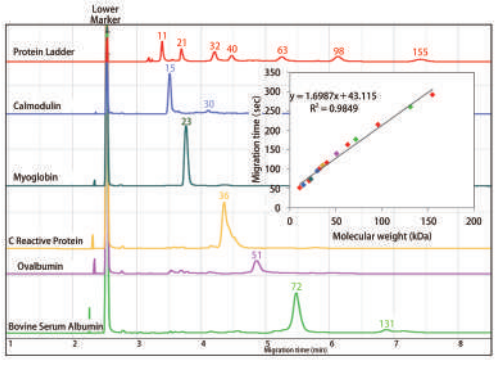
P2 cartridge coupled with Qsep100 Advance platform demonstrates the quick separation for the protein size ladder (BenchMarkTM Fluorescent Protein Standard), containing 7 recombinant proteins of 11-155 kDa.



Accurate Apparent Molecular Weight and Purity Analysis for Unknown Proteins

Basic biochemical properties for protein purification contains both purity check and size-calling at least. Several pure physiological proteins with various molecular weights were analyzed, indicating the linearity relationship between migration time and denatured protein size.

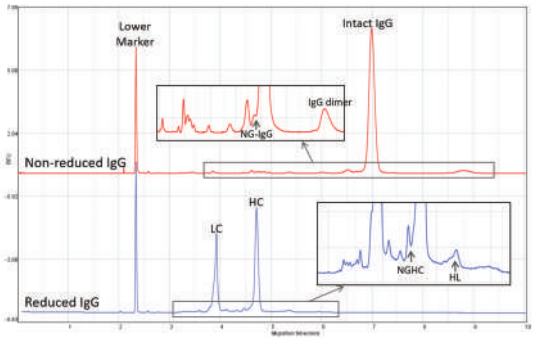
Protein size ladder was also used as ruler to optimize gel formulation for enhancing the resolution of gel toward specific protein(s), and to estimate the MW of unknown proteins as well.



Biochemical properties of IgG

According to the production of biologic drugs such as monoclonal antibody and recombinant protein, both structure study including subunits and aggregate forms are routinely essential checks.

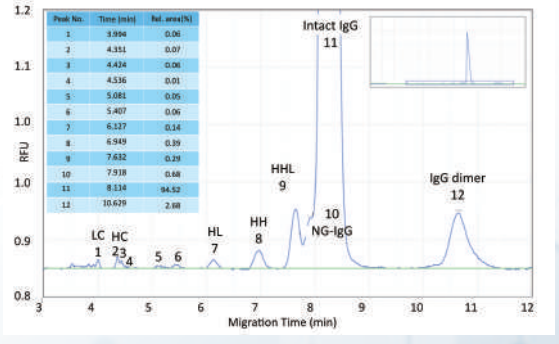
The figure showed that the platform offers high-resolution separation for IgG molecules in either reduced or non-reduced forms.



Quality Control for Biosimilars

During manufacturing biosimilars in biopharma, both impurities and degrades measurement of biosimilars are crucial.

We characterized the IgG obtained from local biopharma, indicating that the platform possesses wide coverage of quantitative measurement for peak area calculation (below 0.1%) in addition to the resolution capability.



Innovation

Revolution

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