C196-E084C

SHIMADZU
Excellence in Science

LC Systems

Nexera-i
Prominence-i

i-Series

innovative

— Realization of Advanced Laboratory

- ICM (Interactive Communication Mode) to free operators from the laboratory
- Remote monitoring regardless of operating environment
- Maximum reliability and stability
  - — Dual temp-control with TC-Optics and flow cells unaffected by room temperature fluctuation
  - — Excellent micro injection volume reproducibility of 1 µL or less
  - — Ultrafast injection cycle reduces analysis times

intuitive

— Achieving Easier Operation

- Unified graphical user interface between system and workstation
- Create analytical sequences on visualized vial positions: Quick batch function

intelligent

— Smart Features Increase Work Efficiency

- Automation of a number of routine analysis procedures
- Migrate existing methods from either Shimadzu or non-Shimadzu systems


SHIMADZU
1.5mL
1.5mL
Nexera-i
LC-2040C 3D

From HPLC to UHPLC
– Extensive Lineup of Shimadzu LCs –

Shimadzu's extensive LC lineup fulfills a wide range of analytical needs, from conventional to ultra-high speed analysis. With scalable column size and packing material particle size, Shimadzu can provide an LC system most appropriate for your applications.

	Conventional			Ultra-high speed/High-separation
Packing material particle size (µm)	10 ~ 3	3 ~ 2		< 2
Column size (mm)	~ 250	~ 75	~ 150	
Typical column	Shim-pack VP	Shim-pack XR	Shim-pack XR II	Shim-pack XR III
Prominence / Prominence-i				
Nexera XR / Nexera-i				
Nexera X2				

Shimadzu LC lineup according to column categories

Routine Analysis
Easy Operation

Nexera-i

The UHPLC system perfect for multi-analyte processing such as drug dissolution testing. Autosampler accommodates a total of 216 standard vials and features a direct access mechanism that allows the user to place the sample even during analysis.

Prominence-i

The HPLC system perfect for checking synthetic compounds, quantitative testing with standard operative procedures, etc. This system is suitable for a wide range of industries, such as pharmaceuticals, chemicals, foods and the environment. It can be operated as a single-use system or a shared system. Its small footprint facilitates the management and relocation of systems.

Nexera X2

The flagship UHPLC system supporting columns with sub-2 µm micro-particle packing materials, realizing both ultra-high speed and ultra-high separation. Excellent reproducibility of low injection volume and ultra-low carryover ensures reliable data, even with ultra-sensitive LC/MS/MS methods.

Nexera XR

The UHPLC system supporting most commercial UHPLC and HPLC columns. Superior gradient performance and minimized delay volume enable ultra-high speed analyses with excellent reproducibility. The Method Scouting System can be constituted to support more efficient method development.

All-round LC Expandability

Prominence

The standard HPLC system with excellent expandability. It can be configured to meet a variety of analytical conditions. This system offers reduced maintenance costs while still enabling high-speed analysis by using short columns with 2 µm particles.

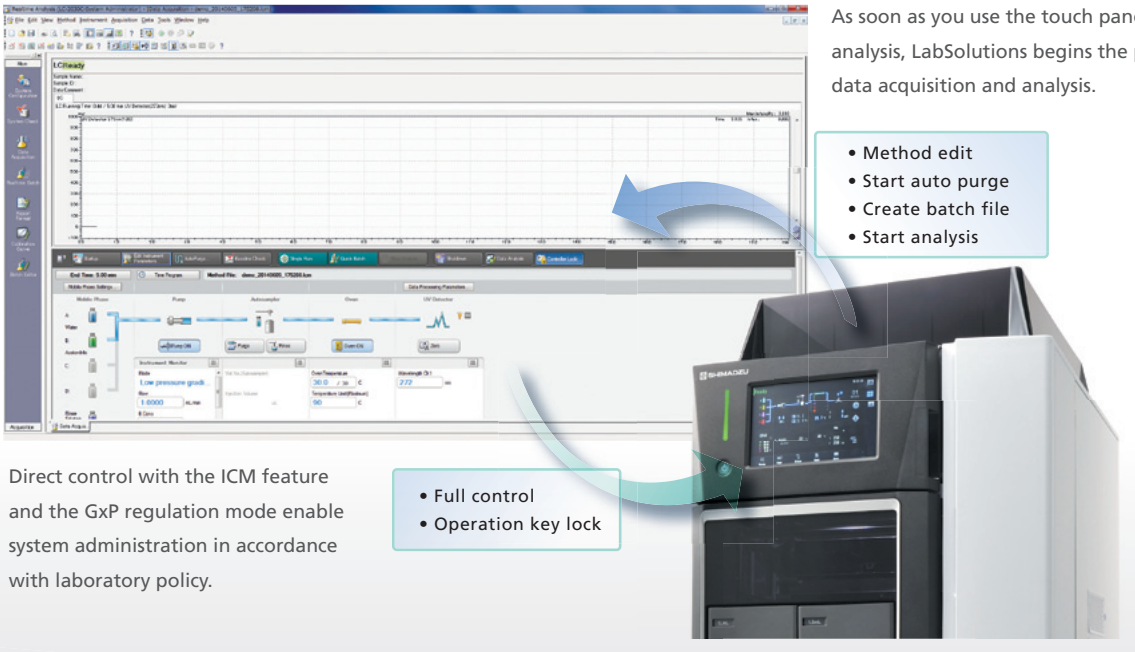
innovative
Realization of Advanced Laboratory

- ✓ From setting vial to starting analysis, all the procedures are performed via the equipment.
- ✓ The operations in the laboratory are minimized and free of errors.
- ✓ The system status can be supervised even from outside the laboratory.
- ✓ More efficient use of laboratory space.

They are parts of the future laboratory that Shimadzu pursues.

ICM (Interactive Communication Mode) Frees Operators from the Laboratory

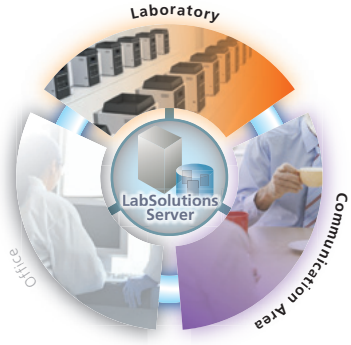
The new ICM (Interactive Communication Mode) feature enables the operator to edit and start analysis methods and batch files from the i-Series. These methods and batch files are uploaded to LabSolutions synchronously. You can also perform routine operations, such as purging mobile phases, while away from the PC.



As soon as you use the touch panel to start analysis, LabSolutions begins the process of data acquisition and analysis.

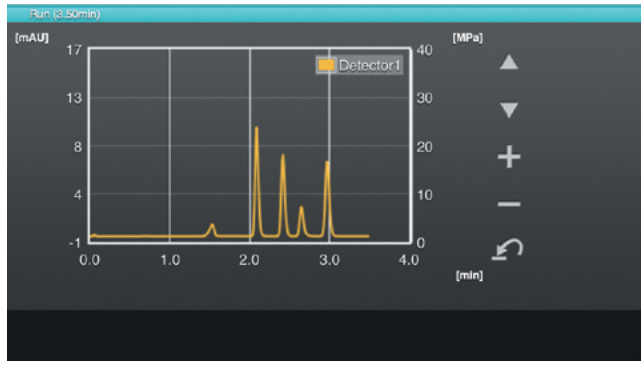
Direct control with the ICM feature and the GxP regulation mode enable system administration in accordance with laboratory policy.

With the i-Series and LabSolutions, Shimadzu offers a new relationship between operators and analytical instruments. The data acquired by i-Series featuring ICM is sent to the data center via the LabSolutions network and managed uniformly by a server. Confirm analytical results from your room. Use a smart device to monitor the current system status and chromatograms from anywhere in the facility.



Remote Monitoring Regardless of Operating Environment

Verify the i-Series' operating status from a smart device without using any special software. With this feature, you can monitor the current system status and chromatograms from anywhere. In addition to monitoring status outside of the laboratory, it allows easy access to a system in a closely-supervised area, such as one installed under a hood, in order to analyze highly active pharmaceutical ingredients.



innovative

Maximum reliability and stability
— Fundamental functions assure analysis results —

Use of Multiple Detectors Expands Application Range

In addition to the UV-visible (UV/VIS) absorbance detector or photodiode array (PDA) detector included as standard, a fluorescence detector or differential refractive index detector can be added.

Excellent Baseline Stability Unaffected by Circumstances

The UV/VIS detector and the PDA detector employ dual-temperature control (TC-Optics and flow cell) and provide measurements with a stable baseline hardly affected by room temperature fluctuation.

Supports High-Speed Multi-Analyte Processing

A 14-second injection cycle maximizes the number of samples that can be processed. Moreover, a total of 1536 samples can be accommodated in right and left sample racks.

Autosampler Enhances Data Reliability

Excellent reproducibility for low injection volume less than 1 µL, wide range of linearity range and ultra-low carryover (<0.0025%) improve the reliability of data, especially for analyses of precious biological samples and direct analyses of concentrated samples.

Open Access Sample Placement

A direct access mechanism on sample racks allows the user to place the sample on racks that are not involved in sample injection even during analysis. Furthermore, racks can be shared by multiple analysts, without interrupting the analysis of samples placed by others. Overall, this function enhances the work efficiency.

Compact Integrated LC

The i-Series brings together all the functions required for LC analysis in an integrated form. With its space-saving design, which is only 410 mm wide, three units can be installed on a laboratory bench compared to only two comparable instruments from other companies. The instrument footprint does not change even if another detector is installed.

Refined Usability

Control panel with a color LCD touch panel allows anyone to operate the instrument, regardless of experience level. Easily and reliably perform routine maintenance following onscreen instructions.

Displays Chromatogram in Real Time

The chromatogram real-time monitor allows the user to immediately confirm the success or failure of data, even in a computer-less laboratory environment.

Large Capacity Column Oven Supports up to 85°C

The Forced-air circulation method enhances column temperature stability. Maximum operating temperature of 85°C allows high-temperature analyses such as sugar analysis. Moreover, three 300 mm long columns or six 100 mm long columns can be accommodated.

Quaternary Solvent Delivery Unit

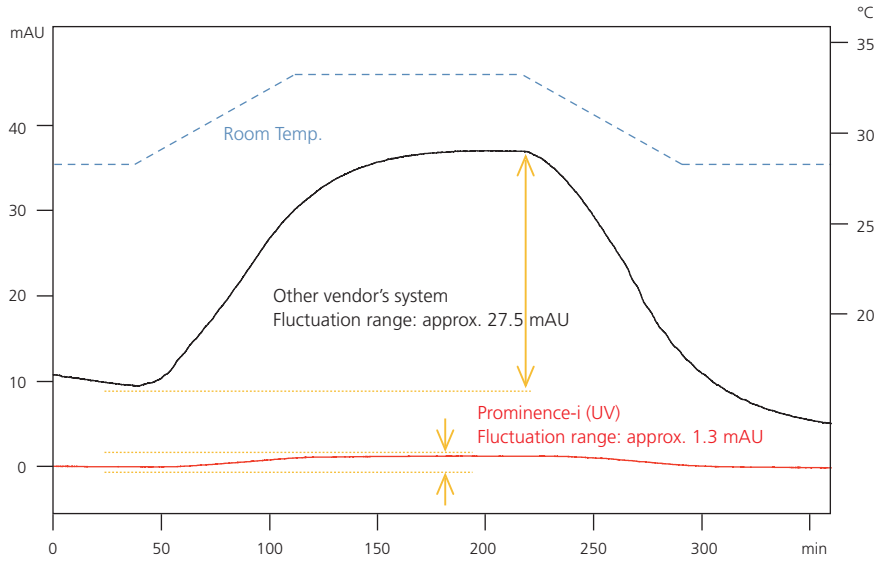
A 10 µL micro plunger ensures accurate quaternary gradient delivery. Optional reservoir switching valve further extends the solvent selection to seven so that the solvent for the flow path rinsing can be set.

innovative

Shimadzu Quality Means Reliability

Excellent Baseline Stability: Dual-Temp Control with TC-Optics and Flow Cells

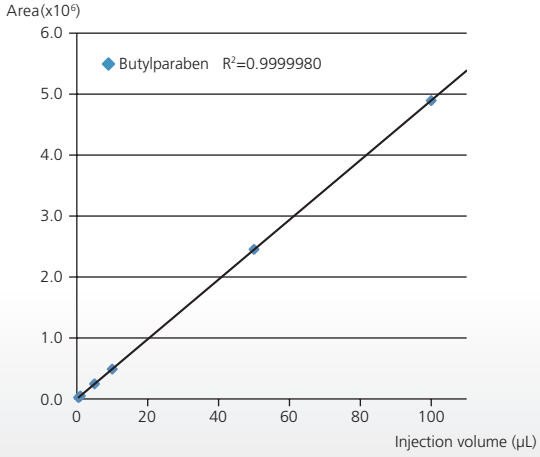
In addition to the temperature control function in flow cells, the i-Series employs new temperature control technology for detector optical systems, known as TC-Optics (Temperature Controlled Optics). Measurement with a stable baseline, hardly affected by room temperature fluctuation, ensures high precision of validation and quantitation tests on trace components.



Assists Analysis over Wide Concentration Range: Linearity and Reproducibility of Injection Volume

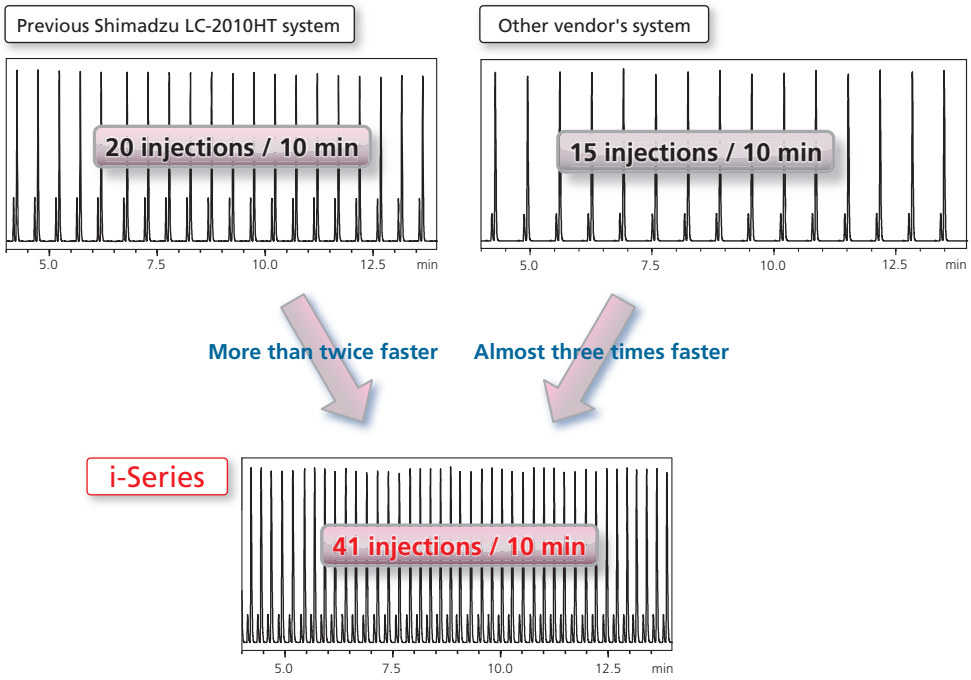
The i-Series provides highly precise data in micro volume injections of 1 µL or less. This system allows the direct injection of the concentrated samples without dilution to save the preprocessing operation. In addition, the superior injection volume linearity improves the reliability of data for a wide range of injection volumes.

Injection Volume (µL)	Area Reproducibility (%RSD)
0.5	0.121
1	0.076
5	0.020
10	0.006
50	0.006
100	0.006



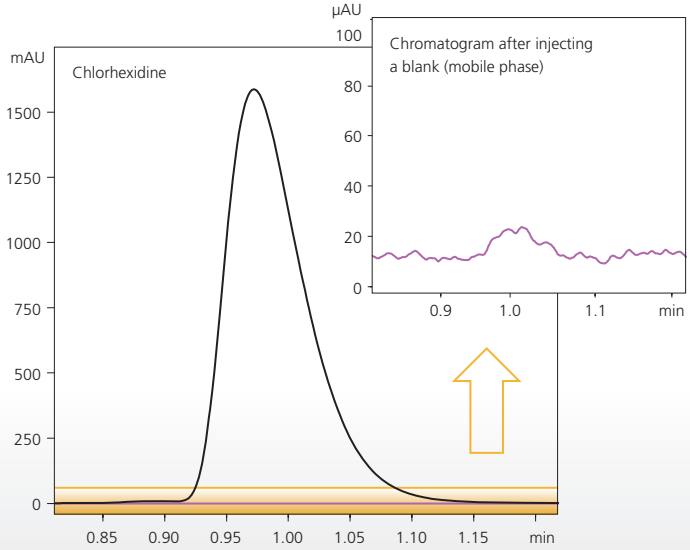
Enhancing Multi-Analyte Processing

When analyzing a large number of analytes, it is crucial to reduce the time between analyses, specifically the time before the next sample injection. With an injection cycle of about 14 seconds, the i-Series achieves processing speeds more than twice as fast as previous Shimadzu systems, and almost three times faster than other vendors' systems.



Ultra-Low Carryover Performance Enables High-Sensitivity Analysis

Due to Shimadzu's proprietary flow channel design, carryover effects from residual samples are reduced to nearly zero. The carryover specification has been improved to 0.0025%, thereby providing highly precise quantitative performance when analyzing complex sample.

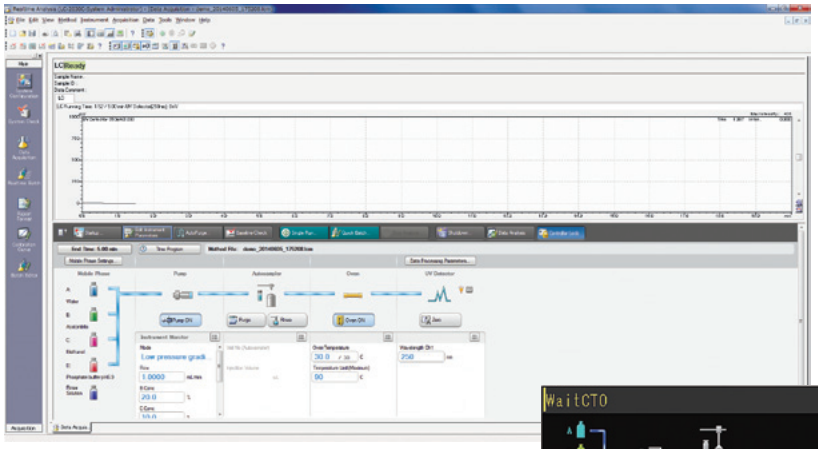


intuitive
Achieving Easier Operation

The combination of i-Series and LabSolutions brings about changes in the laboratory and office. Uniform graphical user interfaces between system and workstation allow intuitive operations regardless of experience level and increase the operation availability of the i-Series. The browser functions in LabSolutions bring rapid processing of large amount of data, realtime statistical calculation and easy confirmation of anomalous values, enabling more efficient data processing.

Graphical User Interface Provides Easy Operation

The LabSolutions analytical window features a user interface with a design similar to that of the i-Series flow lines. This allows you to create analytical methods by following the same steps as for the i-Series control panel. In addition, controlling the window icons enables various operations, such as ON/OFF of pump and oven, auto-purge, and batch creation.

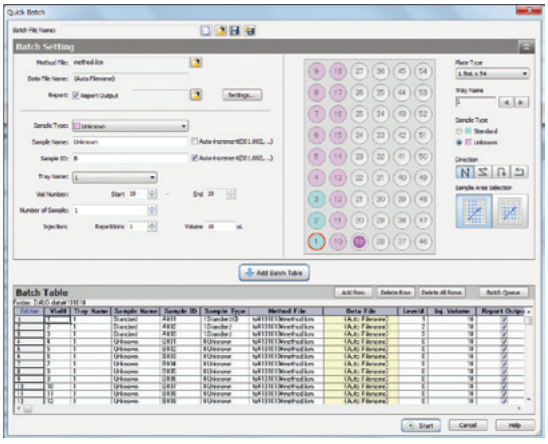


Analytical window of LabSolutions

Touch panel for i-Series

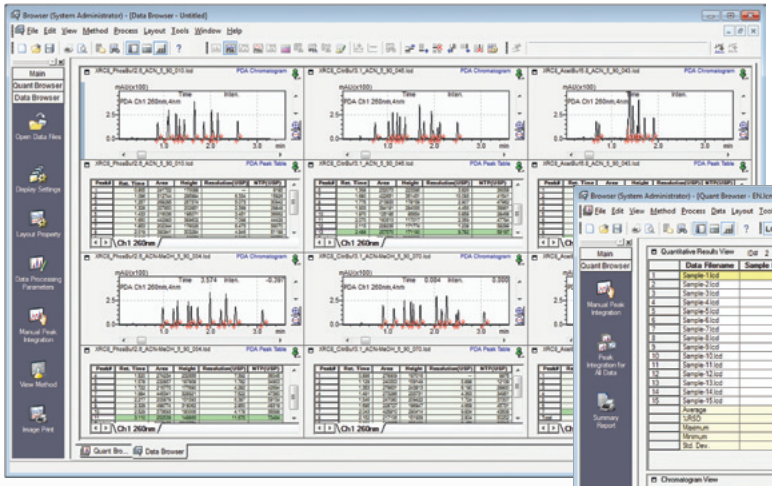
Quick Batch Function Simplifies Batch File Creation

The LabSolutions Quick Batch window displays the sample rack mounted on the system. You can create batch files while checking the vial positions in the window.

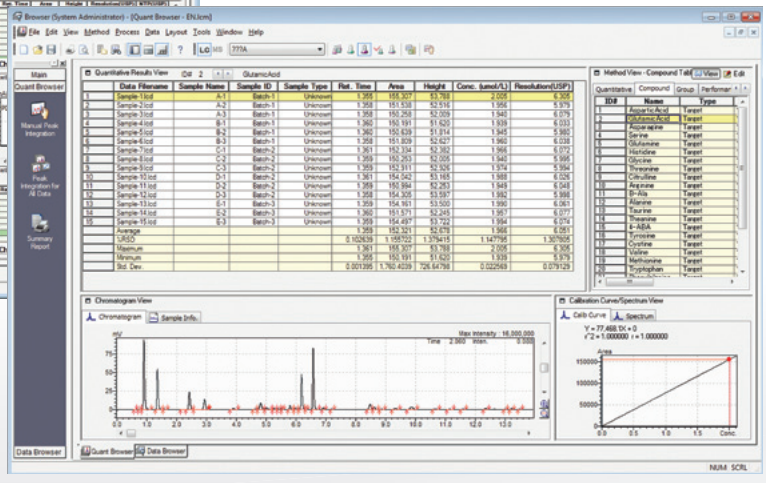


Display a High Amount of Analytical Data in One Window

The Data Browser and Quantitation Browser in LabSolutions incredibly accelerate the comparison of multiple analytical data and processing of all quantitation results. Large amounts of data are intuitively handled by the drag-and-drop data loading and automated data loading from batch files.



The Data Browser displays multiple analysis data in a segmented window. You can choose the information to display, such as the chromatogram and peak table.



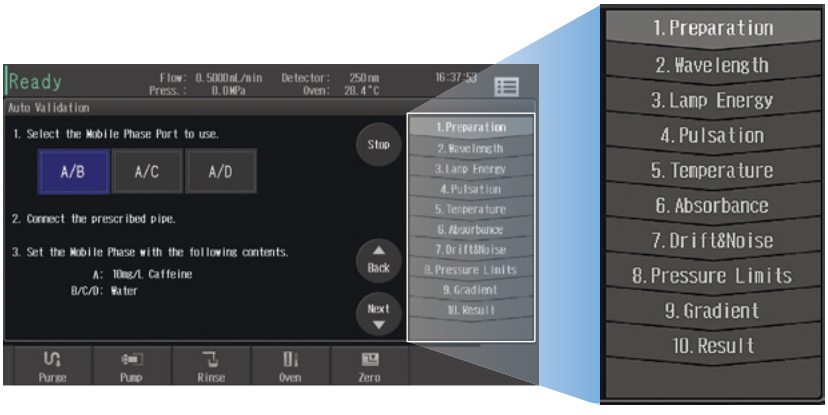
The Quantitation Browser displays a list of quantitation results of large amount of a data including anomalous values. Moreover, individual peak processing, batch peak processing and statistical calculations are processed at a glance.

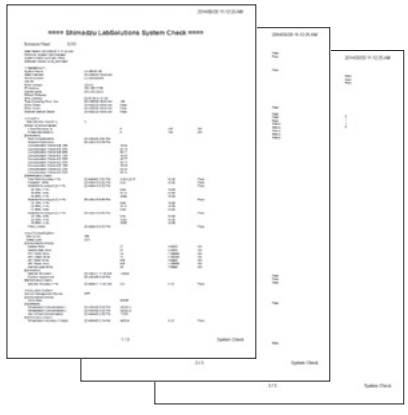
intelligent
Smart Features Increase Work Efficiency

The i-Series saves lab operators time and energy. Combined with the LabSolutions automated functions, it reliably completes analyses under specified procedures. In addition, the E-mail notification feature allows you to focus on other work, without worrying about analysis end time.

Proof That the System Always Operates in a Stable Manner

With the i-Series auto-validation function, anyone can follow a set procedure to examine solvent delivery stability, wavelength accuracy, absorbance accuracy, gradient accuracy, the presence of any drift/noise, and other parameters. In addition, a system check function automatically performs the routine inspections performed before using the instrument, and creates a report indicating system self-diagnostic results and a record of consumables used, such as the total solvent volume delivered by the delivery pump, the number of autosampler injections, and the number of hours the lamp has been illuminated. This makes it easy to accurately determine the instrument operating status.





Starting auto validation

Displays procedures, mobile phases, and other information necessary for validation on the screen, which allows you to perform inspections by simply following the instructions.

Creating system check report

Validation results can be referred from the i-Series main unit, to be output from the workstation in a report format.

Automation of Routine Analysis Procedures

The entire series of operations involved in analysis can be automated, from system startup, mobile phase purging, column equilibration in preparation for starting measurements, and starting the analysis to shutting down the system after analysis. In combination with the automatic pass/fail judgment function for system conformity testing, operations for routine analysis, such as injecting samples based on test results and stopping the analysis, can also be automated.

Start up system

Purge flow lines with mobile phase for analysis

Column equilibration

Analysis starts

Sample measurement

Analysis finishes

Cool-down conditions implemented

Pump delivery switches OFF
Detector switches OFF

Column oven temperature control switches OFF

Shutdown

Auto start-up

Automatically starts up the system. Power consumption can be minimized by activating the sleep mode until the user is ready to run the analysis.

Auto purge

Automatically purges mobile phases before analysis.

Baseline check

Monitors baseline noise and drift values, automatically determines that the values are within the pass/fail criteria specified for each UV/VIS or PDA detector channel (baseline stability), and then starts the analysis.

Monitoring from a smart device

If a smart device is used, the system status and chromatogram results can be confirmed remotely from a separate location. There is no need to go to the laboratory to check the status.

Analysis can be monitored from a smart device

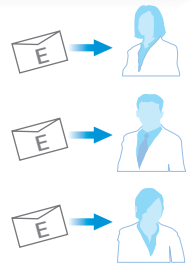
Direct access mechanism

Play samples at anytime without affecting ongoing measurements by other analysts.

Rack can be pulled out even when needle is active

Email notification

Email notifications can be sent automatically to lab personnel after analyses are completed.



Auto-shutdown function reduces power consumption

The auto-shutdown function minimizes power consumption while the system is in the sleep mode after analyses. This allows you to reduce power consumption in sleep mode by 95% or more. Also, by executing operations specified in instrument methods, such as rinsing lines inside the instrument, before the auto-shutdown function puts the system in sleep mode, the function can help manage the instrument status after analyses are finished.

i-Series
LC Systems

intelligent

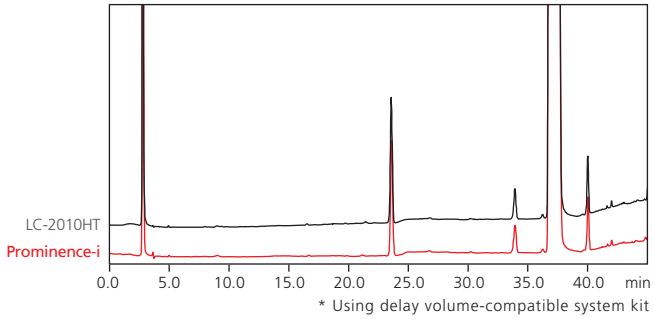
Seamlessly Transfers Existing Methods to a Cutting-Edge System

Replacing your analytical system with the i-Series not only ensures seamless transfer of existing methods, but also dramatically increases analysis reliability and stability. The i-Series saves time and energy in reviewing those methods, and its excellent system-to-system reproducibility enhances data compatibility between labs. It also offers an optimal analysis environment, allowing method development for better separation and higher-speed applications.

Reduces Work for Method Transfer

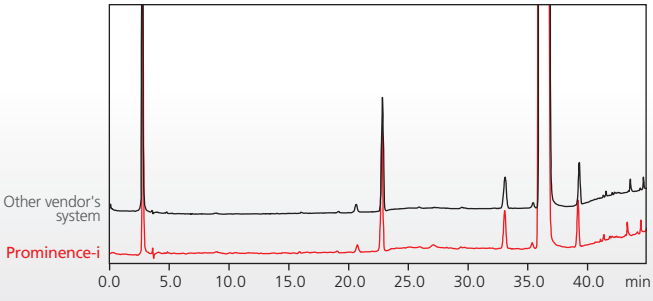
With its system volume optimized, the i-Series significantly reduces the work needed to transfer methods developed on other vendor's systems or previous Shimadzu LC-2010 systems. This helps ensure a smooth launch process after a new installation.

Method transfer from previous Shimadzu LC-2010HT to Prominence-i



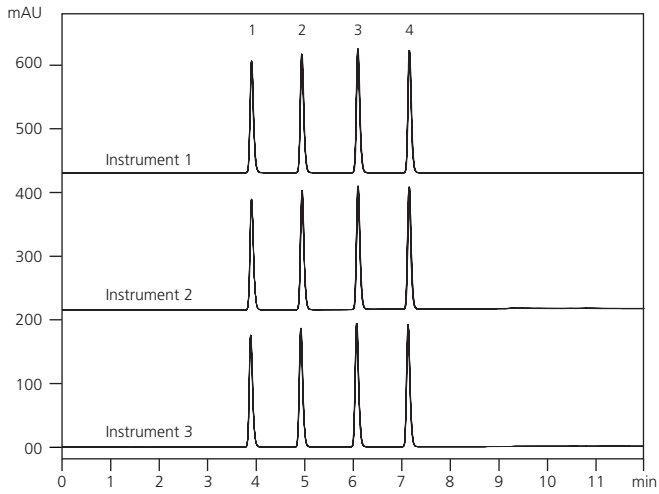
* Using delay volume-compatible system kit

Method transfer from other vendor's system to Prominence-i



System-to-System Reproducibility Improves Data Compatibility

In addition to its reproducible performance on a single system, the i-Series' excellent system-to-system reproducibility further improves data reliability. With its unsurpassed performance in areas such as solvent delivery precision, concentration accuracy, and injection volume accuracy, the i-Series is now a new industry standard for global labs.

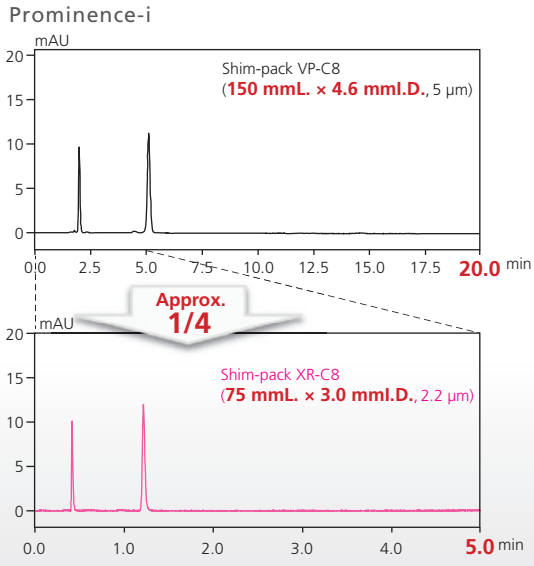


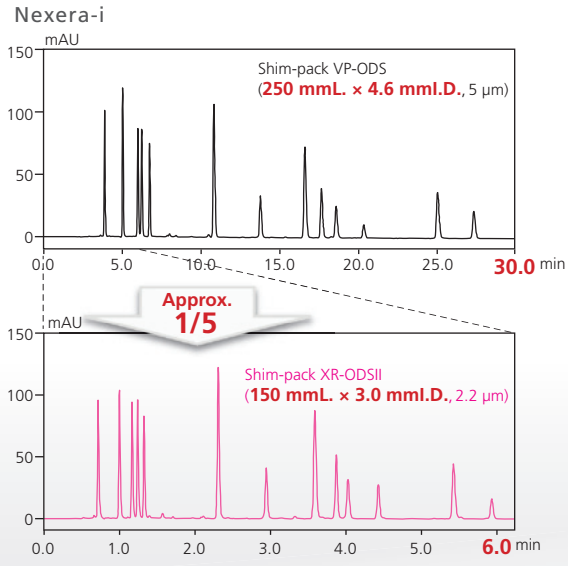
	Peak 1		Peak 2		Peak 3		Peak 4	
	R. time	Area	R. time	Area	R. time	Area	R. time	Area
Instrument 1	0.031	0.032	0.057	0.065	0.049	0.032	0.055	0.022
Instrument 2	0.044	0.027	0.068	0.018	0.064	0.052	0.053	0.037
Instrument 3	0.054	0.062	0.056	0.035	0.055	0.022	0.043	0.040

Retention time and area reproducibility (%RSD) of each instrument

Supports Higher-Speed Applications

A low-volume, high-efficiency mixer and optimized system volume support high-speed applications of existing methods. Furthermore, the pressure resistance of Nexera-i enables both high speed and high separation. The following examples show a method for analyzing bepotastine besilate used in a high-speed application with Prominence-i, and a simultaneous analysis method for cephem antibiotic in a high-speed, high-separation application with Nexera-i.



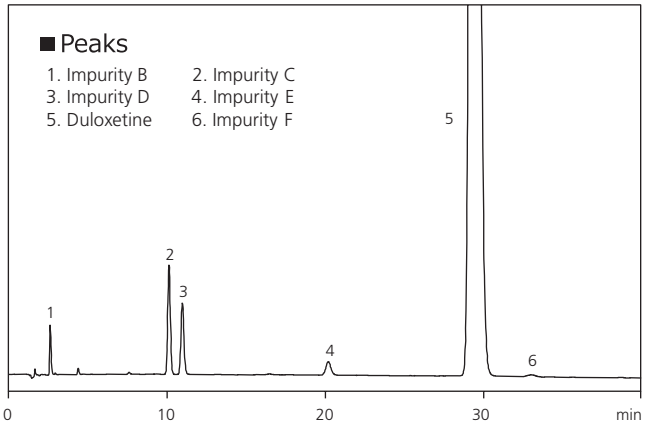


i-Series Addresses a Wealth of Applications

Although it is an integrated LC system, the i-Series supports a wide range of applications according to your choice of detectors. Basic systems come with the choice of a UV/VIS detector or photodiode array (PDA) detector. You can add to this a fluorescence detector, a differential refractive index detector and a Evaporative Light Scattering Detector, as necessary. The innovative and superior performance of the i-Series supports your application requirements.

Pharmaceuticals

The i-Series supports a wide range of HPLC analyses in the pharmaceutical industry, from identification and purity testing at the drug discovery stage to impurity testing and quantitative determination at the manufacturing and quality assurance departments.

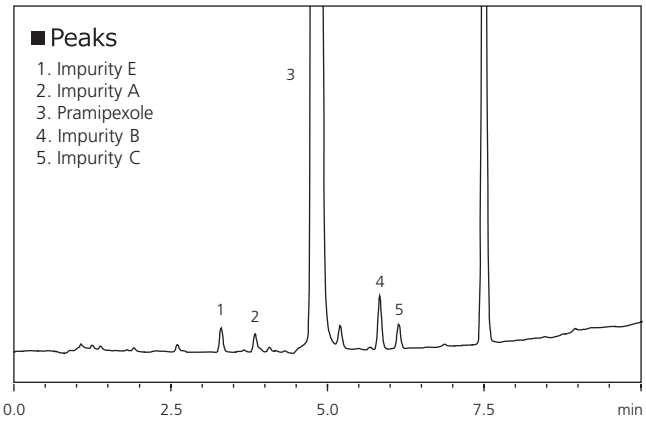


Impurity analysis of Duloxetine Hydrochloride and impurities in conformance with USP

Results of system suitability test in USP monograph of Duloxetine Hydrochloride

	Items for System Suitability Test	Criteria	Observed	Results
Resolution	Duloxetine and Duloxetine related compound F	≧1.5	4.2	PASS
Symmetry	Duloxetine	≦1.5	1.3	PASS
Reproducibility (%RSD)	Duloxetine Peak area	≦1.0	0.17	PASS

Standard performance features, such as excellent baseline stability, ultra-low carryover performance, and excellent reproducibility of sample injection, ensure stable and validated results in any analysis based on national Pharmacopeia of each country.

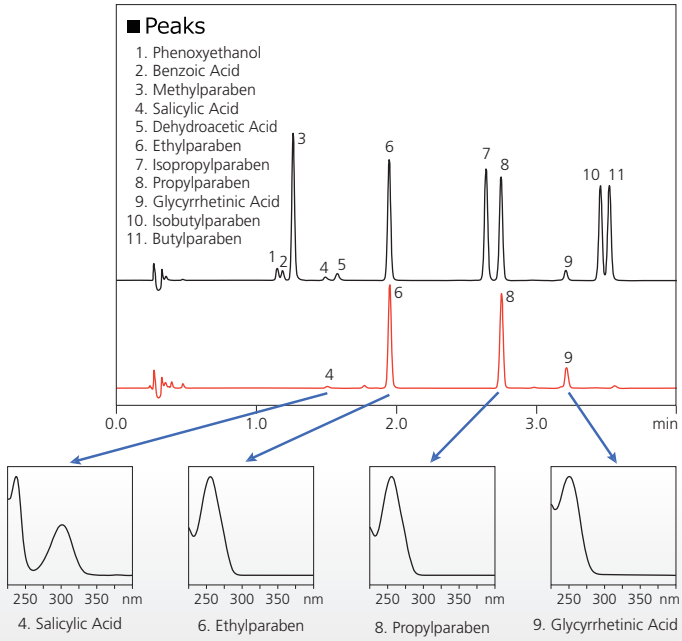


Chromatogram of Pramipexole Dihydrochloride and impurities in conformance with EP

Results of system suitability test in EP monograph of Pramipexole Dihydrochloride

	Items for System Suitability Test	Criteria	Observed	Results
Resolution	Impurity A and Pramipexole	≧6.0	8.2	PASS

Analysis using a PDA detector has the advantage of confirming the UV/VIS spectrum for each peak in the chromatogram.

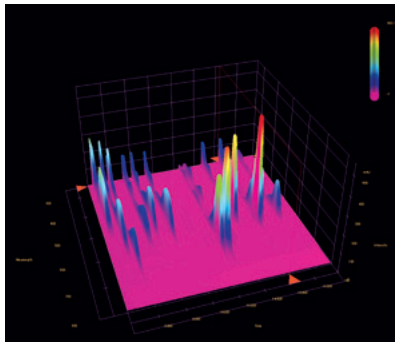


Analysis of therapeutic dentifrice

Foods and Beverages

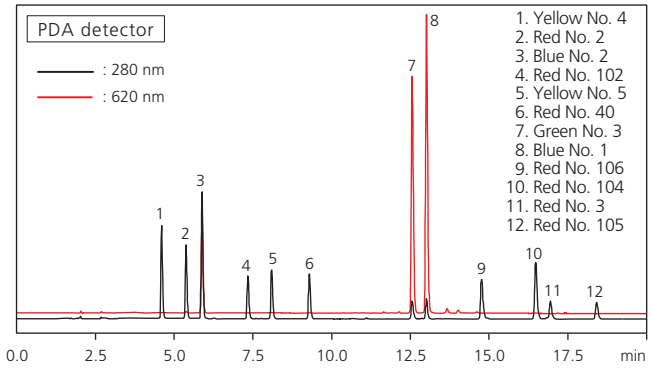
The i-Series supports a wide range of HPLC analyses in the food and beverage industry, such as active ingredient analysis and toxic substance analysis.

Systems with a PDA detector are ideal for the analysis of synthetic pigments. Qualitative analysis with a UV spectrum and sensitive and simultaneous quantitation by wavelength switching are available. By adding an optional tungsten lamp, synthetic pigments and other substances measured in the long-wavelength region can be detected with high sensitivity.

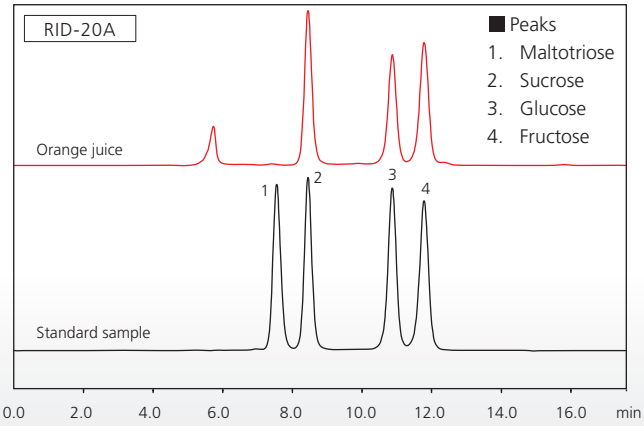


The temperature of the oven can be controlled to as high as 85°C, while still allowing effective analysis, such as that of sugars in ligand exchange mode. Adding the RID-20A differential refractive index detector enables the detection of low light-absorbing compounds such as sugar.

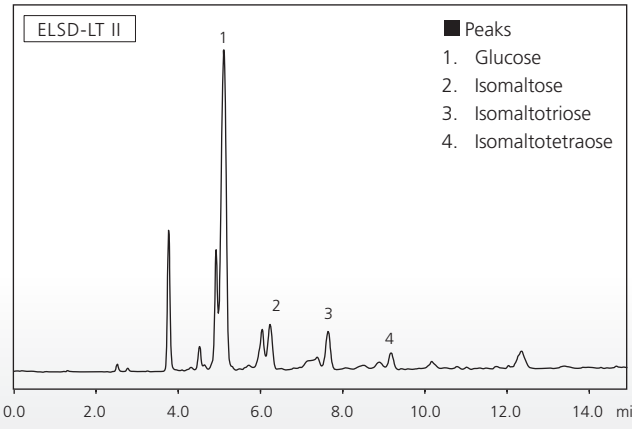
Furthermore, adding the ELSD-LT II evaporative light scattering detector enables detection of low lightabsorbing components with a gradient elution method. A remarkably wide range of applications is possible, including simultaneous analysis of multiple components.



Simultaneous analysis of synthetic pigments



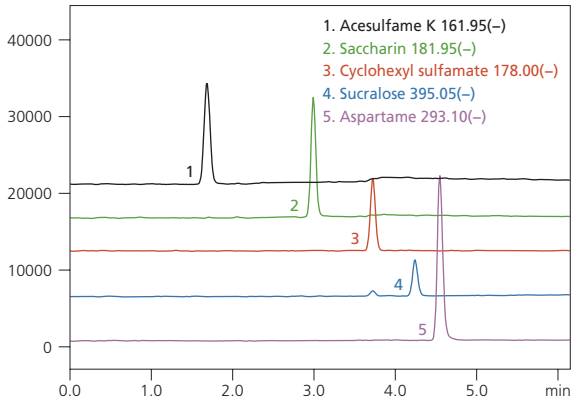
High-temperature analysis of sugars



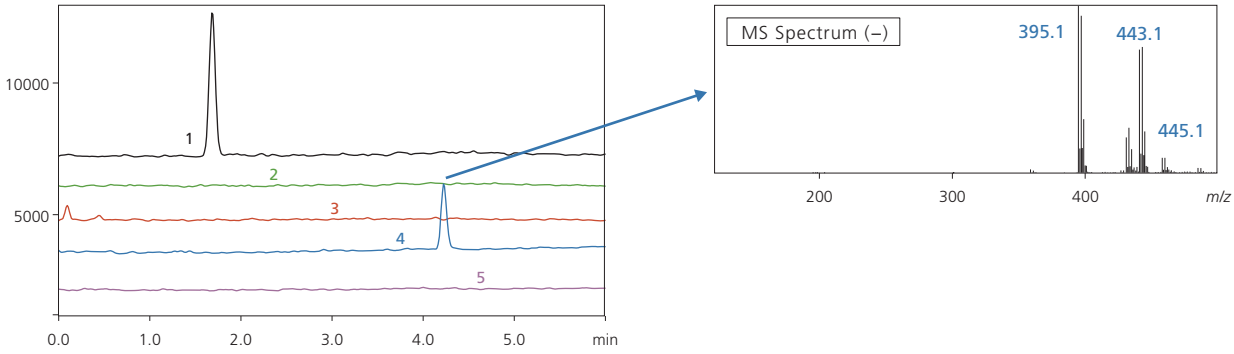
Gradient analysis of oligosaccharides using ELSD in Japanese sake

LC/MS is capable of separation by mass and the identification of components from MS spectral information. As a result, LC/MS has been widely used in the field of food analysis. Combining the i-Series (LC-2030C LT), which features a compact size and multi-specimen handling, with the LCMS-2020, which provides excellent qualitative capacities, enables accurate, high-quality quantitative and qualitative analysis of food products. This includes the analysis of a wide range of components, from effective components to toxic components, in foods.

Low-calories sweeteners are now widely used in food products. Sweeteners exhibit distinct flavors different from sucrose and glucose, so flavors are adjusted by combining multiple sweeteners or other methods. This publication shows the results of an analysis of carbonated beverages and a mixed standard solution of synthetic sweeteners utilizing the i-Series and the LCMS-2020. Sucralose is known for its poor light absorption, which makes it a difficult component to detect using a UV detector. In contrast, the LCMS-2020 can easily analyze these sweeteners.

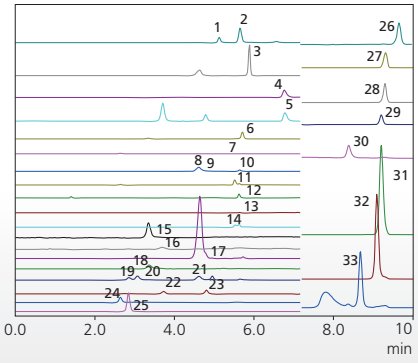


MS Chromatograms for Standard Sweetener Samples



Chromatograms for Solutions of Carbonated Beverages Diluted 400×

In amino acid analysis via HPLC, a long analysis time is required in order to separate the amino acids. When detecting by mass, however, the analysis time can be shortened while avoiding the impact of impurities.



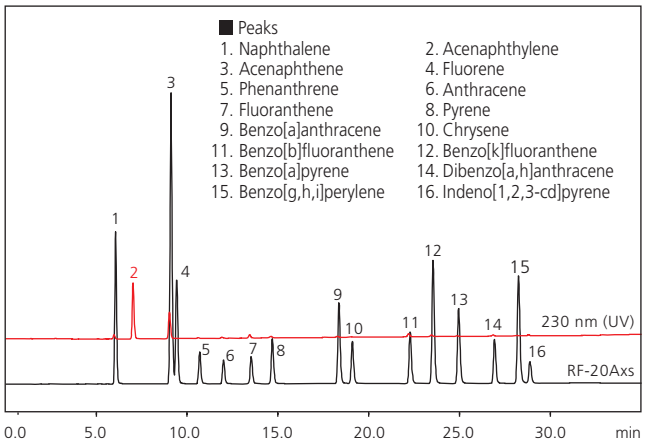
1. 3-Aminoisobutyric acid
2. GABA
3. Citruline
4. (Cys)2
5. Cystathionine
6. Asp
7. Thr
8. Sar
9. Ala
10. β-Ala
11. α-aminoadipic acid
12. Gln
13. Ser
14. Glu
15. Pro
16. Val
17. Theanine
18. Met
19. Leu
20. Ile
21. Hydroxyproline
22. Tyr
23. Methionine Sulfone
24. Phe
25. Trp
26. Arg
27. Hydroxylysine
28. Orn
29. Lys
30. His
31. Carnosine
32. Anserine
33. Methylhistidine

MS Chromatogram for a Standard Sample of 39 Amino Acids

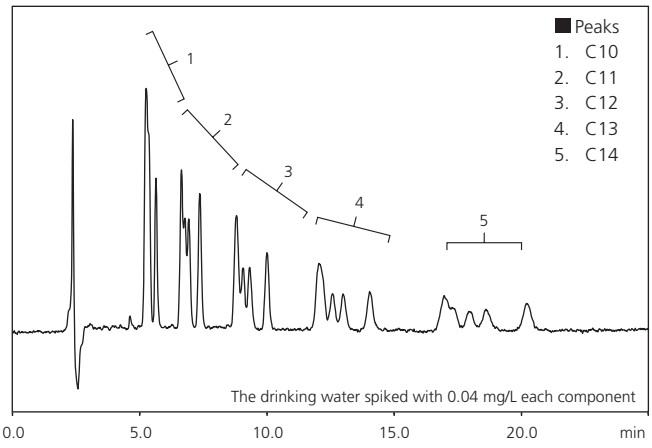
Environmental

The i-Series supports a wide range of HPLC analyses in the environmental industry, water, atmospheric and soil analysis.

Analyses of environmentally hazardous substances require high-sensitivity simultaneous detection. Connecting a worldclass sensitive fluorescence detector, RF-20Axs, to a system equipped with a UV detector increases detection selectivity and sensitivity, and ensures reliable detection and identification of trace-level of environmental contaminants.



Simultaneous analysis of polycyclic aromatic hydrocarbons

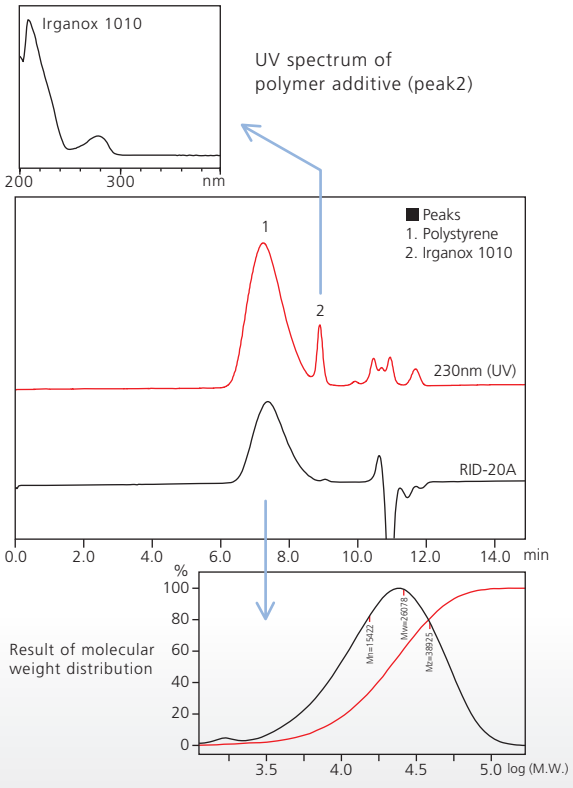


High-sensitivity analysis of anionic surfactants (LAS) in drinking water

Chemicals

The i-Series supports a wide range of HPLC analyses in the chemical industry, from small molecules to polymers.

Since the i-Series column oven accommodates multiple 30 cm columns, adding a differential refractive index detector enables GPC analysis of hydrophobic polymers and other materials. In addition, "LabSolutions GPC software" facilitates molecular weight distribution calculation. For trace amounts of light-absorbing additives in samples, a UV/VIS or PDA detector can be used complementarily.



GPC analysis of polystyrenes

High-Performance Columns for Stable Routine Analyses

With an extensive lineup and assured quality, Shimadzu Shim-pack series columns offer highly reliable and stable routine analyses on various applications.
The Shim-pack XR series, which have same separation characteristics and scalable packing material particle sizes, enable simplified development of analytical methods and transfer to faster analyses.

Shim-pack XR Series

Shim-pack XR series employs particle sizes of 2.2 µm and 1.6 µm to correspond with both ultrafast and high-resolution analyses. The three series, differing according to pressure tolerance, can be selected according to the analysis purpose and the device to be used.

Shim-pack XR-ODS, C8, Phenyl

Shim-pack XR-ODS, C8 and Phenyl columns use a 2.2 µm packing particle size and offer a skillful balance between resolution efficiency and pressure. An XR Series column resolution equivalent to a general-purpose column with 5 µm packing particle size (Shim-pack VP Series) significantly reduces the analysis time. The pressure on the column under many analysis conditions does not exceed 35 MPa. Consequently, ultrafast analysis can be comfortably performed on an existing instrument.

Shim-pack XR-ODS II / Shim-pack XR-ODS III

While the Shim-pack XR-ODS II/III use the same 2.2 µm packing particle size as the Shim-pack XR Series columns, they have higher 60/100 MPa pressure tolerance to achieve high-resolution, fast analysis in a long column using a water/methanol mobile phase. This column significantly extends the range of applications of ultra high-resolution and ultrafast analysis to include analysis near room temperature. The Shim-pack XR-ODS III lineup include a short length column using the 1.6 µm packing particle size, enabling much faster analysis.

Ghost Trap™ DS / DS-HP

It has been designed to effectively adsorb impurities in the mobile phase in order to reduce the time required for method development and impurity analysis. There are two types. The Ghost Trap DS is a high cost-performance cartridge type that can be used at 35 MPa. The Ghost Trap DS-HP is for UHPLC and can be used at 100 MPa.

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