

Hitachi High-Technologies

HITACHI

Hitachi Ultra High-Speed Liquid Chromatograph

LaChromUltra



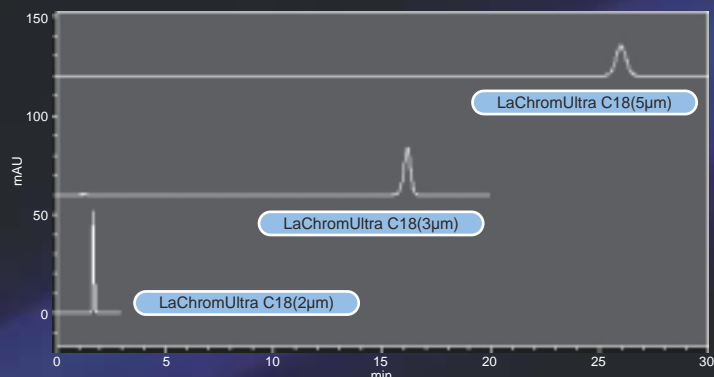
***Hitachi
Ultra High-Speed
Liquid
Chromatograph***

LaChromUltra delivers ultra-fast analysis, higher resolution, increased sensitivity and the flexibility to run both higher pressure and conventional HPLC analyses on a single system.



Hitachi Ultra High-Speed

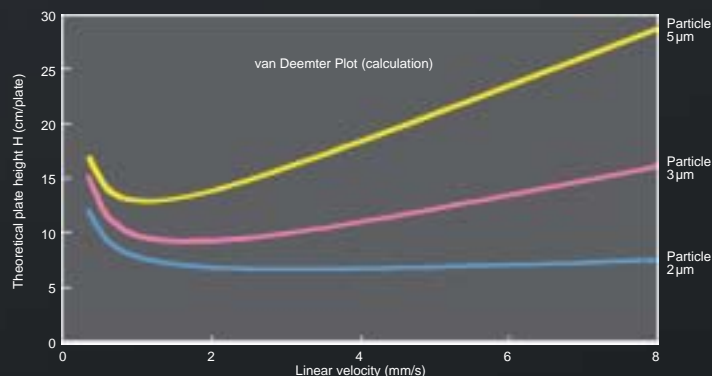
Achieving ultra high-speed, high-resolution LC analysis through the use of smaller particle sizes and higher pressures is a well-established technique that has shaped a new generation of LC columns and instrumentation. The unprecedented performance of this technique is possible because columns containing particles that are equal to or less than 2µm in diameter maintain excellent chromatographic efficiency even at higher flow rates. LaChromUltra delivers ultra-fast, high-resolution analyses through a balanced optimization of a 2µm particle column and a maximum 60MPa system pressure – reducing analysis time to about 1/10 of conventional HPLC systems.



Sample: Coenzyme Q10 100mg/L
 Column: 1. LaChromUltra C18 (5µm)
 (4.6mm I.D. × 150mmL)
 2. LaChromUltra C18 (3µm)
 (4.6mm I.D. × 100mmL)
 3. LaChromUltra C18 (2µm)
 (2.0mm I.D. × 50mmL)

Column temperature: 40°C
 Mobile phase: CH₃OH/C₂H₅OH = 13/7
 Flow rate: 1.0mL/min
 Detector: UV 275nm
 Injection volume: 2µm: 5µL
 3/5µm: 10µL

Convenient and flexible, LaChromUltra allows you to run conventional or ultra-high speed LC analyses on one reliable system. Because LaChromUltra was designed as an integrated LC solution it is compatible with Hitachi's conventional HPLC, LaChrom Elite, making it possible to share modules between systems. And switching between 2µm columns and conventional analytical columns is easy with LaChromUltra's specially designed column connection system.



[Benefits of LaChromUltra]

1. Ultra-fast analysis times: Reduced to about 1/10, as compared with our conventional HPLC.
2. Accurate and complete data: detector response times (0.01sec) and sampling periods (10msec) designed for high speed analysis.
3. Easy to use: finger-tight column switching system allows you to easily change between ultra and conventional LC columns.
4. Flexible: Choose Hitachi's 3/5µm particle columns for easy method transfer between ultra and conventional LC applications – on one system.

High Performance Liquid Chromatography

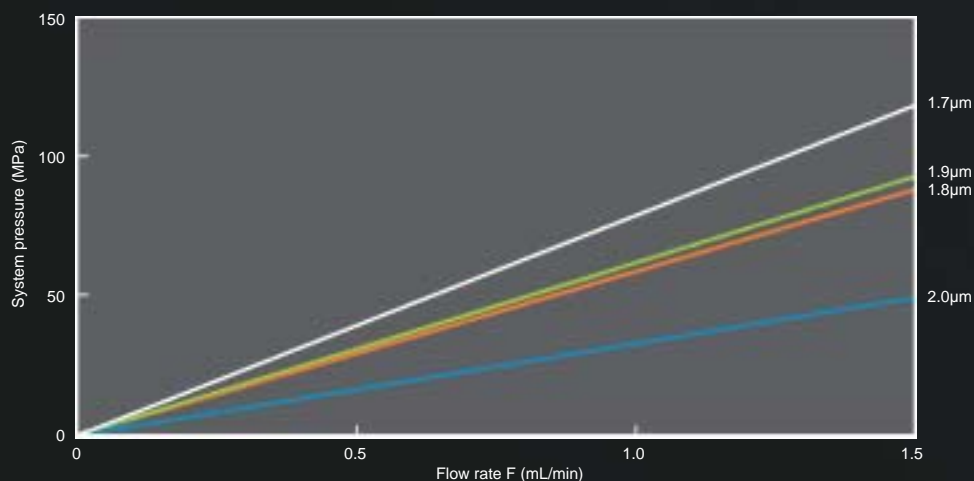
A Balanced Approach to Ultra-fast LC with the Hitachi LaChromUltra C18 2 μ m column: Ultra High-speed, High-resolution Analysis at Pressures < 60MPa

2 μ m column



● Ultra-fast analysis without ultra-high pressures through the use of a high liquid permeability 2 μ m column.

The LaChromUltra (2 μ m) column features high liquid permeability (low pressure resistance) and a small pressure loss allowing you to reduce analysis times to about 1/10 of conventional HPLC at a system pressure of <60MPa.

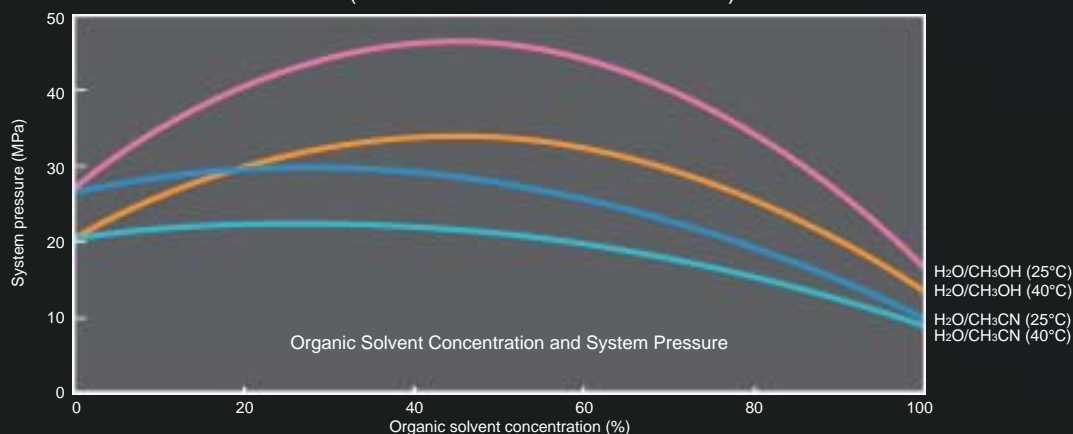


(Note) Liquid permeability data: The graph shows a pressure profile of columns containing different particle sizes at increasing flow rates but the caption says we are comparing pressure loss at a constant flow rate.


Conversion conditions: Feeding of 100% methanol at 25°C to 2mm I.D. \times 50mmL column

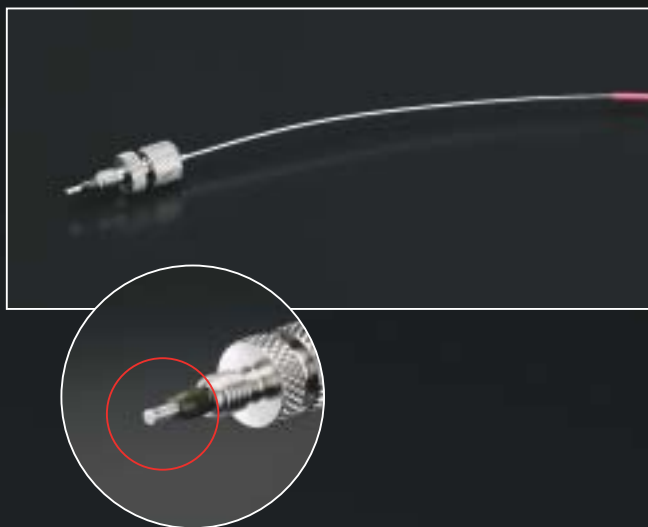
● System Pressure of 60MPa or less in Use of Water-Methanol Eluent

The system pressure does not exceed 60MPa when HITACHI LaChromUltra C18 (2 μ m) is used for viscous water-methanol eluent (delivered at a flow rate of 0.5mL/min).



Changing Columns is Easy with the Specially Designed, Finger-tight Column Connection System.

- LaChromUltra's column connection system easily withstands 60MPa with only finger tightening.
- Ferrule Position ( **portion**) is automatically optimized when tightening eliminating dead volume in the connection.
(Ferrule material is Vespel as a standard and can be changed to PEEK, etc.)



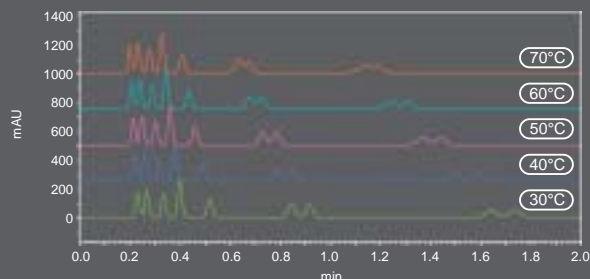
Dangers of using high temperature to achieve high speed analysis.

By increasing the column temperature, the column pressure can be lowered. However, there is a possibility of the following:

- Decrease in retention coefficient (change in mobile phase composition to realize excellent separation)
- Degeneration of sample due to high temperature
- Change of peak shape or poor separation
This means that increasing the column temperature is not effective for all samples.

HITACHI LaChromUltra C18 (2 μ m) column allows high-speed analysis without increasing the column temperature because its pressure is low.

Example of Analysis of Food Preservatives



LaChromUltra is compatible with Hitachi's Conventional HPLC "LaChrom Elite"

5 μ m column **3 μ m column**

- **LaChromUltra builds on the proven LaChrom Elite platform inheriting its ease-of-use and convenient maintenance features.**

(LaChromUltra shares the L-2300/L-2350 column oven, organizer and consumables with LaChrom Elite.)

- **A conventional HPLC mixer and low volume mixer are both standard on LaChromUltra making it easy to use conventional or 2 μ m columns for your analysis.**

- **LaChrom Elite controllable by control software "EZChrom Elite for Hitachi Ver.3.1.8"**

(also controllable by upgrading existing EZChrom Elite software)

- **Whether your application requires conventional or Ultra-fast LC Hitachi provides the highest quality column for your analysis.**

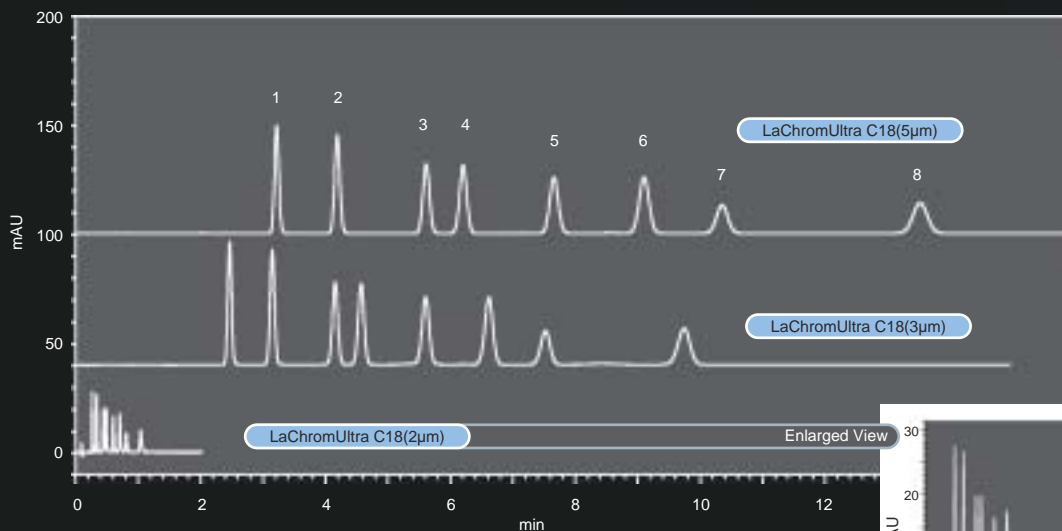
Almost the same separation pattern is obtained from analysis with the column packed with 5 or 3- μ m particles by the method developed in the LaChromUltra system.



LaChromUltra also features front accessibility, thus saving installation space and ensuring easy maintenance. It has the same operability and maintainability as LaChrom Elite.



Same separation pattern obtained with high-speed/ conventional LC columns



Sample: DNPH-aldehyde

1. Formaldehyde
2. Acetaldehyde
3. Acetone
4. Propionaldehyde
5. Crotonaldehyde
6. Isobutyl aldehyde
7. Benzaldehyde
8. n-valeraldehyde

Column: 1. LaChromUltra C18 (5 μ m)
(4.6mm I.D. x 150mmL)
2. LaChromUltra C18 (3 μ m)
(4.6mm I.D. x 100mmL)
3. LaChromUltra C18 (2 μ m)
(2.0mm I.D. x 50mmL)

Column temperature: 40°C

Eluent: CH₃CN/H₂O = 60/40

Flow rate: 1.0mL/min

Detector: 360nm

Instrument: Hitachi LaChromUltra

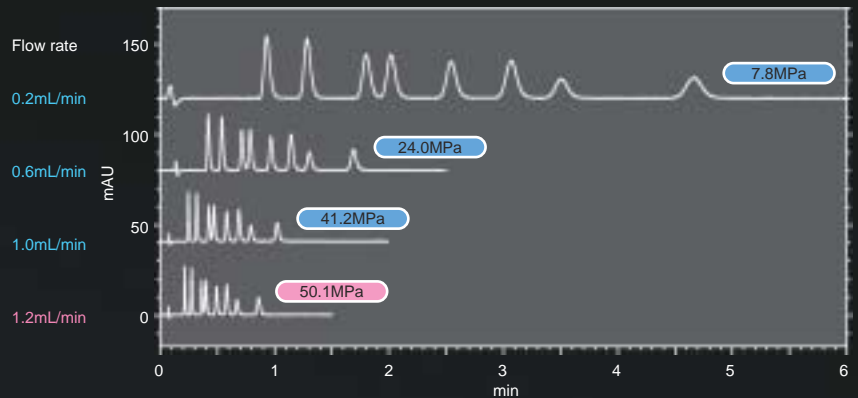
LaChromUltra Modules Specifically Optimized for Ultra High-speed, High-resolution Analysis.

Low noise and highly-accurate solvent mixing ratios with the L-2160U high pressure gradient system.

In the high-pressure gradient system, a sub pressure sensor is installed in the two pumps (1st pump head) in addition to the standard pressure sensor. A total of four sensors function to eliminate mutual pressure interference between the two pumps. This allows feeding of solvents at a very stable mixing ratio, thus realizing high-reproducibility, high accuracy gradient analysis.



Example of Analysis of DNPH Aldehyde



- Reduce bench space and system delay volume with the Built-in Degasser and High-pressure Gradient Unit.

The Degasser[®] and high-pressure gradient unit are internal to the pump resulting in a compact, efficient system minimizing connection tubing and bench space.

- Longer seal life and less maintenance with the standard equipped Plunger Washing Mechanism.

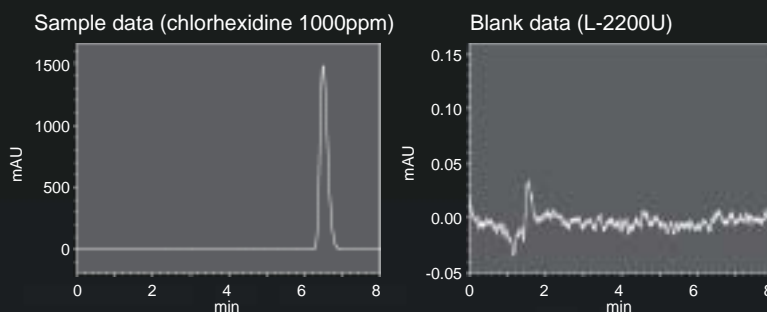
This mechanism prevents damage to the seal or plunger by salt crystallized from buffer solution. Automatic washing is available when the mechanism is used in combination with the auto sampler.



Fast cycle times, low carryover and highly accurate micro-volume injections with the L-2200U Auto Sampler

● Analysis of Micro Samples and Low Carryover

The L-2200U is a direct injection auto sampler that delivers 100% of the aspirated sample into the analytical flow path -- without sample loss. Requiring as little as 2µL of sample for a 1µL injection (using micro vial P/N 890-3673) there is no compromise in performance with very low sample volumes. In addition, carryover is reduced to 0.005% with the specially designed needle and injection port seal.



● High throughput analysis through better design

The analytical cycle time has been shortened by speeding up the mechanical action and washing process (in stand-alone mode: approx. 37sec when number of washings is 3 and injection volume is 1µL). The auto sampler can accommodate up to 200 1.5-mL vials or 3 micro plates (maximum number of samples: 1182), thus meeting the increasing needs for high-speed analysis.

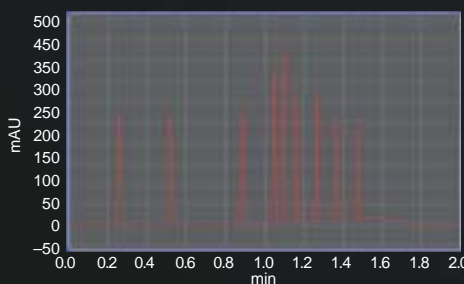
* The analytical cycle time given above is a reference value.

● Low Dead Volume

The respective internal volumes of the injection port, injection valve and flow path have been minimized to reduce sample diffusion. For the user who wants to further reduce the dead volume in the auto sampler, it is standard-equipped with a low-capacity sample loop (0.25mm I.D.). (In use of the sample loop (0.25mm I.D.), the injection volume and syringe speed are restricted.)

● Excellent accuracy and reproducibility

The sample injection timing of the auto sampler is synchronized with the operation timing of the pump to improve the reproducibility of peak retention time and consistently deliver highly accurate results.



Flow rate: 0.9mL/min
 Injection volume: 1µL
 Gradient elution:
 0min: 35% acetonitrile containing 0.1% TFA
 1min: 95% acetonitrile containing 0.1% TFA
 Column: LaChromUltra C18 (2µm), (2mm I.D. x 50mmL)
 Column temperature: 40°C
 Sampleloop: 0.25mmI.D. x 680mmL
 Needle: 0.2mmI.D.
 Mixer: Conventional mixer

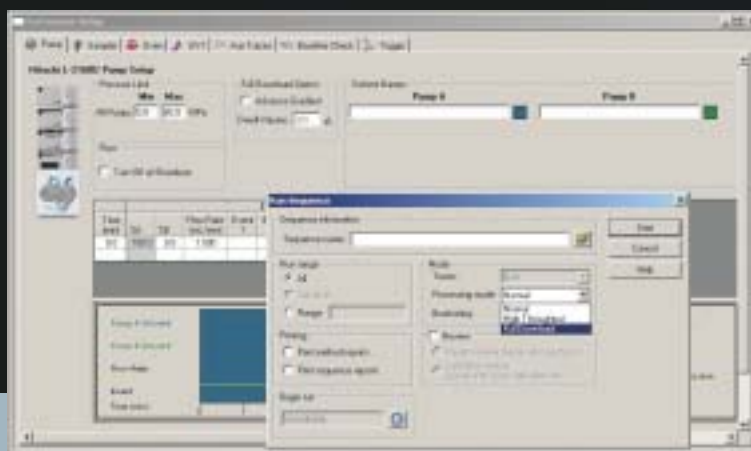
Reproducibility of gradient elution (retention time and peak area) n=10

Peak	Component	RT (min)	RT RSD%	Area (µV·s)	Area SD%
1	Acetanilide	0.255	0.10	1,105,478	0.26
2	Acetophenone	0.520	0.09	1,366,703	0.41
3	Propiophenone	0.886	0.12	1,039,794	0.47
4	Butylophenone	1.048	0.13	912,533	0.30
5	Benzophenone	1.100	0.14	1,088,765	0.45
6	Valerophenone	1.160	0.13	806,033	0.22
7	Hexanophenone	1.264	0.12	760,224	0.44
8	Heptanophenone	1.365	0.08	711,477	0.62
9	Octanophenone	1.474	0.06	694,373	0.36

New Software "EZChrom Elite for Hitachi Ver.3.1.8"

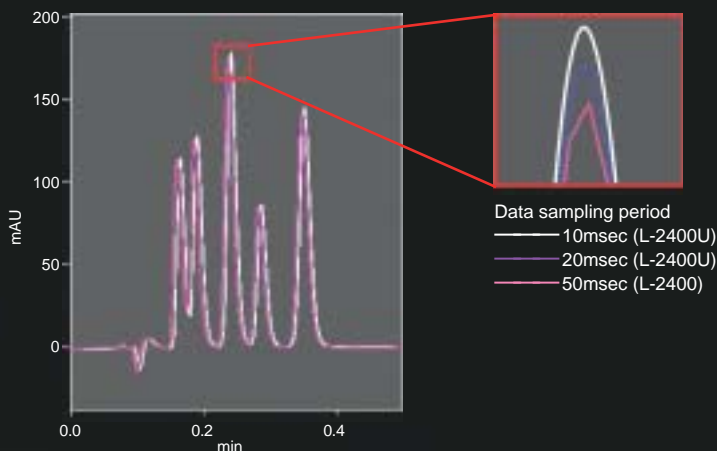
● Intelligent Gradient Function (only with LaChromUltra, only at measurement through sequence run in full sequence download mode)

LaChromUltra features an optimized delay volume and reduced volume mixer but to further reduce gradient delay Hitachi has developed the Advance Gradient Function which starts the gradient program at a time prior to sample injection based on your specific volume configuration.



Optimized Detectors for Ultra High-Speed Analysis

Ultra-high speed LC analysis results in ultra-sharp peaks, often with peak widths <1sec. Hitachi's LaChromUltra detectors are optimized for high speed analysis conditions with low volume flow cells and inlet tubing to minimize peak dispersion and ultra-fast response times (0.01sec.) and data sampling periods (as low as 10msec.) providing accurate, reliable data every time.



L-2400U UV Detector/L-2420U UV-VIS Detector

[Benefits]

- More information about your sample through greater sensitivity and reduced noise (0.6×10^{-5} AU or less).
- Confidence in your data with the automated wavelength accuracy verification of six wavelengths.
(when combined with EZChrom Elite for Hitachi Ver. 3.1.8)



L-2485U Fluorescence Detector

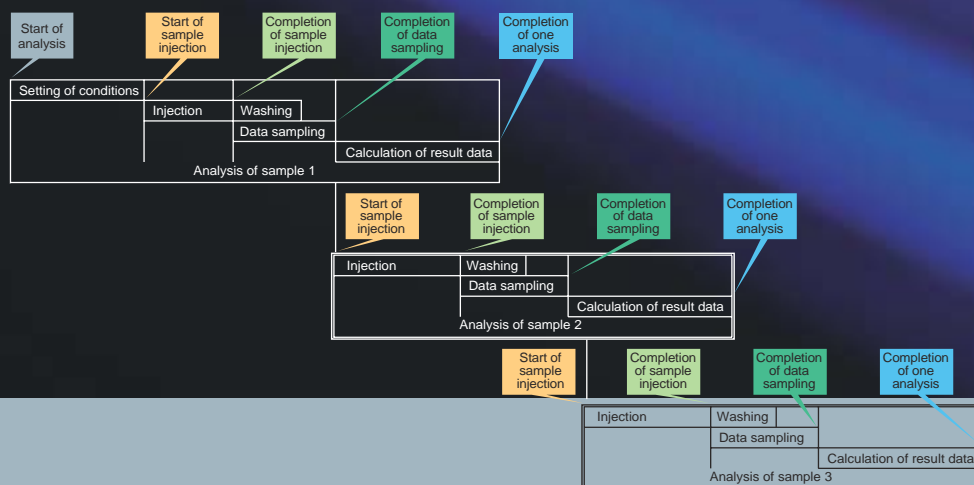
[Benefits]

- More information about your sample through greater sensitivity – S/N ratio of 550 or better realized in combination with ultra high-speed LC flow cell (under specified conditions).
(S/N ratio of 900 or better (with Raman peak of water) in combination with standard flow cell)
- Confidence in your data with automatic wavelength check at three wavelengths (254, 365 and 536nm) each on both excitation and emission sides with built-in Hg lamp.
(when combined with EZChrom Elite for Hitachi Ver. 3.1.8)



● Full Sequence Download Mode (only with LaChromUltra)

At the beginning of an analysis sequence all method and sequence information is transferred to the system one time reducing cycle time delays due to repeated information transfer for each individual sample analysis.



Major Specifications of LaChromUltra

L-2160U Pump

Liquid feed system	Dual-plunger reciprocating pump (series connection, pulsation suppression)
Flow rate range	0.001 to 5.000mL/min
Max. discharge pressure	60MPa (0.001 to 2.500mL/min)
Flow rate accuracy	±2% (0.101 to 2.500mL/min)
Flow rate precision	RSD 0.07% or SD 0.02min
Dimensions/weight	340 (W) × 400 (D) × 150 (H)mm, 15kg
Power supply	DC24V (supplied from organizer)
Power consumption	50VA

Gradient System

Number of solutions mixable	2 solutions
Mixing system	2-pump flow rate control

L-2200U Auto Sampler

Number of samples	1.5mL × 200 pcs (1mL vial and micro plate usable with optional rack)
Sample injection system	Direct injection
Sample injection volume	0.1 to 50μL
Injection volume reproducibility	0.3% RSD or less (when 10μL is injected)
Carryover	0.005% or less (under specified conditions)
Withstand pressure	60MPa
Sample cooling	Thermoelectric cooling rack optionally available
Dimensions/weight	340 (W) × 400 (D) × 300 (H)mm, approx. 19kg
Power supply	DC24V (supplied from organizer)
Power consumption	50VA

L-2300 Column Oven (usable in common with LaChrom Elite)

Temperature control system	Block heating + Air circulation
Temperature setting range	1 to 65°C (in 1°C steps)
Temperature control range	(room temperature -15) to (room temperature + 50)°C (up to 65°C)
Temperature control accuracy	±0.1°C
Column accommodated	Up to 3 25-cm columns
Dimensions/weight	340 (W) × 400 (D) × 150 (H)mm, approx. 10kg
Power supply	100V (50/60Hz) (organizer and AC adapter not required)
Power consumption	200VA

L-2350 Column Oven (usable in common with LaChrom Elite)

Temperature control system	Block heating + Air circulation
Temperature setting range	1 to 85°C (in 1°C steps)
Temperature control range	(room temperature -15) to (room temperature + 50)°C (up to 85°C)
Temperature control accuracy	±0.1°C
Column accommodated	Up to 4 50-cm columns (10mm I.D. max.)
Dimensions/weight	210 (W) × 360 (D) × 615 (H)mm, approx. 20kg
Power supply	100V (50/60Hz) (organizer and AC adapter not required)
Power consumption	300VA

L-2400 UV Detector

Optical system	Double-beam ratio photometry system
Light source	D2 lamp, Hg lamp (for wavelength check)
Flow cell	3.2μL (optical path length 5mm)
Measuring wavelength range	190 to 600nm
Wavelength accuracy	±1nm
Noise	0.6 × 10 ⁻⁵ AU or less (250nm, air in cell, response 2.0sec, cell length 5mm)

Drift	1.0 × 10 ⁻⁴ AU/hr or less (250nm, air in cell, response 2.0sec, constant temperature, cell length 5mm)
Response	0.01 to 2.0sec (7 steps)
Data sampling period	10msec (shortest)
Dimensions/weight	340 (W) × 400 (D) × 150 (H)mm, approx. 11kg
Power supply	DC24V (supplied from organizer)
Power consumption	85VA

L-2420U UV-VIS Detector

Optical system	Double-beam ratio photometry system
Light source	D2 lamp, W lamp, Hg lamp (for wavelength check)
Flow cell	3.2μL (optical path length 5mm)
Measuring wavelength range	190 to 900nm
Wavelength accuracy	±1nm
Noise	0.6 × 10 ⁻⁵ AU or less (250/600nm, air in cell, response 2.0sec, cell length 5mm)
Drift	1.0 × 10 ⁻⁴ AU/hr or less (250/600nm, air in cell, response 2.0sec, constant temperature, cell length 5mm)
Response	0.01 to 2.0sec (7 steps)
Data sampling period	10msec (shortest)
Dimensions/weight	340 (W) × 400 (D) × 150 (H)mm, approx. 11kg
Power supply	DC24V (supplied from organizer)
Power consumption	85VA

L-2485U Fluorescence Detector

Light source	Xe lamp, Hg lamp (for wavelength check)
Wavelength range	Excitation side: 200 to 850nm Emission side: 250 to 900nm (For 731nm or longer, the photomultiplier needs to be changed.)
Wavelength accuracy	±3nm
Spectral bandwidth	Excitation side: 15nm Emission side: 15, 30nm (switchable)
Sensitivity	S/N ratio at Raman peak of water: 550 or better [ultra high-speed LC flow cell: 3μL (volume irradiated)] (baseline method) (Em: 30nm) S/N ratio at Raman peak of water: 900 or better (standard flow cell)(baseline method)(Em: 30nm)(option)
Material of wetted parts	Quartz, fluorocarbon resin
Response	0.01 to 2.0sec (7 steps)
Data sampling period	10msec (shortest)
Dimensions/weight	340 (W) × 400 (D) × 300 (H)mm, approx. 23kg
Power supply	100 V (50/60 Hz) (organizer and AC adapter not required)
Power consumption	450 VA

Organizer (usable in common with LaChrom Elite)

Output	DC24V, 300VA Power supply to 2 pumps, 1 auto sampler and 1 detector
Dimensions/weight	340 (W) × 400 (D) × 150 (H)mm, approx. 10kg
Power supply	100 to 240V (50/60Hz)
Power consumption	400VA
Software	EZChrom Elite for Hitachi Ver.3.1.8
OS	Windows XP*
USB I/F board	Common to LaChromUltra and LaChrom Elite

* Windows is a registered trademark of Microsoft Corporation in USA and other countries.

Modules for both LaChromUltra and LaChrom Elite

L-2300 Column Oven

[Benefits]

The block type preheating system improves the symmetry and sharpness of peaks. An air circulating system is adopted for the column block and the column can easily be detached. The standard-equipped cooling function permits temperature control in a wide range of 5 to 65°C (at a room temperature of 20°C).



L-2350 Column Oven

[Benefits]

This column oven adopts the same preheating system as in the L-2300 and is standard-equipped with the cooling function to allow temperature control in a wide range of 5 to 85°C (at a room temperature of 20°C). It can accommodate columns of up to 50cm in length.



Organizer

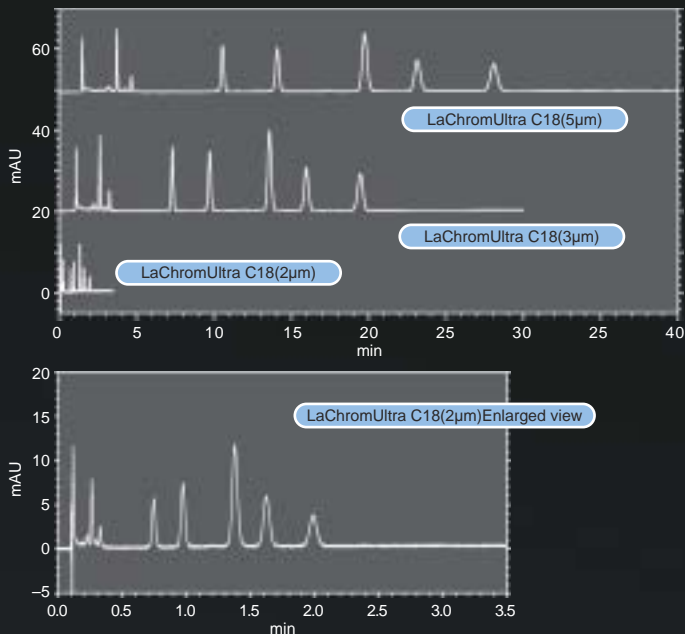
[Benefits]

The organizer is capable of supplying power to two pumps, one auto sampler and one detector. It is also usable as a reservoir to accommodate solvent bottles.



Examples of Analysis with LaChromUltra

Fat-soluble vitamins

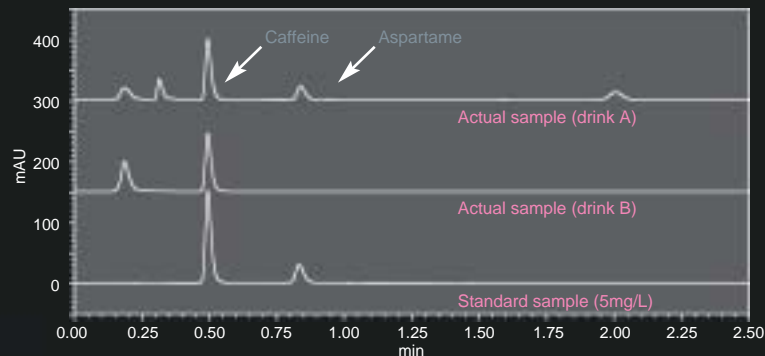


- Sample:
1. Vitamin A
 2. Retinol acetate
 3. Vitamin K2
 4. Vitamin D3
 5. Vitamin E
 6. α -tocopherol acetate
 7. Vitamin K1

- Column:
1. LaChromUltra C18 (5 μ m)(4.6mm I.D. \times 150mmL)
 2. LaChromUltra C18 (3 μ m)(4.6mm I.D. \times 100mmL)
 3. LaChromUltra C18 (2 μ m)(2.0mm I.D. \times 50mmL)

Column temperature: 30°C
 Eluent: CH₃CN
 Flow rate: 1.0mL/min
 Detector: UV 240nm
 Injection volume: 2 μ m: 1 μ L, 3/5 μ m: 10 μ L

Edulcorant Diluted to 1/10 with deionized water and then percolated with 0.45 μ m filter.

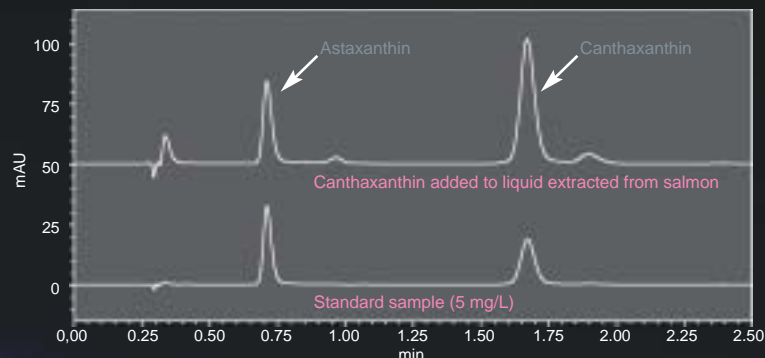


Sample:

1. Aspartame (5 mg/L)
2. Caffeine (5 mg/L)

Column: LaChromUltra C18 (5 μ m)(4.6 mm I.D. \times 150mmL)
 Column temperature: 40°C
 Mobile phase: CH₃CN/0.01 mol/L H₃PO₄ buffer solution (pH 3.2) =15/85
 Flow rate: 0.6mL/min
 Detector: UV 210nm
 Injection volume: 2 μ L

Astaxanthin

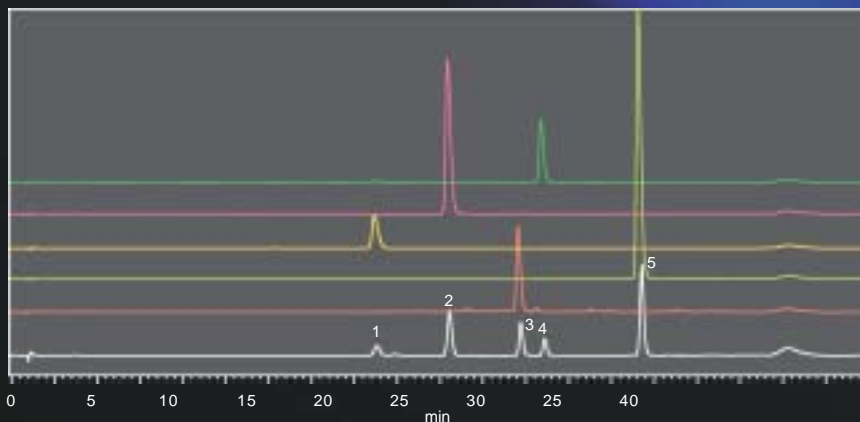


Sample:

1. Astaxanthin (5mg/L)
2. Canthaxanthin (5mg/L)

Column: LaChromUltra C18 (2 μ m)(2.0mm I.D. \times 50mmL)
 Column temperature: 40°C
 Mobile phase: 0.05% TFA/CH₃OH = 3/97
 Flow rate: 0.4mL/min
 Detector: UV 470nm
 Injection volume: 1 μ L

Catechin



1. Epigallocatechin + Catechin
2. Caffeine
3. Epigallocatechin gallate
4. Epicatechin
5. Epicatechin gallate

Time(min)	%A	%B
0.0	85	15
1.5	85	15
6.0	67	33
6.1	85	15
8.0	85	15

Measuring Conditions

Column: LaChromUltra C18 (2 μ m)(2.0mm I.D. \times 50mmL)
 Mobile phase: A: 0.05%(v/v) H₃PO₄, B: CH₃OH
 Flow rate: 0.5mL/min
 Detector: UV 280nm
 Flow cell: Ultra high-speed LC flow cell
 Injection volume: 5 μ L

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NOTICE: For proper operation, follow the instruction manual when using the instrument.

Specifications in this catalog are subject to change with/or without notice, as Hitachi High-Technologies Corporation continues to develop the latest technologies and products for our customers.

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