Hitachi
Ultra High-Performance
Liquid Chromatograph

Hitachi High-Tech
HITACHI

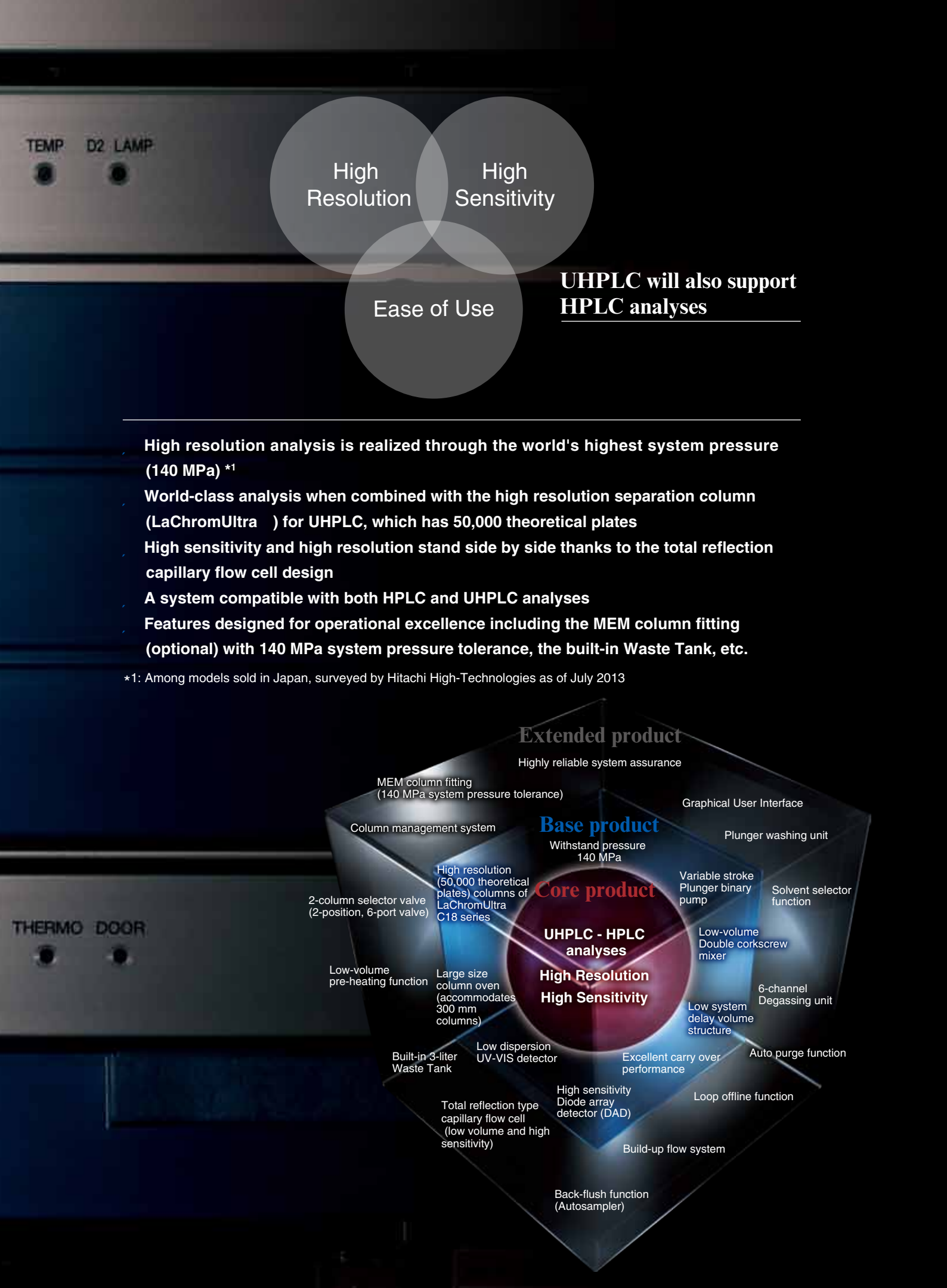
ChromasterUltra RS

ChromasterUltraRs

Visualize the future

A new UHPLC, designed for a new era, has emerged to lend indispensable support to your research.

We set out to view the issues from a new angle;
visualizing the future with no preconceptions.
Toward the realization of high resolution
and high sensitivity, achieved through advanced
technologies,
our daring approach resulted
in the ChromasterUltra Rs.
The future of UHPLC starts here and now.



UHPLC will also support HPLC analyses

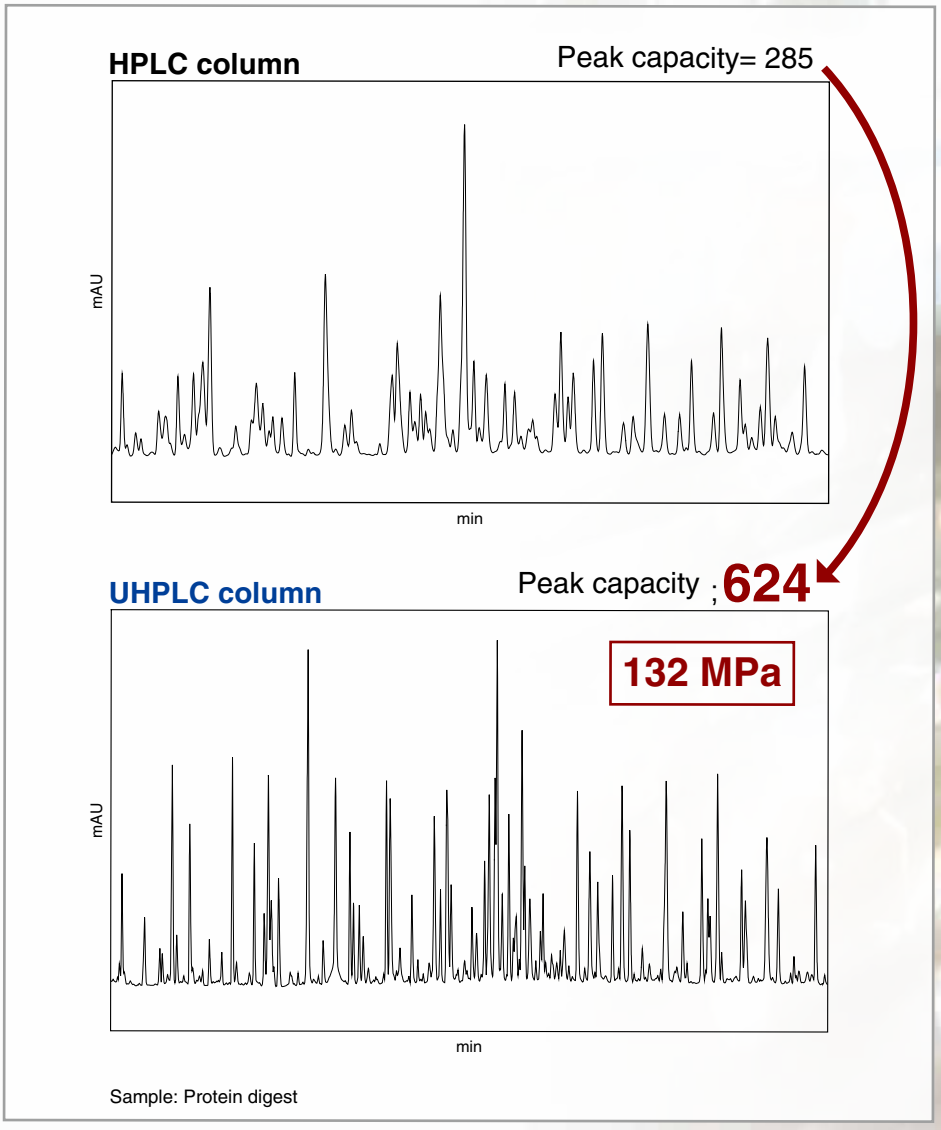
- **High resolution analysis is realized through the world's highest system pressure (140 MPa) *1**
- **World-class analysis when combined with the high resolution separation column (LaChromUltra) for UHPLC, which has 50,000 theoretical plates**
- **High sensitivity and high resolution stand side by side thanks to the total reflection capillary flow cell design**
- **A system compatible with both HPLC and UHPLC analyses**
- **Features designed for operational excellence including the MEM column fitting (optional) with 140 MPa system pressure tolerance, the built-in Waste Tank, etc.**

*1: Among models sold in Japan, surveyed by Hitachi High-Technologies as of July 2013

High Resolution

Sharp peaks hint at the capability of this system

When true separation performance is required,
tap into the high resolution analysis that only UHPLC can offer.

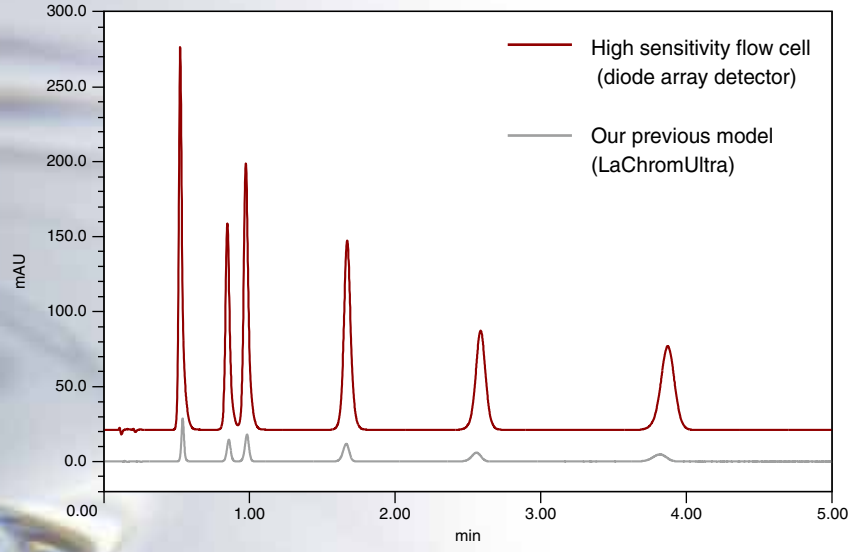


See P. 9 for details

High Sensitivity

Even peaks normally obscured by noise will not be missed

Lower the risk of missing trace components and impurities.



See P. 11 for details

ChromasterUltra R_S

Thorough inspection of individual systems
just prior to shipment assures delivery
of high quality products

Lineup

- Diode array detector (DAD) system
- UV-VIS system

R_S Resolution
Sensitivity

Contents

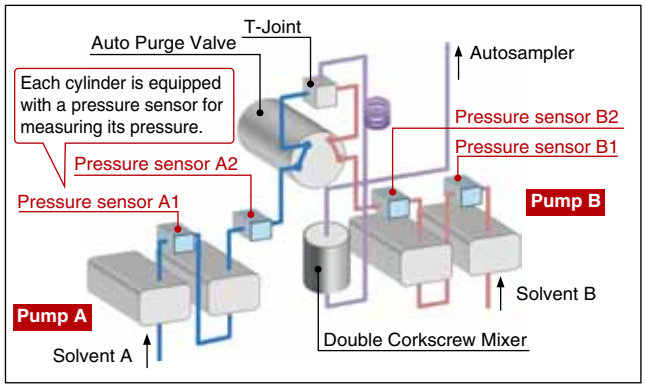
HPLC analyses

nce up to 140 MPa system pressure

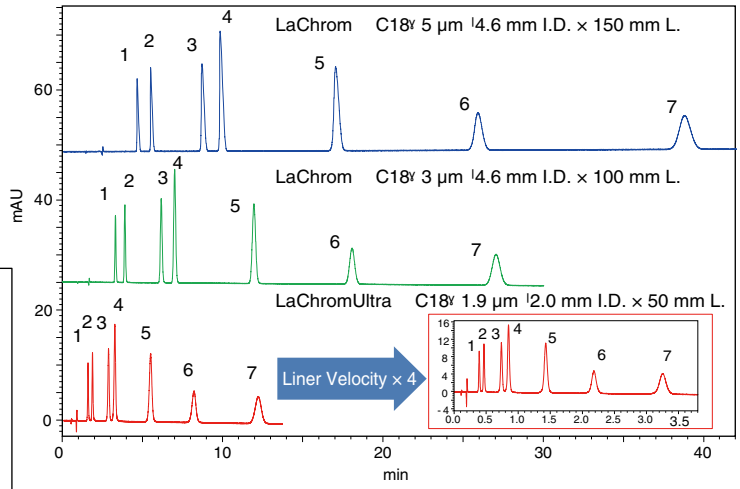
broad range of pressure, as high as 140 MPa, by incorporating a Binary pump. Even for gradient analysis under high pressures, ble

ted by improving the gradient response using an extremely low

Stable solvent delivery is realized, independent of pressure and solvent composition, by incorporating LBT control and by correcting the bulk modulus of solvent.
Stable analyses are achieved with 5 µm columns, 3 µm columns, and 1.9 µm columns.



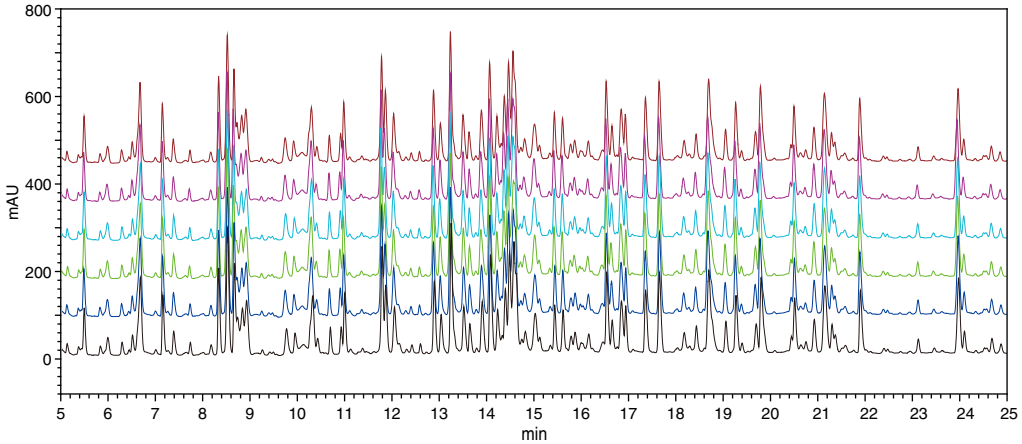
System configuration of Binary pump



[Conditions]
Eluent: 20 mM KH_2PO_4 / CH_3CN = 95/5
Detection: 274 nm

[Sample]
1. 1-Methyluric acid
2. 3-Methylxanthine
3. 1,3-Dimethyluric acid
4. Theobromine
5. Theophyline
6. h -Hydroxyethyltheophyline
7. Caffeine

Even for gradient analysis under high pressure conditions, highly reproducible, high resolution results are achieved.



[Conditions]
Column: LaChromUltra GC C18 1.9 µm
3.0 mm I.D. × 250 mmL.
Eluent: A 0.05 TFA/H_2O v/v
B 0.05 TFA/CH_3CN v/v
5 B 0 min 45 B 30 min
Flow rate: 0.85 mL/min
Column Temperature: 40
Detection: UV 214 nm

[Sample]
Protein digest

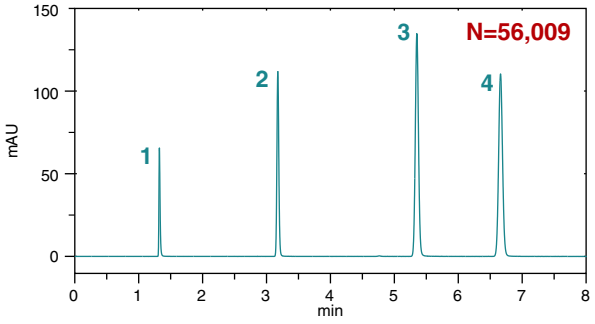
Highly reproducible analyses are also possible for analyses of protein digests, which produce numerous peptide peaks.

For the LaChromUltra C18 (1.9 µm) column, a high system pressure tolerance of 140 MPa* is realized by using grafted material comprised of organic-inorganic silica, the physical and chemical durability of which is improved compared to the conventional silica gel particle.
The combination of this column and the ChromasterUltra Rs will enable a system pressure tolerance of 140 MPa with 50,000 or more theoretical plates per column.

┤Features├

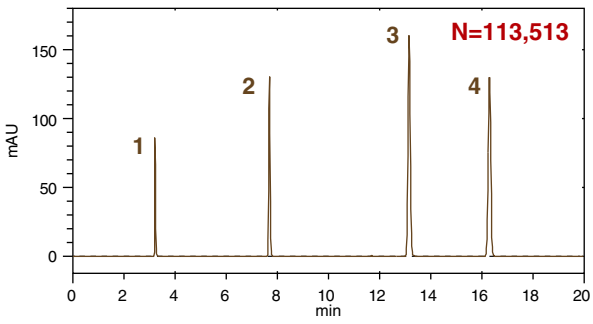
- High system pressure tolerance of 140 MPa*
- Mobile phase selectable for a wide range of pH from 1 to
- Ultra high resolution analysses by connecting columns in s

Column size: 3.0 mm I.D. × 250 mm L.
Flow rate: 0.7 mL/min **(72 MPa)**



Higher Resolution!

Column size: 3.0 mm I.D. × (250+250) mm L.
Flow rate: 0.7 mL/min **(128 MPa)**



[Conditions]
Eluent : 70% CH_3CN
Detection : UV 270 nm

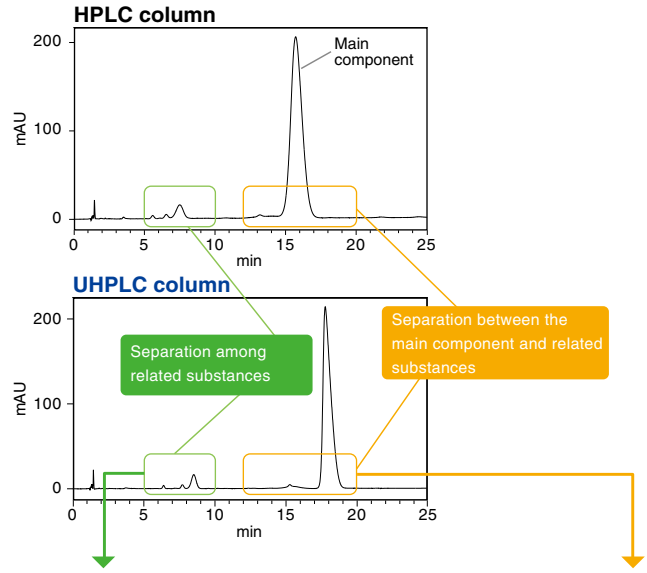
[Sample]
1. Uracil
2. Methyl benzoate
3. Naphthalene
4. Buthyl benzoate

* Each column has its own recommended flow rate range for analysis, and it is advisable to respect these limits in order to maintain and optimize the separation performance of any column.

The ChromasterUltra Rs is designed with reduced piping volume and minimized piping length, thereby improving the gradient response and reducing the extra-column dispersion.

The diode array detector (DAD) is equipped with a standard total reflection type capillary flow cell. Through the incorporation of capillary structure, the flow cell volume and the dispersion within the flow cell are reduced, leading to high resolution separation.

Erythromycin (a macrolide antibiotic having a basic structure comprised of a 14-membered ring) is used as a sample model for separation of the main component and related substances to compare the separation using an HPLC column vs. the separation using a UHPLC column.

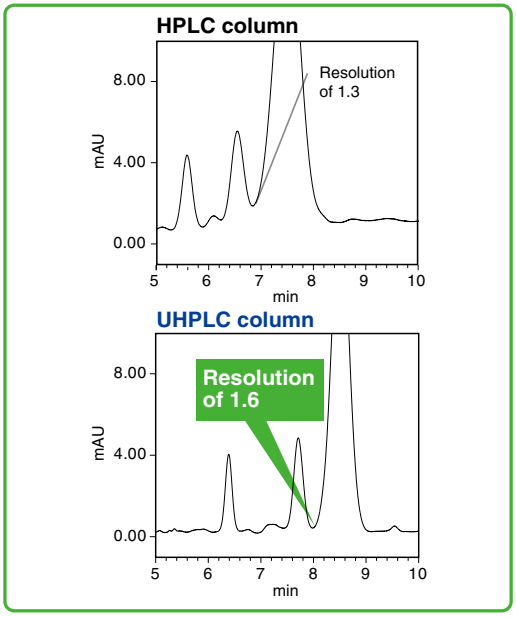


HPLC column

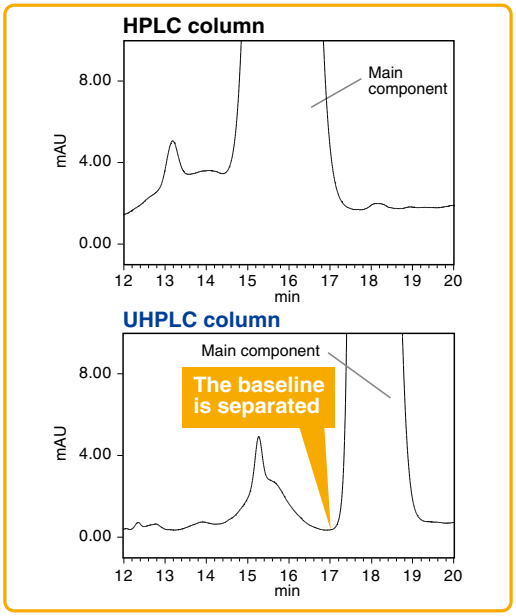
[Conditions]
Column : LaChrom GCI8(5 µm I4.6 mm I.D.x150 mm L.
Flow rate : 1.0 mL/min
Eluent : 20 mmol/L Phoshate Buffer/CH_3CN/CH_3OH ~ 45/40/15
Detection : DAD 210 nm

UHPLC column

[Conditions]
Column : LaChromUltra GCI8(1.9 µm I3.0 mm I.D.x250 mm L.
Flow rate : 0.710 mL/min
Eluent : 20 mmol/L Phoshate Buffer/CH_3CN/CH_3OH ~ 45/40/15
Detection : DAD 210 nm



Complete separation of related substances

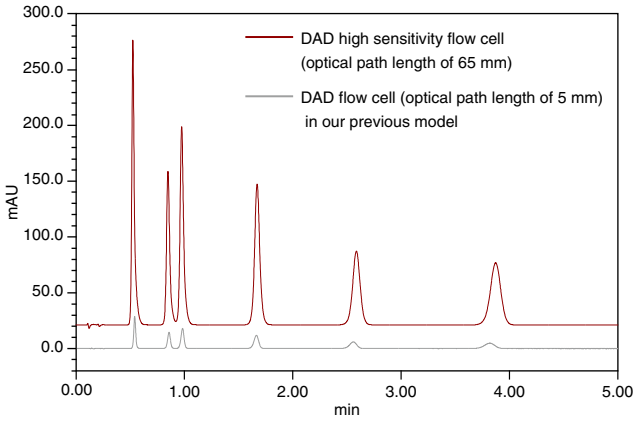


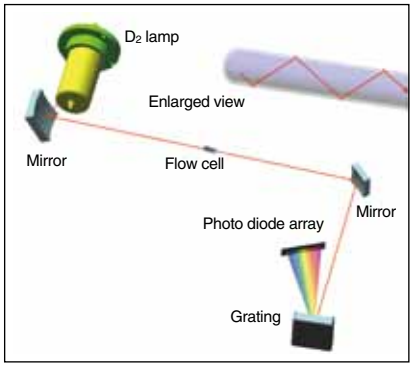
Separation of the main component peak

More satisfactory separations are attained by the use of the newly developed high resolution column for UHPLC applications.

* The “complete separation” stipulated in the Japanese Pharmacopoeia is resolution of 1.5 or more.

The diode array detector (DAD) exhibits low noise and low drift, achieved through the use of a new optical system providing optimal conditions for high sensitivity analysis. The optional high sensitivity flow cell (optical path length of 65 mm) further enhances, sensitivity; about a 10-fold increase is obtained compared with our previous model (LaChromUltra), thus making possible applications including impurities from side-reactions, genotoxic impurities, etc.
The acquisition of impurity profiles during all stages of synthesis and in raw materials used in medicines and chemicals, intermediate by-products, and finished drugs would be one of the useful applications.





DAD optical system

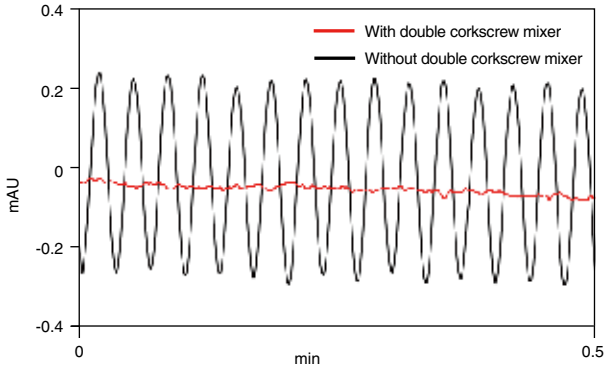
A quartz glass capillary tube is adopted as the flow cell channel, and the efficient total reflection at the capillary surface is harnessed to minimize the loss of flow cell transmission light. Consequently, even with the elongated optical path length of the flow cell, the baseline performance is comparable to the previous flow cell, resulting in a sensitive detector.

The Binary pump is equipped with the latest design in microfluidic double corkscrew mixers.
An efficient mixture is attained even for a low volume, resulting in a baseline that is extremely stable during gradient analysis, enabling higher sensitivity analysis.


Double corkscrew mixer
flow path diagram

Structure of
double corkscrew mixer:

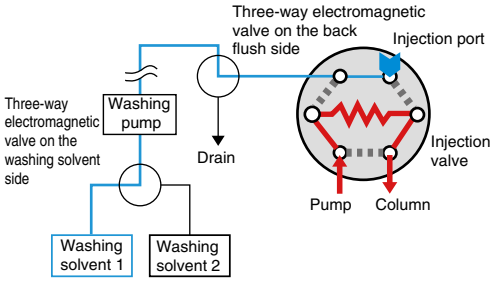
Repeated branching and merging of channels within the mixer provide effective solvent mixing (mixer volume of 55 µL).

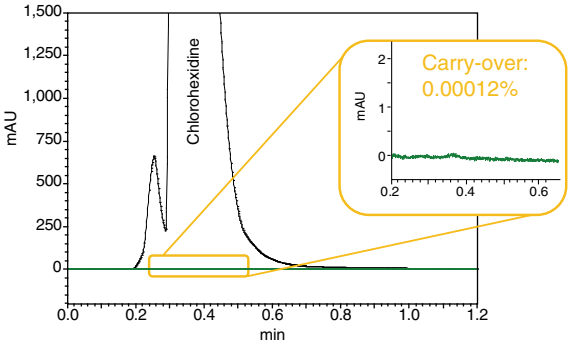


[Conditions]
Column: LaChromUltra C18, 1.9 µm, 2.0 mm I.D.×50 mm L.
Eluent: A) 0.1% TFA/H_2O (v/v)
B) 0.1% TFA/CH_3CN (v/v)
A/B=50/50
Flow rate: 0.500 mL/min
Detection: UV 214 nm

Low carry-over (0.001% or less) is attained via and optimized injection port structure.

- •The dead volume of the injection port is reduced
- •High flow rate washing is achieved through the use of a washing pump dedicated to the autosampler
- •Two solvents are available for washing the needle inner wall as well as the inside of the injection valve
- •A back flush function for the injection port is a newly incorporated feature

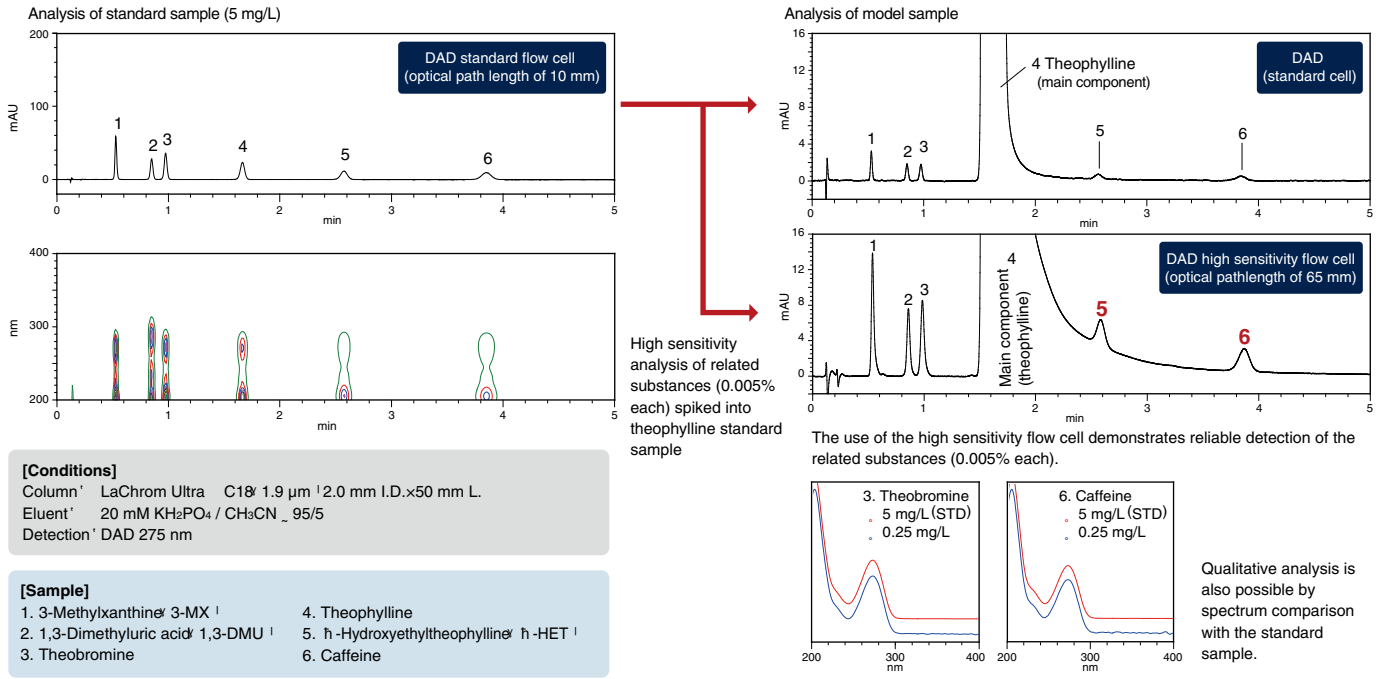




[Conditions]
Column: LaChromUltra C18, 1.9 µm, 2.0 mm I.D.x50 mm L.
Eluent: A) 0.1% TFA/H_2O (v/v)
B) 0.1% TFA/CH_3CN (v/v)
A/B=50/50
Detection: UV 257 nm
Wash Fluid: A/B = 50/50

[Sample]
Chlorhexidine

In developing drug and chemical materials, the characterization of active ingredients and impurities contained in raw materials and final products is an important process. Impurity profiling is achieved when high sensitivity detection of active ingredients and all impurities is complete. As an example, a model sample which contains theophylline as the main component is analyzed for comparing detection sensitivity.

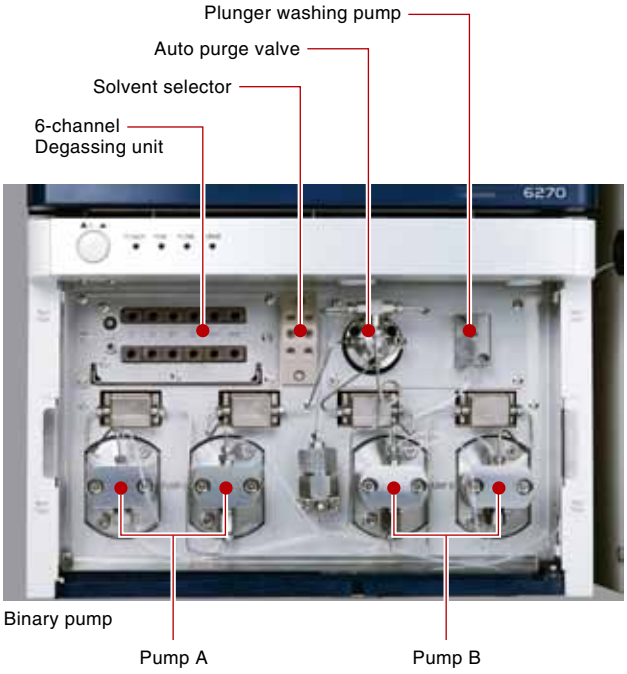


[Conditions]
Column: LaChrom Ultra C18, 1.9 µm, 2.0 mm I.D.x50 mm L.
Eluent: 20 mM KH_2PO_4 / CH_3CN = 95/5
Detection: DAD 275 nm

[Sample]
1. 3-Methylxanthine (3-MX)
2. 1,3-Dimethyluric acid (1,3-DMU)
3. Theobromine
4. Theophylline
5. 8-Hydroxyethyltheophylline (8-HET)
6. Caffeine

The auto-purge valve provides automatic switching from purging action to analysis.
Furthermore, the addition of the GUI controller (optional) allows Wakeup (automatic pre-analysis tasks) and Sleep (post-analysis tasks) programs to enhance user efficiency.

The solvent selector is standard equipment.
Two types of eluent can be selected by either pump.
This is particularly useful during analysis method development.



The 6-channel degassing unit can be used for four solvents when the solvent selector is in use and for two solvents for the autosampler.
This feature prevents trouble caused by bubble generation during operation.

Damage to the plungers caused by salt precipitation from buffer solutions or plunger seal wear from debris can be greatly reduced by using the plunger wash unit to perform automatic washes after each analysis.

This function will minimize damage to the column resulting from rapid changes in the flow rate or column pressure.
When pumping starts or during flow rate changes, the system can automatically accelerate or decelerate the flow rate to the set point.

The oven temperature can be set within the range from 4 to 90 ,*1 and the setpoint is reached quickly

- R e m p e r a t u r e c o n over the entire range of temperature 1 settings
- L e w l y d e s i g n e d * l o w + t o l u m e p o r t h e a t
- U p t o t h r e e * 1 0 0 m m c o l u m n s c a n b e

*18 Rhe range of temperature control depends on the ambien
*28 Uhen MCM column fitting and optional taltes are not us

A view of column oven accommodating columns

A 3-liter Waste Tank is housed within the column oven.
Typically, a waste solution container is placed underfoot, but now the space for the container can be utilized for other purposes, and safety is also improved.
(User is able to utilize a different waste solution container, if preferred. Contact Hitachi for details.)

3-liter Waste Tank

A large-size tinted window (155 mm in height and 280 mm in width). plus a built-in LED lamp allow easy visual confirmation of the operating conditions and the number of samples inside the autosampler during system operation.

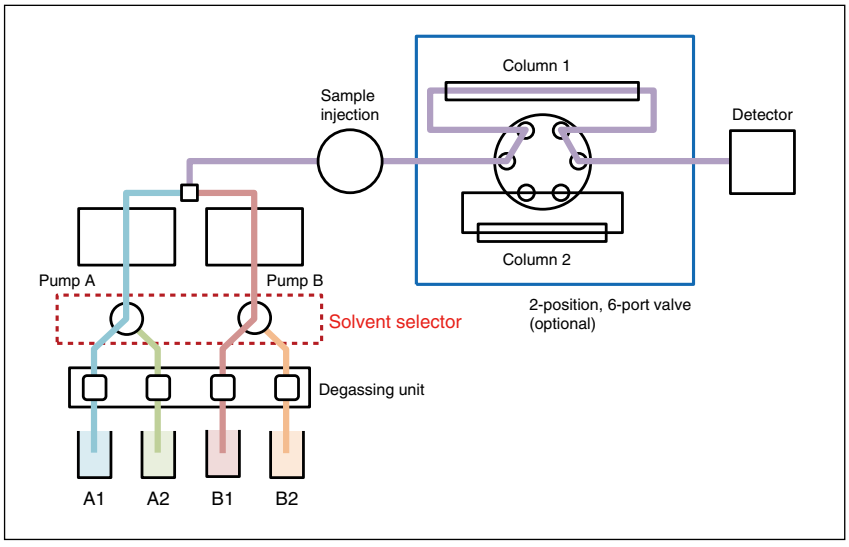
A large-size autosampler window

Hitachi's own Moment Enhancing Mechanism (MEM) column fitting is a simple but exciting new development.
The finger-tight piping integral fitting, which has a very small dead volume, is capable of safely tolerating system pressures as high as 140 MPa.

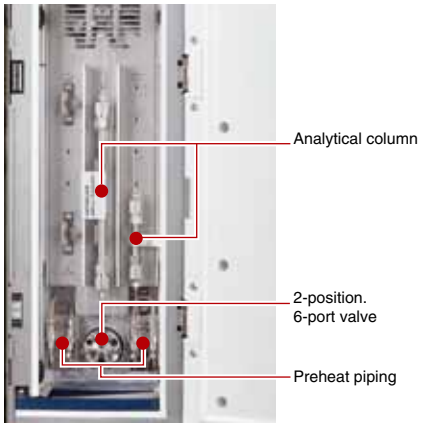
MEM column fitting

A view of operation of attaching a column

The column oven, can be fitted with an optional 2-column selector valve.
The combination of column switching and the solvent selector allows testing and analysis of various chromatographic conditions.
(When the 2-position, 6-port valve is incorporated, columns in length up to 250 mm can be used.)



Demonstrating the utility of the 2-column selector

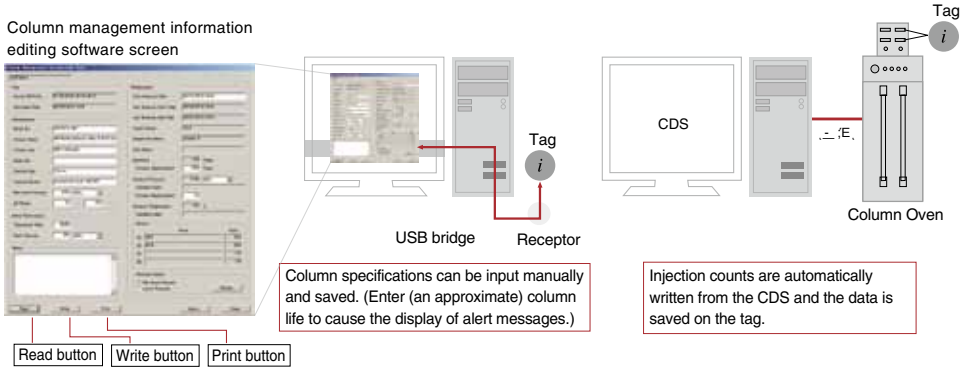


Column oven

analysis needs

The Hitachi column management system can be used to track the log information on analytical columns and guard-columns from any manufacturer. Log information can be written and read through a connector mounted on the column oven or a USB port in the computer.

* Up to two columns can be fitted at the same time.



A view of connector for column management system connected

All modules can be controlled from the Graphical User Interface (GUI) controller.
The GUI is comprised of a color LCD monitor (5.7-inch color TFT display with LED back-light) and a touch panel makes for easy viewing and simple operation.
Up to 10 programs including a timer function, pre-analysis tasks (Wakeup), and post-analysis tasks (Sleep) can be created for a system.
The GUI controller enables you to check the status of consumables usage for all units that are connected to the system.

Main settings in the modules

Pump: Solvent feeding on/off, pump purging, and plunger washing
Autosampler: Needle washing, rinse-port washing, and syringe purging
Oven: Temperature settings and valve switching
Detector: Lamp on/off and auto-zero

A view of GUI screen display

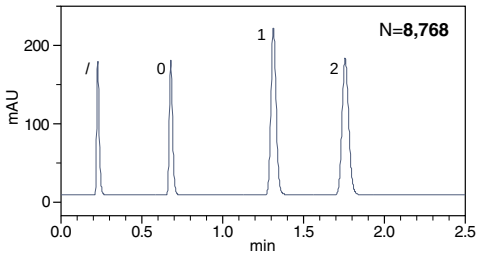

Operation


Maintenance (GLP)


Conditioning

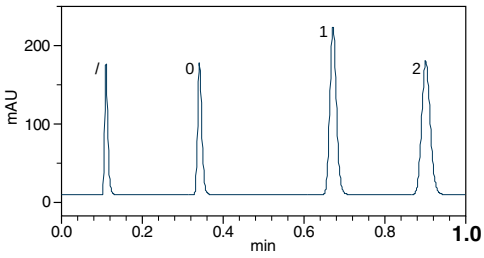
High resolution columns that are capable of attaining 50,000 theoretical plates will prove their capability in demanding applications such as isomer separation, multi-component analysis, etc. Furthermore, with the ChromasterUltra Rs it is possible to attain even higher resolution performance (as high as 100,000 theoretical plates) by connecting two columns of 250 mm in length.

Column size: 2.0 mm I.D. × 50 mm L.
Flow rate: 0.4 mL/min (22 MPa)



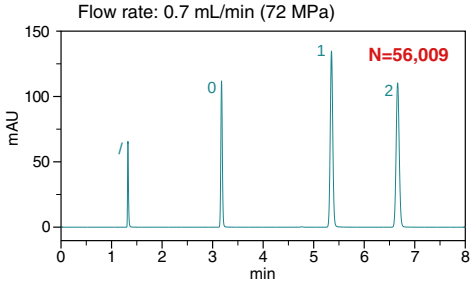
Higher Speed!

Column size: 2.0 mm I.D. × 50 mm L.
Flow rate: 0.8 mL/min (45 MPa)



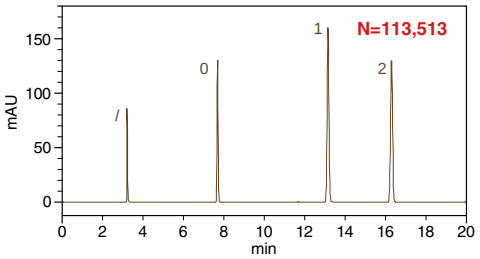
High Resolution

Column size: 3.0 mm I.D. × 250 mm L.
Flow rate: 0.7 mL/min (72 MPa)



Higher Resolution!

Column size: 3.0 mm I.D. × (250+250) mm L.
Flow rate: 0.7 mL/min (128 MPa)

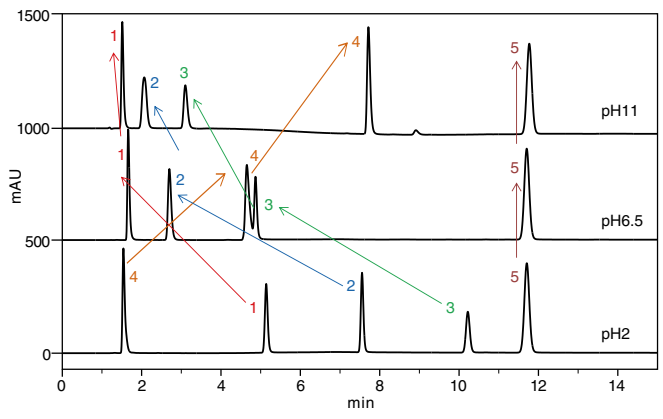


[Conditions]
Eluent: 60% CH_3CN (v/v) 70% CH_3CN (v/v)
Column Temperature: 40°C
Detection: UV 270 nm
Injection Vol.: 1 µL (v/v) 2 µL

[Sample]
1. Uracil (w)
2. Methyl benzoate (w)
3. Naphthalene (w)
4. Buthyl benzoate

* Each column has its own recommended flow rate range for analysis, and it is advisable to respect these limits in order to maintain and optimize the separation performance of any column.

The LaChromUltra (1.9 µm) and LaChrom (3 µm and 5 µm) columns are superior in not only their system pressure tolerance, but also their peak profile and alkali resistance performance owing to polymeric surface modification. Therefore, these columns allow a broad selection of eluent at different pH values ranging from 1 to 12.
Since a wide range of choices in mobile phase composition is available to the user, the retention and selectivity of ionic compounds can be freely controlled when establishing analytical conditions.



[Conditions]
Column: LaChrom C18 (5 µm) 4.6 mm I.D. × 150 mm L.
Eluent: A) 20 mM Potassium phosphate buffer(pH 2, 6.5, 11) / CH_3CN =95 / 5
B) CH_3CN
Gradient: B 30% (0min), 60% (3.5 min), 60% (15 min)
Flow rate: 1 mL/min.
Column Temperature: 40°C
Detection: UV 220 nm
Injection Vol.: 10 µL

[Sample]
1. Salicylic acid (w) 2. Ketoprofen (w) 3. Ibuprofen (w) 4. Quinidine (w) 5. Naphthalene (w)
(1-3: Acidic compounds, 4: Basic compound, 5: Neutral compound)

high system pressure

UHPLC columns in the HITACHI LaChromUltra series

Product Name	Particle Diameter (µm)	Size (mm I.D. × mm L.)	P/N
HITACHI LaChromUltra C18 (1.9 µm) The particles have the same properties as LaChrom (3 µm, 5 µm) but different sizes. It is easy to transfer methods between UHPLC and HPLC.	1.9	2.0 × 50	889-0901
		2.0 × 100	889-0902
		2.0 × 150	889-0903
		3.0 × 50	889-0904
		3.0 × 100	889-0905
		3.0 × 150	889-0906
		3.0 × 250	889-0907
		4.6 × 250	889-0908

Parker type is adopted for the column connections.

HPLC columns in the HITACHI LaChrom series

Product Name	Particle Diameter (µm)	Size (mm I.D. × mm L.)	P/N
HITACHI LaChrom C18 The particles have the same properties as LaChromUltra (1.9 µm) but different sizes. It is easy to transfer methods between UHPLC and HPLC.	3	4.6 × 100	889-0909
		4.6 × 150	889-0910
	5	4.6 × 150	889-0911
		4.6 × 250	889-0912

CAUTION: For correct operation, follow the instruction manual when using the instrument.

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

NOTICE: The system is For Research Use Only, and is not intended for any animal or human therapeutic or diagnostic use.
These data are an example of measurement; the individual values can not be guaranteed.

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Printed in Japan (H) **HTB-E110** 2014.2