SHIMADZU
Excellence in Science

High Performance Liquid Chromatograph
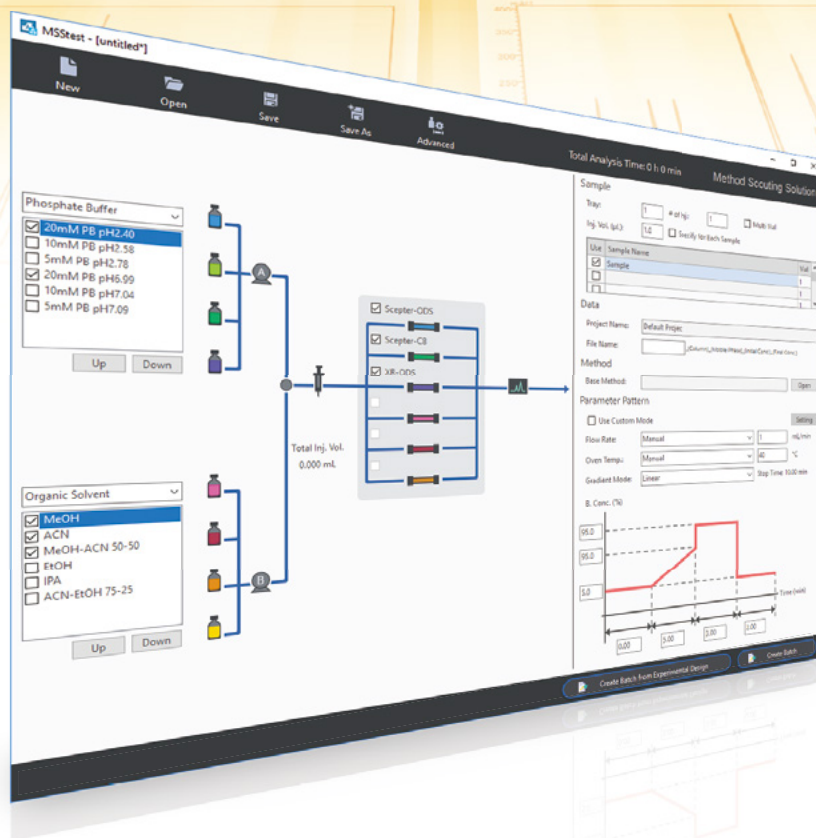
Method Scouting System

Maximizing Efficiency for Method Development

Fully Automated Method Scouting

Method Scouting System is a method development system based on Shimadzu's UHPLC technology.

The combination with Method Scouting Solution dedicated control software achieves a fast and accurate method scouting workflow, offering excellent support for method development.

Improving Method Development Productivity

Method Scouting System assists in analyses involving a large number of parameters for columns, mobile phases, etc., such as method scouting for new compounds or chiral compounds in the pharmaceutical and chemical fields. It can automatically determine optimum analysis conditions, improving method development efficiency.

❯ Flexible System Options

Method scouting can be carried out with the various LC models provided by Shimadzu. Choose from more compact instruments with excellent ease-of-use, systems designed for SFC, etc., depending on your analysis needs.

❯ Fully Automated Method Scouting

Method Scouting System is able to perform highly efficient and robust method scouting by automating entirely the switching between different combinations of mobile phases and columns.

❯ Optimization and Robustness Evaluation

In addition to column and mobile phase selection, the system supports gradient optimization and robustness evaluations. Analysis is run with varying parameters such as gradient, oven temperature, and flow rate. It is also compatible with continuous analysis based on a user-determined experimental plan.
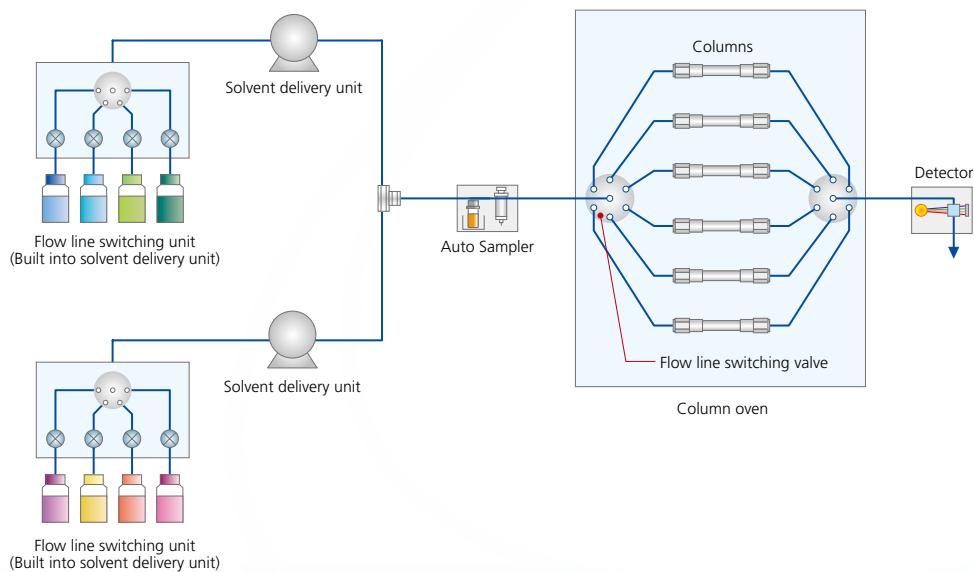
❯ Flexible System Options

Method scouting can now be performed with Shimadzu's diverse LC product line-up. Choose the system suited to your laboratory environment, whether for SFC investigations or simple investigations on compact systems.
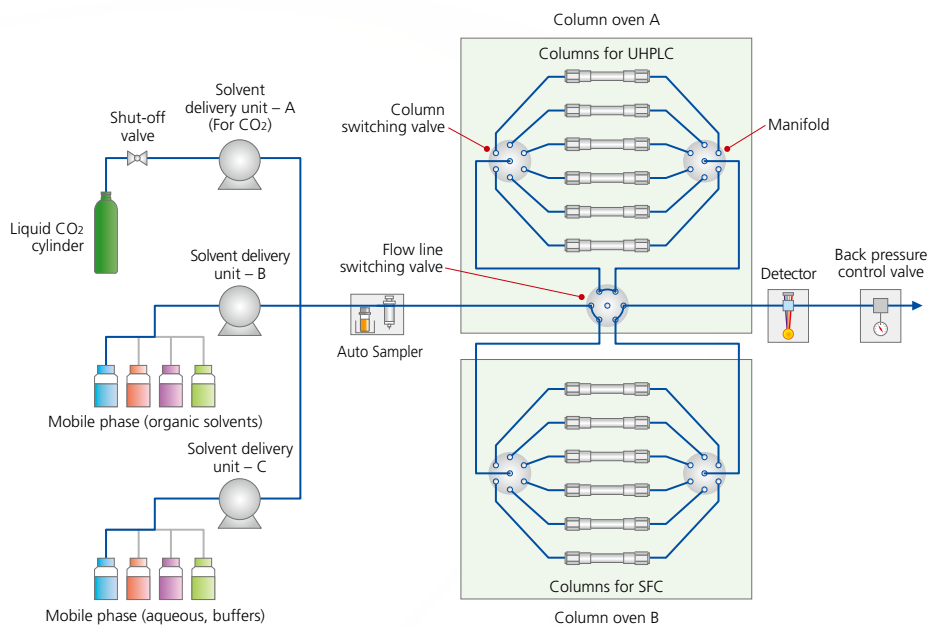
Nexera™ Method Scouting System

● Investigate analytical conditions with automated switching of columns and mobile phases
● Compatible with systems including 130 MPa UHPLC models or UHPLC-like models with method transfer.

Solvent delivery unit

Flow line switching unit
(Built into solvent delivery unit)

Auto Sampler

Solvent delivery unit

Flow line switching unit
(Built into solvent delivery unit)

Columns

Flow line switching valve

Column oven

Detector

Supercritical Fluid Chromatograph
Nexera/UCs
UHPLC/SFC Switching System

- Optimized for method investigation of chiral compounds
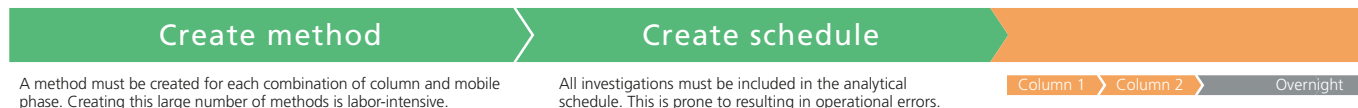- Also compatible with LC/SFC switching, and can investigate various separation modes

Shut-off valve

Solvent delivery unit – A (For CO_2)

Liquid CO_2 cylinder

Solvent delivery unit – B

Auto Sampler

Mobile phase (organic solvents)

Solvent delivery unit – C

Mobile phase (aqueous, buffers)

Column oven A

Columns for UHPLC

Column switching valve

Manifold

Flow line switching valve

Detector

Back pressure control valve

Columns for SFC

Column oven B

i-Series Method Scouting System

- Saves costs in transferring to routine testing
- Space-saving, low-cost design

Detector

Column oven

Auto Sampler

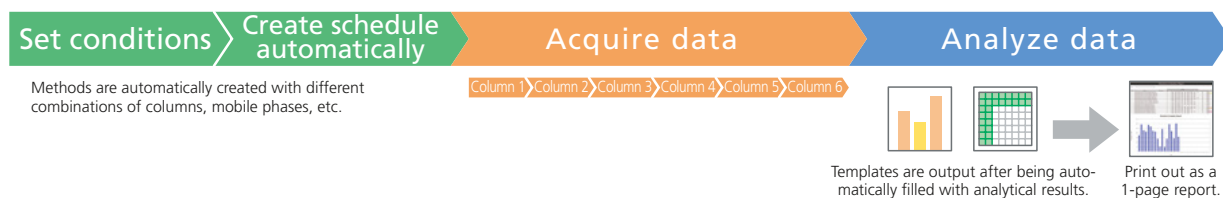Flow line switching valve

Solvent delivery unit
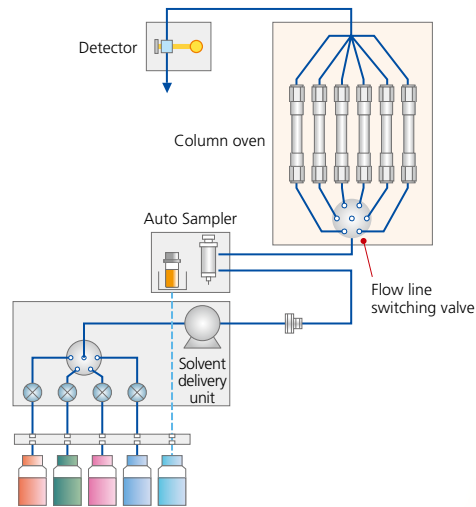
❯ Fully Automated Method Scouting

Method Scouting Solution dedicated software automates the switching of column and mobile phase combinations, leading to efficient and reliable method development.
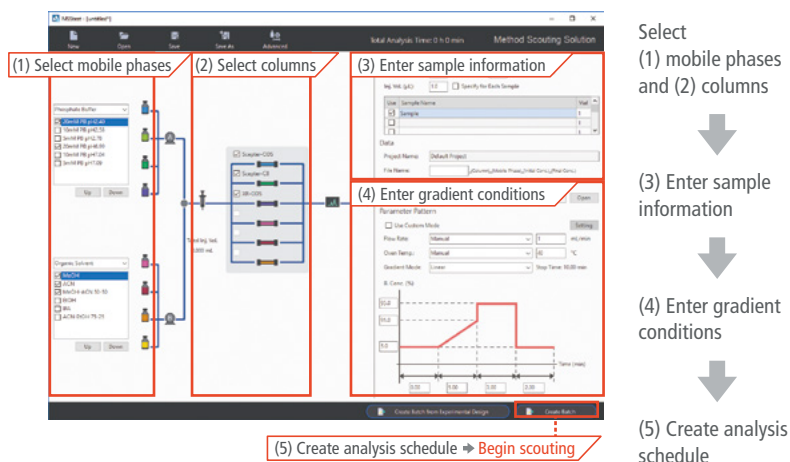
Previous Method

Create method	Create schedule	

A method must be created for each combination of column and mobile phase. Creating this large number of methods is labor-intensive.

All investigations must be included in the analytical schedule. This is prone to resulting in operational errors.

Column 1 ❯ Column 2 ❯ Overnight

Method Scouting System + Method Scouting Solution

Set conditions	Create schedule automatically	Acquire data	Analyze data

Methods are automatically created with different combinations of columns, mobile phases, etc.

Column 1 ❯ Column 2 ❯ Column 3 ❯ Column 4 ❯ Column 5 ❯ Column 6

Templates are output after being automatically filled with analytical results.

Print out as a 1-page report.

Leave Your Method and Analysis Scheduling to Method Scouting System

Usually when method scouting, a method has to be created every time the column or mobile phase is switched. For example, 100 combinations of analytical conditions leads to 100 method files, not only creating a huge amount of labor but also increasing the risk of operational mistakes.
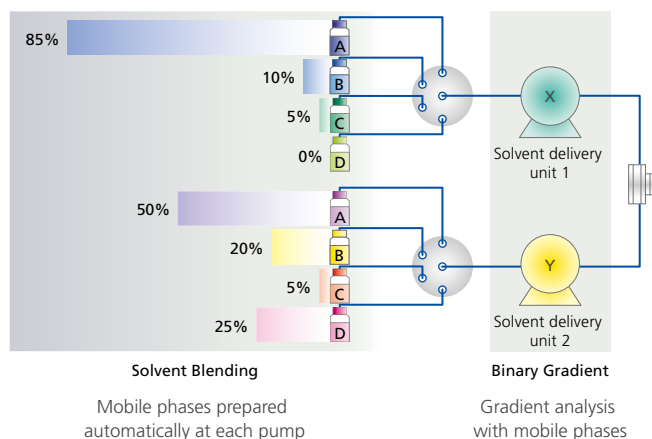
Method Scouting System is intuitive to operate and can automate these changes in analytical conditions, allowing you to use your resources more efficiently.

(1) Select mobile phases (2) Select columns (3) Enter sample information (4) Enter gradient conditions

(5) Create analysis schedule ➡ Begin scouting

Select
(1) mobile phases and (2) columns

⬇

(3) Enter sample information

⬇

(4) Enter gradient conditions

⬇

(5) Create analysis schedule

Labor-Saving Mobile Phase Blending

The mobile phase blending function in Method Scouting System allows you to quickly adjust the salt concentration, pH, and organic solvent ratio on-line using only a few pre-prepared solvents, and quickly search for suitable conditions.

This significantly reduces the time required to prepare and evaluate mobile phases. The integrated i-Series LC system can also perform different types of mobile phase blending, two for water-based and two for organic solvents, using a low-pressure gradient.
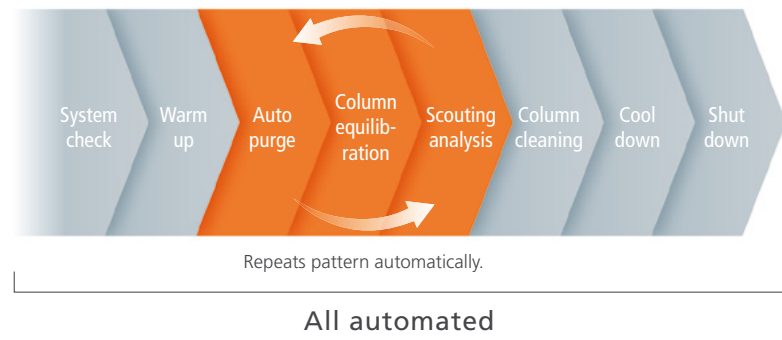

Solvent Blending

Mobile phases prepared automatically at each pump

Binary Gradient

Gradient analysis with mobile phases

Analyze data

Print out large volumes of analytical results. → Manually transcribe the necessary values into spreadsheet software. → Print out as a 1-page report.

Improved Operating Rates with Automation of Analysis Sequences

Purge conditions and equilibration during automatic switching of mobile phases and columns are key issues in method scouting.

With Method Scouting Solution, these and all laboratory operations can be performed automatically based on conditions set in advance, from automated control to system checks and system shutdown.

System check — Warm up — Auto purge — Column equilib-ration — Scouting analysis — Column cleaning — Cool down — Shut down

Repeats pattern automatically.

All automated

Seamless Evaluation of Results in a Multi-Data Report

The data can be evaluated quantitatively with a multi-data report. Shimadzu's evaluation method, based on the degree of separation and the number of peaks detected, can quantitatively analyze chromatograms to derive the optimum method. Register templates provided in Method Scouting Solution and the report will be produced as soon as the analysis is completed, so the optimum conditions can be checked right away.

Evaluation report

Data comparison graph

Number of peaks	Evaluation value	Rank
9	289.583	2
9	148.786	16
9	294.684	1
9	287.342	3
9	278.126	4
8	214.383	5
7	164.639	12

Ordered by evaluated score

A browser also allows for visual evaluation of multiple chromatograms.

› Optimization and Robustness Evaluation

In addition to column and mobile phase selection, the system supports gradient optimization and robustness evaluations. Analysis is run with varying parameters such as gradient, oven temperature, and flow rate. It is also compatible with continuous analysis based on a user-determined experimental plan.

Simple to Set Conditions for Optimization

After choosing the columns and mobile phases, gradient conditions need to be optimized. Using Method Scouting Solution, it is simple to create an analysis schedule which changes these conditions automatically.

Set number of steps and step size for changing parameters

Easily create an analysis schedule for changing parameters:
• Gradient conditions (concentration/time)
• Column oven temperature
• Flow rate
etc.

Efficient Robustness Evaluations

Method Scouting Solution can import any experimental design (Excel® format) and execute the analysis schedule. It can finely adjust analytical parameters such as flow rate and oven temperature to streamline robustness assessments that require multiple runs.

Experimental plan created with dedicated software

Link experimental plan and HPLC conditions

Batch schedule including column equilibration is automatically created

Improve Efficiency Even With Standard LCs

Operational efficiency can be improved even with a standard hardware configuration in the optimization and robustness evaluation stages that do not require automatic switching of mobile phases and columns.
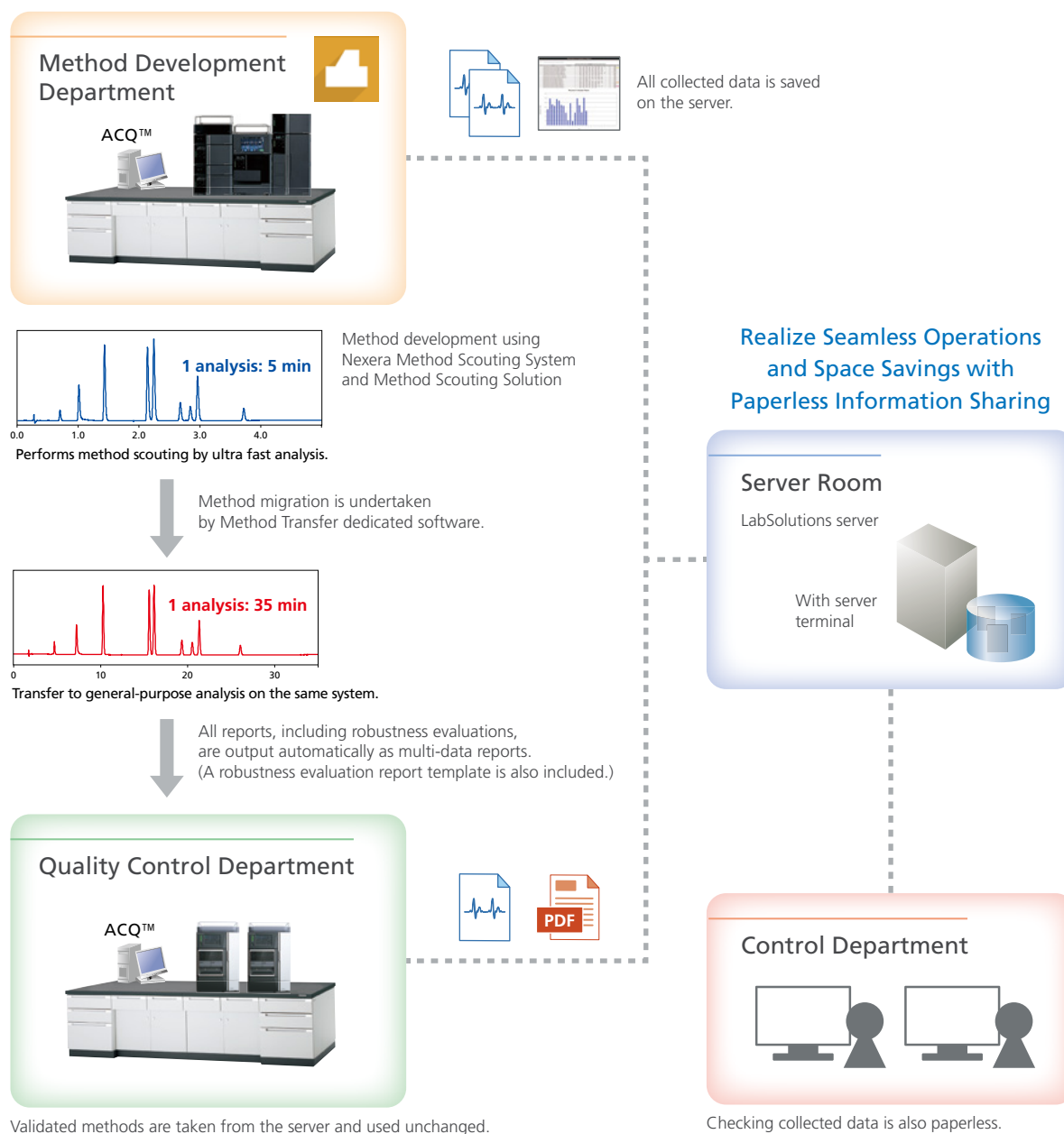
Method Scouting Solution is compatible with LCs that do not include mobile phase or column switching valves, so you can use your current LC for more efficient method development.
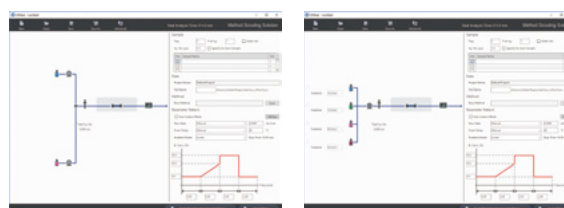
Interface for a simple configuration

Seamless Method Migration with LabSolutions™ CS

Once the optimal conditions are determined, they may be applied as general-purpose analysis conditions and transferred to other working departments. The data needs to be managed over long time periods and retrieved smoothly when needed. The combination of LabSolutions CS and Method Scouting Solution not only makes the method development process more efficient, but also streamlines a series of workflow tasks from reporting results to other departments to transferring methods.

Method Development Department

ACQ™

All collected data is saved on the server.

1 analysis: 5 min

Method development using Nexera Method Scouting System and Method Scouting Solution

Performs method scouting by ultra fast analysis.

Method migration is undertaken by Method Transfer dedicated software.

1 analysis: 35 min

Transfer to general-purpose analysis on the same system.

All reports, including robustness evaluations, are output automatically as multi-data reports. (A robustness evaluation report template is also included.)

Quality Control Department

ACQ™

PDF

Validated methods are taken from the server and used unchanged.

Realize Seamless Operations and Space Savings with Paperless Information Sharing

Server Room

LabSolutions server

With server terminal

Control Department

Checking collected data is also paperless.

❯ Application

Productivity Improvements for Method Scouting Process

When looking for the optimum mobile phase, column, and gradient conditions for a simultaneous analysis of multiple components, it is more efficient to break down the process into a number of steps. In the example shown below, simultaneous analysis conditions for a 13-component mixture of cephem antibiotics are determined by first narrowing down the mobile phase and column to items that are suited to the type of analysis (STEP 1) then optimizing the gradient conditions (STEP 2). This sequence of steps allows for efficient method scouting with reduced mobile phase consumption.

13-Component Mixture of Cephem Antibiotics

1. Cefsulodin
2. Cefadroxil
3. Cephapirin
4. Cefaclor
5. Cephalexin
6. Cephradine
7. Cefotaxime
8. Cefazolin
9. Cefuroxime
10. Cefmetazole
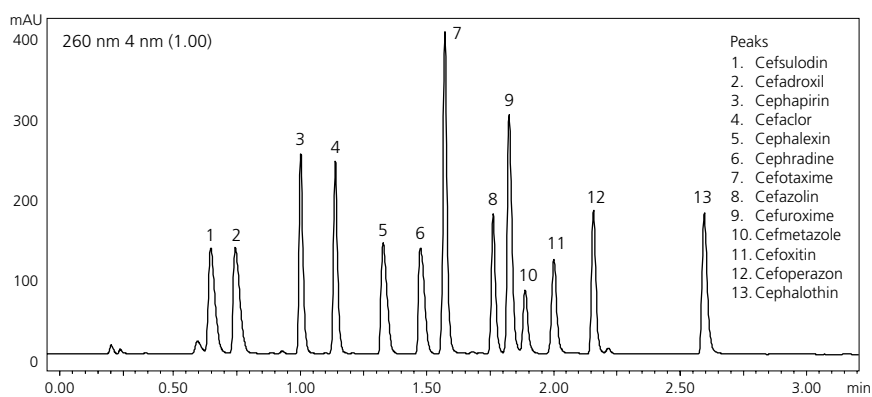11. Cefoxitin
12. Cefoperazone
13. Cephalothin

Preparation of Mobile Phases and Columns

Mobile Phase: (A) (a) Phosphoric acid (sodium) buffer solution (pH 2.6)
　　　　　　　　　(b) Citric acid (sodium) buffer solution (pH 3.1)
　　　　　　　　　(c) Acetic acid (ammonium) buffer solution (pH 4.7)
　　　　　　　　　(d) Acetic acid (ammonium) aqueous solution (pH 6.7)   — 4 aqueous mobile phases

　　　　　　　(B) (a) Acetonitrile
　　　　　　　　　(b) Methanol
　　　　　　　　　(c) Acetonitrile/Methanol = 1/1 (v/v)   — 3 organic mobile phases

Column: (1) Reversed phase column A　(50 mm L. × 3.0 mm i.d., 2.2 mm)
　　　　 (2) Reversed phase column B　(50 mm L. × 3.0 mm i.d., 2.2 mm)
　　　　 (3) Reversed phase column C　(50 mm L. × 3.0 mm i.d., 2.2 mm)
　　　　 (4) Reversed phase column D　(50 mm L. × 3.0 mm i.d., 2.6 mm)
　　　　 (5) Reversed phase column E　(50 mm L. × 3.0 mm i.d., 2.6 mm)
　　　　 (6) Reversed phase column F　(50 mm L. × 3.0 mm i.d., 2.6 mm)   — 6 columns

STEP 1 Select mobile phase and column.

STEP 2 Investigate gradient conditions.

Determine conditions for simultaneous analysis.

mAU
260 nm 4 nm (1.00)

Peaks
1. Cefsulodin
2. Cefadroxil
3. Cephapirin
4. Cefaclor
5. Cephalexin
6. Cephradine
7. Cefotaxime
8. Cefazolin
9. Cefuroxime
10. Cefmetazole
11. Cefoxitin
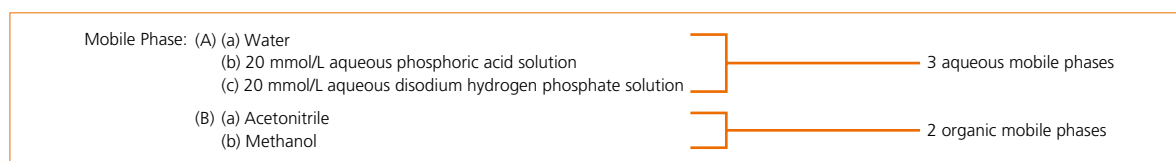12. Cefoperazon
13. Cephalothin

Mobile Phase　　　　　: (A) Phosphoric acid (sodium) buffer solution (pH 2.6)
　　　　　　　　　　　　 (B) Acetonitrile
Column　　　　　　　　: Reversed phase column E (50 mm L. × 3.0 mm i.d., 2.6 μm)
Time Program　　　　　: B. Conc. 5% (0 min) → 65% (5 min) → 90% (5.01–7 min)
Flowrate　　　　　　　 : 1.0 mL/min
Injection Volume　　　 : 5 μL
Column Temp　　　　　 : 40°C
Detection Wavelength : 260 nm (SPD-M20A)

Method Scouting Example for 13-Component Mixture of Cephem Antibiotics

Reducing the Labor Involved in Mobile Phase Blending

Method development for HPLC requires the selection of mobile phases and columns that are suited to the type of analysis. Mobile phase optimization has a particularly large influence on separation, and is therefore treated as important. However, mobile phase optimization requires the examination of a wide variety of parameters, including salt concentration, pH, and proportions of organic solvents. Because of this, mobile phase optimization commonly requires substantial time, effort, and skill. Nexera Method Scouting System has a mobile phase blending function that adjusts salt concentration, pH, and proportions of organic solvent on-line from multiple solvents that have been prepared in advance, and is quickly able to find conditions suited to a given type of analysis. This function can not only reduce considerably the time required to prepare and investigate mobile phases, it can also reduce solvent consumption.

Mobile Phase: (A) (a) Water
(b) 20 mmol/L aqueous phosphoric acid solution
(c) 20 mmol/L aqueous disodium hydrogen phosphate solution
⎤ 3 aqueous mobile phases

(B) (a) Acetonitrile
(b) Methanol
⎤ 2 organic mobile phases

Water, aqueous phosphoric acid solution, and aqueous disodium hydrogen phosphate solution are connected to solvent delivery unit A, and the pH and salt concentration can be adjusted at will by changing the mixing ratio.

Pump A Mixing Ratio (a/b/c)		Buffer Concentration (mmol/L)		
		2	5	10
pH	3.01	90/6/4	75/15/10	50/30/20
	5.67	90/5/5	75/12.5/12.5	50/25/25
	6.50	90/4/6	75/10/15	50/20/30

Optimization of pH

Optimization of Salt Concentration
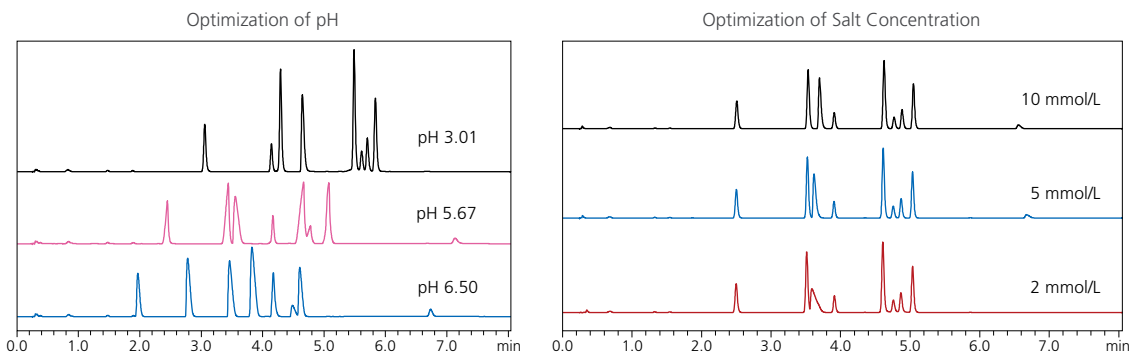
In reversed-phase chromatography, the type of organic solvent used affects retention behavior and peak shape. When a single organic solvent is used and a component cannot be separated or there is a desire to improve peak shape, mixing more than one organic solvent can resolve the problem.

Optimization of Organic Solvent Ratio
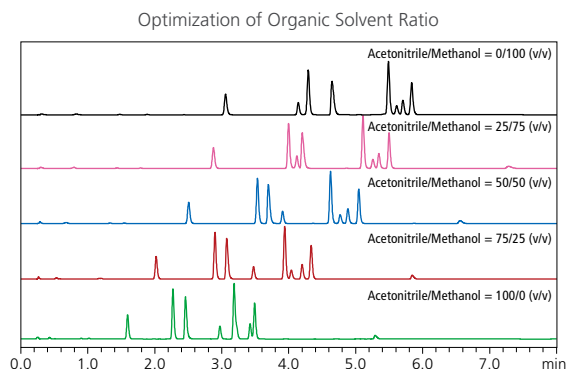
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