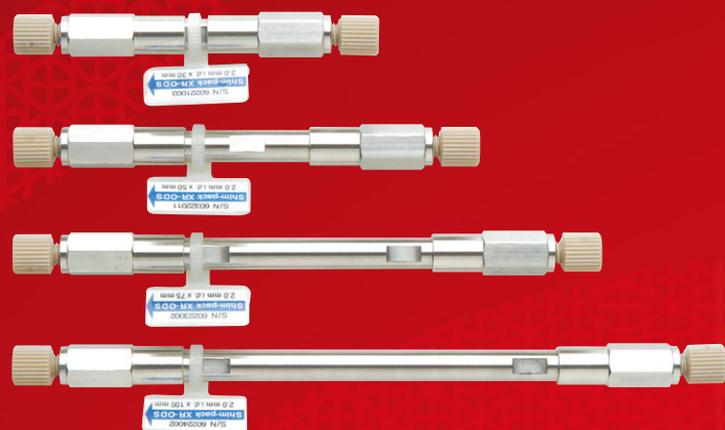




Shim-pack XR Columns

Shimadzu
Packed Columns for High-Performance
Liquid Chromatograph





Packed Columns for High-Performance Liquid Chromatograph
Shim-pack XR Columns

Shim-pack XR Columns

Shimadzu

Packed Columns for High-Performance Liquid Chromatograph

More Effective Use of Your Precious Time...

The 2.2 μm particle size of the Shim-pack XR column packing achieves resolution equivalent to a general-purpose column with 5 μm packing particle size, but significantly reduces the analysis time. Ideal for use at pressures below 35 MPa, it enables fast analysis to be easily performed on an existing instrument. Shim-pack XR-ODS II / III have a higher pressure resistance to achieve optimal performance by combining these columns with optimized Shimadzu Nexera or Prominence UFLC Systems.

Easy, High-Resolution Fast Analysis

Prominence UFLC

Shim-pack XR-ODS

Shim-pack XR-C8

Shim-pack XR-Phenyl

Shim-pack XR-SIL

Increased Pressure Tolerance While Retaining Stable Quality and Reliability

Prominence UFLC_{XR}

Shim-pack XR-ODS II

Pressure tolerance of 100 MPa achieves both higher resolution and faster speed
Shim-pack XR Series Columns Offer Versatility and Fast Analysis

Nexera UHPLC

Shim-pack XR-ODS III

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P 7 - Specifications

Shim-pack XR Series Columns Offer Versatility and Fast Analysis

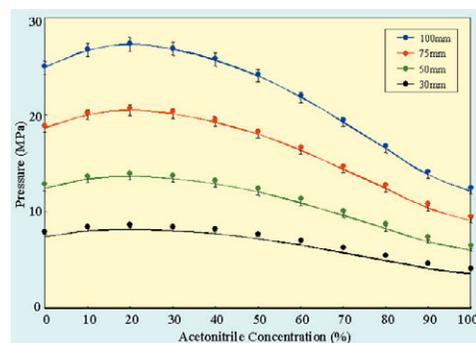
Shim-pack XR Series columns use a 2.2 μm packing particle size and offer a skillful balance between resolution efficiency and pressure. An XR Series column resolution equivalent to a general-purpose column with 5 μm packing particle size (Shim-pack VP-ODS), but significantly reduces the analysis time. 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.

Pressure Curves Using Acetonitrile Solvent

The diagram to the right shows pressure curves using water and acetonitrile as the mobile phase. The horizontal axis represents the acetonitrile concentration (%) and the vertical axis represents the pressure (MPa). The curves show maximum pressure at approximately 20% acetonitrile concentration.

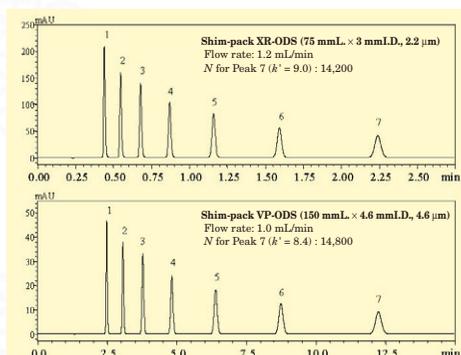
However, the pressure does not exceed 30 MPa even for a 100 mm-long column, indicating that the column adequately supports analysis on a conventional general-purpose instrument.

| Analytical Conditions | |
|-----------------------|--------------------------------|
| Flow rate | 1.0 mL/min |
| Column | Shim-pack XR-ODS (3.0 mm I.D.) |
| Temperature | 40 °C |

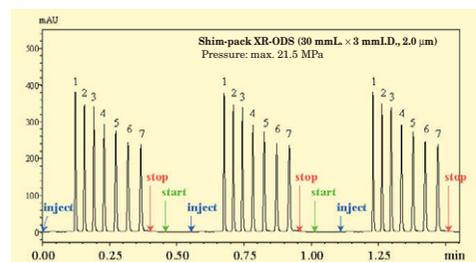


Shim-pack XR-ODS Permits Simple Switching from Conventional Analysis

The two chromatograms to the right show conventional analysis that is performed faster. The lower chromatogram is the result of analysis using a Shimadzu Shim-pack VP-ODS general-purpose column. The upper chromatogram is from analysis with a Shim-pack XR-ODS fast analysis column. As both Shim-pack VP-ODS and Shim-pack XR-ODS offer identical resolution properties, Shim-pack XR-ODS maintains the resolution while significantly reducing analysis times.



Chromatographic conditions: Column: described above; Mobile phase: water/acetonitrile (3/7, v/v); Flow rate: described above; Temperature: 40 °C; Detection: absorbance at 245 nm; Sample volume: 4 μL (XR-ODS), 10 μL (VP-ODS)
Peaks: 1: Acetophenone, 2: Propiophenone, 3: Butyropfenone, 4: Valerophenone, 5: Hexanophenone, 6: Heptanophenone, 7: Octanophenone
Top: Shim-pack XR-ODS / Bottom: Shim-pack VP-ODS



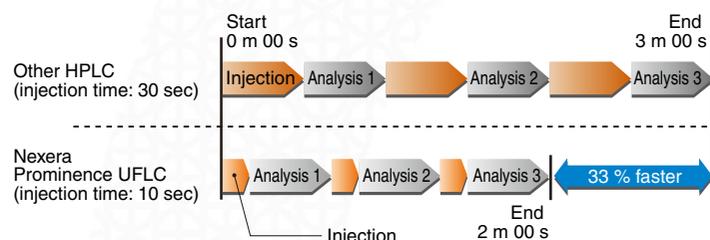
Chromatographic conditions: Column: Shim-pack XR-ODS (30 mm L x 3 mm I.D., 2.2 μm); Mobile phase: water/acetonitrile (4/6 to 2/8 in 0.4 min, convex gradient); Flow rate: 3 mL/min; Temperature: 80 °C; Detection: absorbance at 245 nm; Sample volume: 4 μL (each 800 nmol), 0.1 min delayed injection
Peaks: 1: Acetophenone, 2: Propiophenone, 3: Butyropfenone, 4: Valerophenone, 5: Hexanophenone, 6: Heptanophenone, 7: Octanophenone

Fast Analysis with One Minute Max. Cycle Time

Optimal Instrument and Optimal Column Achieve Genuine Fast Analysis

Using a fast column reduces the time required per analysis. However, true fast analysis is not possible if the other tasks required for actual analysis, including rinsing and intake and injection of the sample, take a long time.

The Shimadzu Nexera / Prominence UFLC Systems support ultrafast analysis. They require only about 10 sec from the start of sample injection to the start of analysis. Combining with a Shim-pack XR Series column achieves optimal performance.



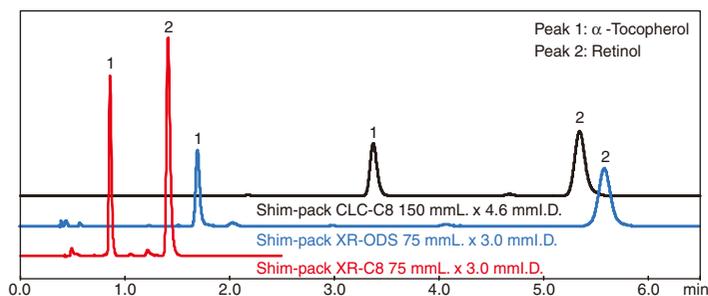
(Comparison of total times for 3 consecutive ultrafast analyses)
Note: Time for single analysis set to 30 sec

Shim-pack XR Series Comprehensive Product Range

Customers can select the ideal column for the intended analysis. In addition to the versatile Shim-pack XR-ODS that is bonded with the C18 group, the comprehensive Shim-pack XR Series product range includes the Shim-pack XR-C8 that is bonded with the C8 group to give different retention behavior to ODS, Shim-pack XR-Phenyl that is bonded with the phenylpropyl group, and the normal-phase Shim-pack XR-SIL silica column that achieves higher speeds.

Analysis of Fat-Soluble Vitamins / Shim-pack XR-C8

The fat-soluble vitamins Vitamin E (tocopherol) and Vitamin A (retinol) were analyzed. The Shim-pack XR-C8 column achieves higher speed than a conventional C8 column.



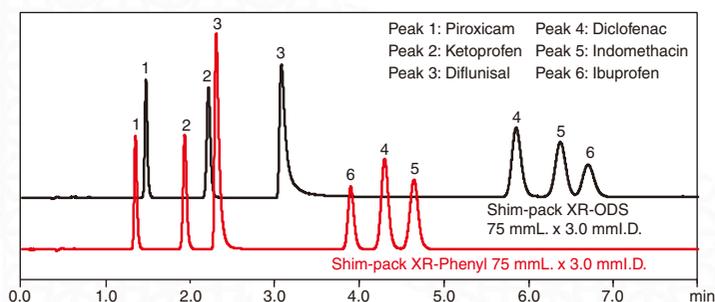
Analytical Conditions

| | |
|--------------|--|
| Column | Shim-pack XR-C8 (75 mmL. x 3.0 mmI.D.) |
| Mobile phase | Methanol |
| Flow rate | 1.0 mL/min |
| Temperature | 40 °C |
| Detection | Absorbance 290 nm |
| Peaks | 1: α -Tocopherol, 2: Retinol |

Analysis of Non-Steroidal Anti-Inflammatory Drug / Shim-pack XR-Phenyl

The column was switched from Shim-pack XR-ODS to Shim-pack XR-Phenyl to improve the resolution.

The difference in retention properties between the ODS group and the phenylpropyl group improves the peak shape, controls the resolution, and further reduces the analysis time.

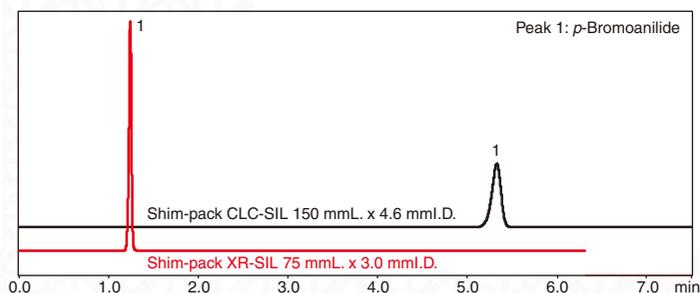


Analytical Conditions

| | |
|--------------|---|
| Column | Shim-pack XR-Phenyl (75 mmL. x 3.0 mmI.D.) |
| Mobile phase | A) 20 mmol/L phosphate buffer solution (pH 2.5) B) acetonitrile A/B; 30/20 (v/v) |
| Flow rate | 1.0 mL/min |
| Temperature | 40 °C |
| Detection | Absorbance 220 nm |
| Peaks | 1: Piroxicam, 2: Ketoprofen, 3: Diflunisal, 4: Diclofenac, 5: Indomethacin, 6: Ibuprofen |

Fast Normal-Phase Analysis / Shim-pack XR-SIL

Organic solvents are used as the mobile phase for normal-phase analysis. Due to environmental considerations, it is necessary to reduce the consumption of mobile phase compared with normal reverse-phase analysis. The Shim-pack XR-SIL silica column increases the speed of normal-phase analysis while reducing the consumption of mobile phase. In this example, the analysis time is reduced by 80 % while maintaining the flow rate, thereby reducing the overall mobile phase consumption to 20 % or less.



Analytical Conditions

| | |
|--------------|---|
| Column | Shim-pack XR-SIL (75 mmL. x 3.0 mmI.D.) |
| Mobile phase | Hexane/ethanol = 90/10 (v/v) |
| Flow rate | 1.0 mL/min |
| Temperature | 40 °C |
| Detection | Absorbance 254 nm |
| Peaks | 1: p-Bromoanilide |

Shim-pack XR-ODS II/III High-Pressure Columns for Higher Resolution and Sensitivity

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 high-resolution fast analysis to include analysis near room temperature.

The Shim-pack XR-ODS II/III columns are ideal for the Nexera UHPLC or Prominence UFLC. This combination achieves both faster speed and higher resolution.

Extensive Product Range, Including 1.5 mmI.D. Column to Reduce Mobile Phase Consumption

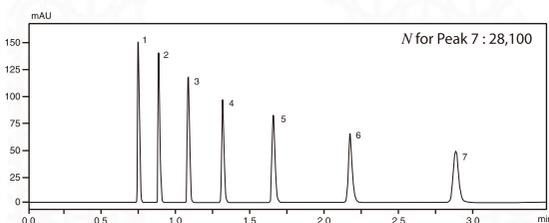
The Shim-pack XR-ODS II range includes a 1.5 mmI.D. model in addition to normal 2 mm and 3 mmI.D. columns. With an optimal flow rate of 0.2 to 0.3 mL/min, the 1.5 mmI.D. column offers the optimal flow rate for LC/MS and reduces mobile phase consumption. The pressure resistance of Shim-pack XR-ODS III has been increased to 100 MPa, so when a 200 mm-long column is used, both faster speed and higher resolution can be achieved.

| I.D. (mm) | Length (mm) |
|-----------|-----------------------|
| 1.5 | 30, 50, 75, 100, 150 |
| 2.0 | 50, 75, 100, 150, 200 |
| 3.0 | 75, 100, 150 |

Analysis by Shim-pack XR-ODS III

The Shim-pack XR-ODS III with an increased pressure tolerance of 100 MPa can be used for a wider range of applications while maintaining the ease of use of the Shim-pack XR-ODS II. By combining Shim-pack XR-ODS II / III with Prominence UFLC or Nexera, high-resolution and high-sensitivity detection of minute components can be achieved in impurity analysis, etc.

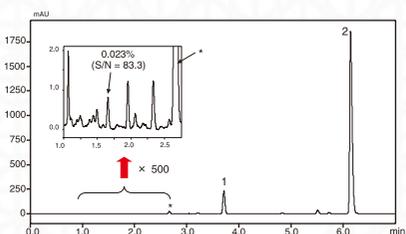
A 200 mm column with 100 MPa pressure tolerance achieves both fast speed and high resolution



Analytical Conditions

| | |
|--------------|--|
| Column | Shim-pack XR-ODS III (200 mmL. x 2.0 mmI.D.) |
| Mobile phase | Water / Acetonitrile = 3/7 (v/v) |
| Flow rate | 1.0 mL/min |
| Temperature | 80 °C |
| Detection | Absorbance 245 nm |
| Peaks | 1: Acetophenone, 2: Propiophenone, 3: Butyrophenone, 4: Valerophenone, 5: Hexanophenone, 6: Heptanophenone, 7: Octanophenone |

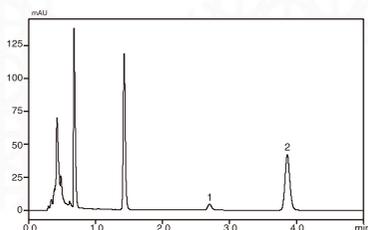
Application to evaluation of minute impurities in cefazolin



Analytical Conditions

| | |
|--------------|---|
| Column | Shim-pack XR-ODS II (150 mmL. x 3 mmI.D.) |
| Mobile phase | A) 20 mmol/L (Sodium) phosphate buffer (pH2.5) B) Acetonitrile B.Conc. 15% (0 min.) 30% (4 min.) 50% (9 min.) |
| Flow rate | 0.9 mL/min |
| Temperature | 40 °C |
| Detection | Absorbance 245 nm |
| Peaks | 1: 5-Methyl-1,3,4-thiazole-2-thiol (major impurity), 2: Cefazolin (main peak) |

Analysis of food additives with a mobile phase containing methanol



Analytical Conditions

| | |
|--------------|--|
| Column | Shim-pack XR-ODS II (75 mmL. x 3 mmI.D.) |
| Mobile phase | 40 mmol/L (sodium) acetate buffer (pH4.0) / Methanol = 80 / 20 (v/v) |
| Flow rate | 1.0 mL/min |
| Temperature | 40 °C |
| Detection | Absorbance 250 nm |
| Sample | Soft drink |
| Peaks | 1: Aspartame, 2: Benzoic acid |

Size Lineup of Shim-pack XR Series and Shim-pack XR-ODS II/III

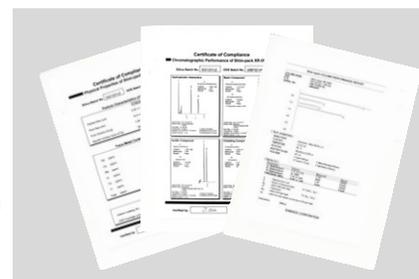
| Stationary Phase | Name of Column | Particle Size | Pressure | Column Size | 1.5 mmI.D. | 2.0 mmI.D. | 3.0 mmI.D. | 4.6 mmI.D. |
|------------------|----------------------|---------------|----------|-------------|--------------|--------------|--------------|--------------|
| ODS | Shim-pack XR-ODS III | 1.6 μm | 100 MPa | 50 mm | – | 228-59922-91 | – | – |
| | | | | 75 mm | – | 228-59922-92 | – | – |
| | | | | 150 mm | – | 228-59910-91 | – | – |
| | | | | 200 mm | – | 228-59910-92 | – | – |
| | Shim-pack XR-ODS II | 60 MPa | 2.2 μm | 30 mm | 228-59907-91 | – | – | – |
| | | | | 50 mm | 228-59907-92 | 228-41623-94 | – | – |
| | | | | 75 mm | 228-59907-93 | 228-41623-91 | 228-41624-91 | – |
| | | | | 100 mm | 228-59907-94 | 228-41623-92 | 228-41624-92 | – |
| | Shim-pack XR-ODS | 35 MPa | 2.2 μm | 150 mm | 228-59907-95 | 228-41623-93 | 228-41624-93 | – |
| | | | | 30 mm | – | 228-41605-91 | 228-41606-91 | 228-41607-91 |
| | | | | 50 mm | – | 228-41605-92 | 228-41606-92 | 228-41607-92 |
| | | | | 75 mm | – | 228-41605-93 | 228-41606-93 | 228-41607-93 |
| C8 | Shim-pack XR-C8 | 2.2 μm | 35 MPa | 100 mm | – | 228-41605-94 | 228-41606-94 | 228-41607-94 |
| | | | | 30 mm | – | 228-59901-91 | 228-59902-91 | – |
| | | | | 50 mm | – | 228-59901-92 | 228-59902-92 | – |
| | | | | 75 mm | – | 228-59901-93 | 228-59902-93 | – |
| Phenyl | Shim-pack XR-Phenyl | 2.2 μm | 35 MPa | 100 mm | – | 228-59901-94 | 228-59902-94 | – |
| | | | | 30 mm | – | 228-59903-91 | 228-59904-91 | – |
| | | | | 50 mm | – | 228-59903-92 | 228-59904-92 | – |
| | | | | 75 mm | – | 228-59903-93 | 228-59904-93 | – |
| SIL | Shim-pack XR-SIL | 2.2 μm | 20 MPa | 100 mm | – | 228-59903-94 | 228-59904-94 | – |
| | | | | 50 mm | – | 228-59905-91 | 228-59906-91 | – |
| | | | | 75 mm | – | 228-59905-92 | 228-59906-92 | – |
| | | | | 100 mm | – | 228-59905-93 | 228-59906-93 | – |

Specifications

Quality Assurance Certificates Supporting Analytical Method Development

The Shim-pack XR-ODS includes 3 types of quality assurance certificates. The excellent uniform manufacturing of these columns is authenticated based on the criteria specified in the certificates.

- Certificate of Analysis for Packing Material (Physical Properties)
Authenticates packing material physical properties by batch
- Certificate of Analysis for Packing Material (Chromatographic Performance)
Authenticates packing material retention and separation properties by batch
- Shim-pack Column Performance Report
Authenticates packing condition by column



Shim-pack XR-ODS Column Quality Certificates

| | Shim-pack XR-ODS | Shim-pack XR-ODS II | Shim-pack XR-ODS III |
|-------------------------------|------------------|---------------------|----------------------|
| Particle size | 2.2 μm | | 1.6 μm |
| Pore size | 12 nm | 8 nm | 7.5 nm |
| Surface modification | Octadecyl group | | |
| pH range | 2 – 7.5 | | |
| Maximum pressure (as a guide) | 35 MPa | 60 MPa | 100 MPa |
| Maximum temperature | 80 °C | | |

| | Shim-pack XR-C8 | Shim-pack XR-Phenyl | Shim-pack XR-SIL |
|-------------------------------|-----------------|---------------------|------------------|
| Particle size | 2.2 μm | | |
| Pore size | 12 nm | | |
| Surface modification | Octyl group | Phenylpropyl group | – |
| pH range | 2 – 7.5 *1 | | – |
| Maximum pressure (as a guide) | 35 MPa | | 20 MPa |
| Maximum temperature | 80 °C *1 | | |

*1 : Restricted partially



Ultra High Performance Liquid Chromatograph

Nexera

Ultra High Performance Liquid Chromatograph

Nexera is the next-generation UHPLC designed without compromising the requirements of LC. Nexera offers ultra-high speed and high resolution, addresses a wider range of applications, and delivers the performance necessary to provide highly reliable data in various kinds of analysis.



JQA-0376

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