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THE SCIENCE OF WHAT'S POSSIBLE.™

ACQUITY UPLC Systems and ACQUITY Premier Systems with Multi-Dimensional Technology

Enhanced UPLC Technology – now with multi-dimensional capability

THE SEPARATION POWER ONLY MULTIPLE DIMENSIONS CAN BRING YOU

For research and development chromatographers, the ACQUITY™ UPLC™ and ACQUITY Premier Systems with Multi-Dimensional Technology add a new magnitude of orthogonal separations, providing the superior sensitivity and selectivity required for complex sample analysis.

Now, with a holistically designed multi-dimensional system installed and certified by Waters technicians, your laboratory can achieve the benefits of multi-dimensional analysis easily and efficiently.

ACQUITY UPLC and ACQUITY Premier Systems with Multi-Dimensional Technology:

- Provide ready-to-use configurations allowing for faster Multi-Dimensional UPLC analysis, with less troubleshooting, and more confidence

- Offer a range of sub-2-μm ACQUITY UPLC and ACQUITY Premier column chemistries for true UPLC results

- Enhance the ability to eliminate unwanted interferences

- Built to overcome interactions with metals and metal surfaces with MaxPeak™ High Performance Surfaces (HPS) Technology (ACQUITY Premier Multi-Dimensional Systems only)

- Increase peak capacity and resolution for characterizing the most complex samples

- Provide flexibility in utilization of mobile phases for mass spectrometry detection

- Minimize sensitivity drift in mass spectrometers by reducing source contamination

- Improve assay ruggedness and overall speed of analysis

WITH MULTI-DIMENSIONAL LC YOU GET A RANGE OF FUNCTIONALITY FOR YOUR LAB

- **Trapping**
  Increases sensitivity by loading more sample

- **Heart cutting**
  Increases resolution by incorporating orthogonal chemistries

- **At-Column Dilution**
  Enables large volume injections of sample in strong solvent

- **Parallel column regeneration**
  Increases throughput

ACQUITY UPLC I-Class PLUS System with Multi-Dimensional Technology.

FUNCTIONALITY TO SUIT YOUR LABORATORY'S NEEDS

TRAPPING

Trapping can be utilized to increase sensitivity or eliminate interference from a sample.

- To increase sensitivity, more sample is loaded onto the trapping column

- To trap impurities, the trapping column can trap interferences allowing the analyte of interest to flow through
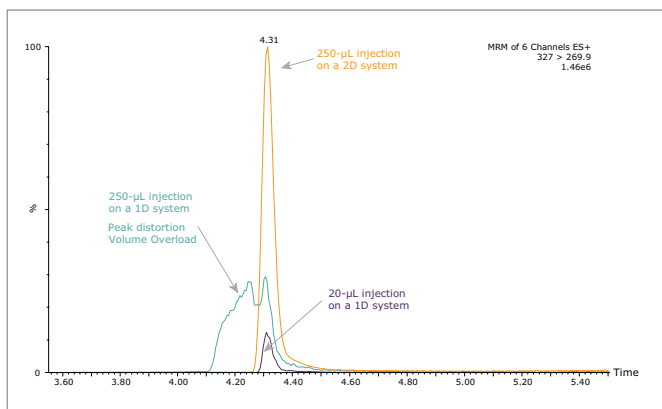

Figure 1. Comparison of clozapine separation on 1D and 2D systems. 20 µL of clozapine was injected onto a 1D system. To increase sensitivity, 250 µL of clozapine was injected onto a 1D system and peak distortion was observed. Next, 250 µL of clozapine was injected onto an ACQUITY UPLC System with Multi-Dimensional Technology where the analyte of interest was trapped onto a trapping column, then eluted using a rapid gradient onto an analytical column. The results showed increased sensitivity and peak shape maintenance. Ion chromatograms of clozapine were extracted at a concentration of 1 ppb (327.0 > 269.9) using an ACQUITY TQD.

PARALLEL COLUMN REGENERATION

This configuration reduces run times by performing parallel tasks, resulting in increased throughput. As one column performs an analytical separation, the second column is regenerated and re-equilibrated to prepare for the next injection.

PURPOSEFULLY DESIGNED FOR MULTI-DIMENSIONAL LC

The ACQUITY UPLC and ACQUITY Premier Column Manager is specifically designed for multi-dimensional applications. Two columns with different chemistries can be housed with independent temperature control for each column, providing versatility for orthogonal separations.

- Standardized with easy-to-access, low-volume, active solvent pre-heaters, resulting in the same efficiency run-to-run and system-to-system

- Two easy-to-access, six-port, two-position high pressure valves enable a wide range of applications

- Two independent heating/cooling zones with an extended temperature range of 4 to 90 °C for optimal performance

- Supports two 150-mm or four 50-mm length columns

ACQUITY UPLC Column Manager for multi-dimensional applications.

HEART CUTTING

Heart cutting increases resolution by using orthogonal chemistries. This option is generally used to determine if additional chemical entities are co-eluting with a target analyte during a single dimension separation. Analytes of interest eluting off a column are diverted and loaded onto a second column for a second analytical separation. This is a powerful technique that increases separation power by using orthogonal chemistries.

"The ability to perform two-dimensional UPLC separations with Waters technologies has provided my bioanalytical laboratory with a robust tool with powerful benefits for high-sensitive assays, from assay ruggedness to instrument uptime."

RAND JENKINS,
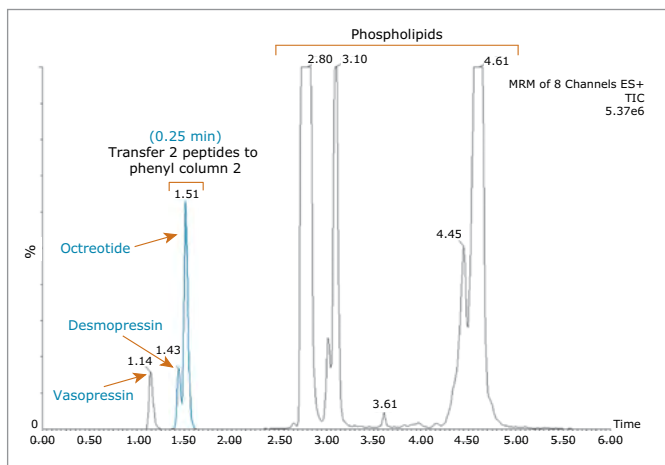*Scientific Director for Chromatographic Sciences, PPD*

Figure 2. 1D separation of a peptide mixture. 1D separation of a peptide mixture with the ACQUITY UPLC System and the Xevo™ TQ MS using an ACQUITY UPLC BEH C$_8$, 1.7 μm Column. Analytes of interest co-elute at 1.43 and 1.51 minutes followed by phospholipid interferences.
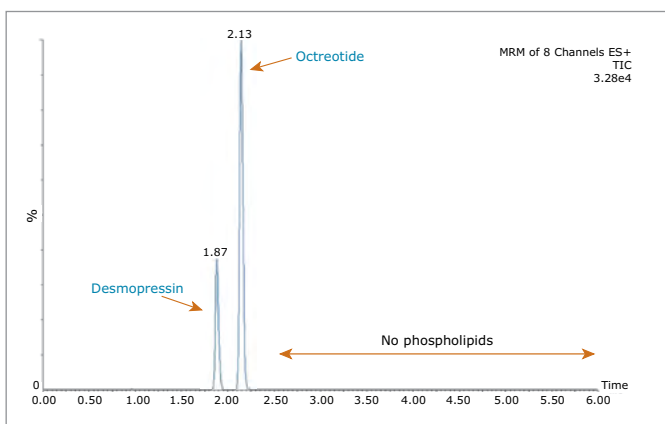

Figure 3. 2D heart cut separation of analytes of interest in peptide mixture. Analytes of interest that co-eluted from the first dimension are diverted in a 0.25-minute window and loaded onto an ACQUITY UPLC BEH Phenyl, 1.7 μm Column for a second separation, increasing resolution and preventing phospholipid interferences from reaching the source of the Xevo TQ MS using an ACQUITY UPLC System with Multi-Dimensional Technology.

AT-COLUMN DILUTION

ACQUITY UPLC Systems with Muti-Dimensional Technology can be configured with Waters patented At-Column Dilution technique to allow direct injection of large volume sample extracts in strong solvent while maintaining peak shape. This will eliminate extraneous dry-down steps, reduce the possibility of sample loss, and improve sensitivity, accuracy, and precision by injecting more analyte.
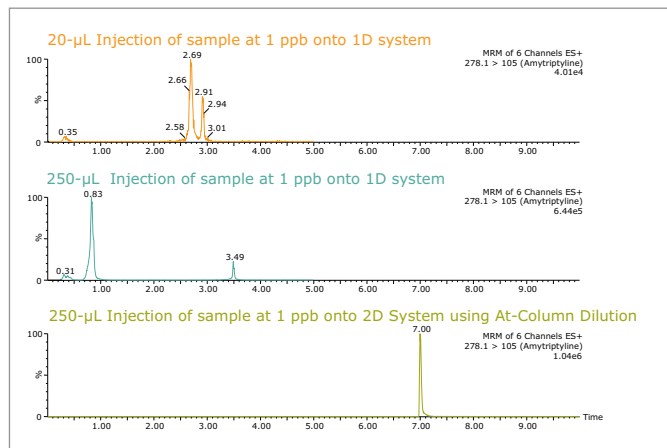
ACQUITY UPLC SYSTEM OPTIONS FOR MULTI-DIMENSIONAL

- ACQUITY Premier
- ACQUITY UPLC H-Class
- ACQUITY UPLC I-Class

Figure 4. Comparison of organic eluent samples on 1D and 2D systems. Injections of 20 µL and 250 µL of sample in 100% organic eluent were made on a 1D system resulting in poor peak shape. Next, an injection of 250 µL of the same sample in 100% organic eluent was made onto an ACQUITY UPLC System with Multi-Dimensional Technology using At-Column Dilution where peak shape was maintained. MRM chromatograms demonstrating effective focusing of analyte at a concentration of 1 ppb in 100% ACN injected onto an XBridge™ C_{18} Direct Connect HP Column, 2.1 x 30 mm, 10 µm and separated with ACQUITY UPLC BEH C_{18} Column, 2.1 x 50 mm, 1.7 µm using the ACQUITY UPLC with Multi-Dimensional Technology and the ACQUITY TQD.

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