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Targeted MRM Screening Using the ACQUITY UPLC I-Class/ Xevo TQ-S micro

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For forensic toxicology use only.

This is an Application Brief and does not contain a detailed Experimental section.

Abstract

This technical brief has highlighted the increased response of the Xevo TQ-S micro when using a preconfigured targeted MRM qualitative screening method; when compared to data collected from the same samples on the Xevo TQD an improvement in the number of true positives was observed. The ACQUITY UPLC I-Class/Xevo TQ-S micro is a highly-versatile instrument for use in toxicology, providing the user with both broad qualitative screening capabilities as well as high sensitivity quantitative detection on the same instrument platform.

Benefits

A simple, sensitive UPLC-MS/MS method for targeted forensic toxicology screening of compounds in various biological matrices.

Introduction

Forensic toxicology laboratories require reliable screening techniques that can detect a wide variety of toxicants in highly complex biological matrices, such as ante and postmortem specimens. The Waters targeted toxicology screening application using the ACQUITY TQD System was released in 2009.[1] This approach has been used by Rosano ***et al*** to compare screening methodologies for postmortem blood samples.[2] Following its success, this solution was transferred in 2013 to the ACQUITY UPLC I-Class and Xevo TQD system.[3] The release of the Xevo TQ-S micro allows for further evolution of this solution.[4]

Figure 1. ACQUITY UPLC I-Class and Xevo TQ-S micro configuration.

Combining the ACQUITY UPLC I-Class with the Xevo TQ-S micro allows this established UPLC-MS/MS screening methodology to be used on the latest generation of Waters mass spectrometers.

Experimental

Test substances

The following commercial human urine reference controls were obtained: Basis-line U from Medidrug (40201); Blankcheck urine (UR015) and DCT -25% (UR22020A) both from ACQ Science; Urine Toxicology Control DAU HC2 (50701) from UTAK; and the following Liquichek Urine Toxicology Quality Controls from Bio-Rad: Negative Control (460), C2 (442), and S10 (673).

Sample preparation

The commercial reference urines were diluted 5-fold with mobile phase A and vortex-mixed. Following centrifugation the supernatant was transferred to a Waters Maximum Recovery vial and triplicate injections were analyzed.

LC Conditions

System:	ACQUITY UPLC I-Class with FTN
Column:	ACQUITY UPLC HSS C_{18}, 100A, 1.8 µm, 2.1 mm x 150 mm (P/N 186003534)
Column temp.:	50 °C
Sample temp.:	10 °C
Injection volume:	5 µL
Wash solvent:	Acetonitrile/water (95:5 v/v)
Purge solvent:	5 mM ammonium formate pH3.0
Flow rate:	0.4 mL/min
Mobile phase A:	5 mM ammonium formate pH3.0
Mobile phase B:	Acetonitrile containing 0.1% formic acid

MS conditions

System:	Xevo TQ-S micro
Ionization mode:	ESI+
Capillary voltage:	3.0 KV

Source temp.:	150 °C
Desolvation temp.:	400 °C
Desolvation gas:	800 L/Hr
Cone gas:	20 L/Hr
Cone voltages:	Preconfigured in provided MRM method
Collision energies:	Preconfigured in provided MRM method

Results and Discussion

The data was collected using the supplied MRM method which contains two transitions (qualifier and quantifier) per compound, with associated preconfigured parameters for cone voltage and collision energies for 178 compounds. The three negative control reference urines (Basis-line U, Blankcheck, and Negative Control) and four positive control reference urines (C2, S10, DAU HC2, and DCT -25%) containing certified levels of analytes, were assayed using the method described above. The data was automatically processed using the TargetLynx Application Manager, following a slight increase in the area threshold reject parameter, as a result of the increased response of the TQ-S micro. Screening results were compared for equivalence to the data obtained from the Xevo TQD platform.

A number of compounds were detected in the negative control reference urines on both platforms, i.e. caffeine and other substances associated with over-the-counter medications, which are routinely detected in urine screens.

For the certified positive control reference urines, both platforms detected the same number of expected compounds in the S10 reference urine. The Xevo TQ-S micro also found the same analytes as the Xevo TQD in the C2 and DAU HC2 urine samples, but in addition was able to detect α-hydroxyalprazolam in the C2 urine and lorazepam in the DAU HC2 urine.

Additional sensitivity for the benzodiazepines was also confirmed through analysis of the ACQ Science DCT -

25% sample. Figure 2 details five additional benzodiazepines which were detected using the Xevo TQ-S micro. This commercial reference urine has certified levels of analytes at a concentration equivalent to 25% lower than the maximum cut-off concentration currently recommended by the European Workplace Drug Testing Society (EWDTS) for confirmation tests in urine;[5] the benzodiazepines detected here are present in this urine at 75 ng/mL.

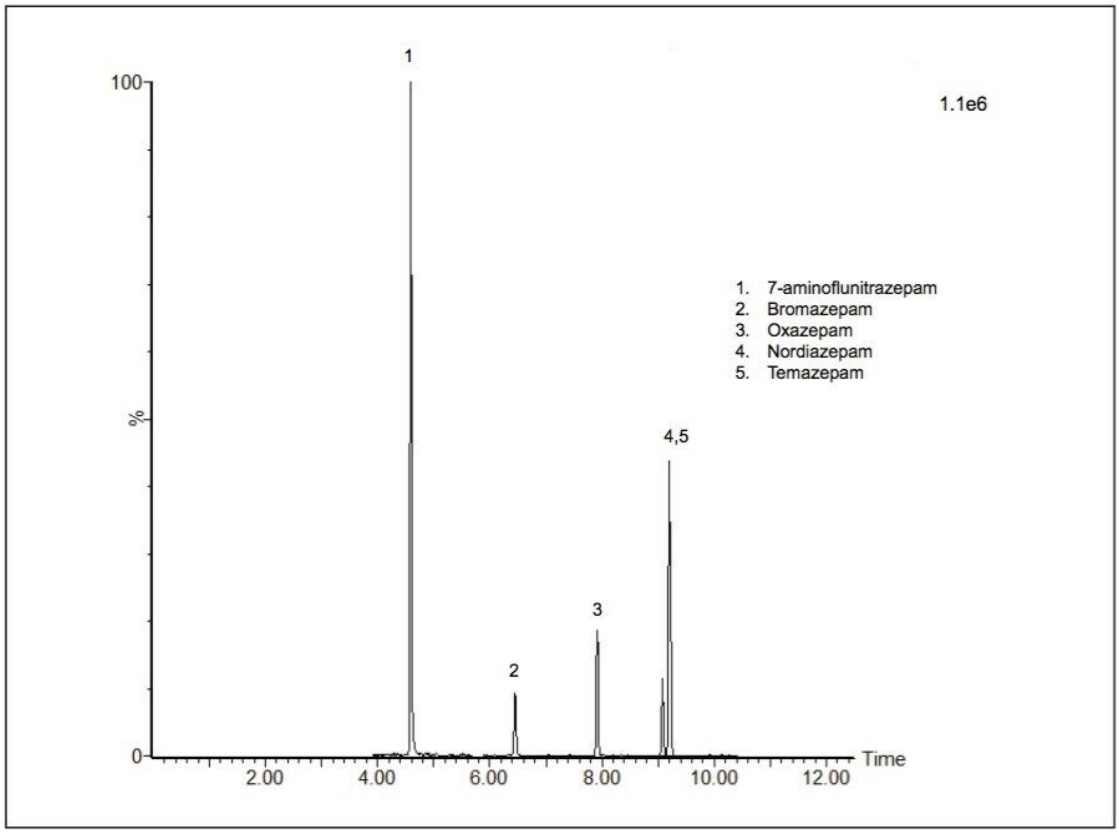

Figure 2. Chromatogram showing benzodiazepines in the ACQ DCT -25% commercial reference urine detected by the Xevo TQ-S micro using the supplied targeted MRM method but not the Xevo TQD. The quantifier ion transition is displayed.

The average number of scans per function has increased as the method has evolved from the ACQUITY TQD System through the ACQUITY UPLC I-Class/Xevo TQD and now to the ACQUITY UPLC I-Class/Xevo TQ-S micro; because the dwell time (10 msec) in the supplied MRM method has not changed this increase can be attributed to the improvements in electronic design that have accompanied each new MS platform. This increased number of scans per function improves precision, reproducibility, and sensitivity.

Conclusion

References

1. Roberts M, Lee R, and Wood M. Targeted MRM Screening for Toxicants in Biological Samples by UPLC-MS/MS. 2009. Waters Application Note, 720002749EN.
2. Rosano T, Wood M, and Swift T. Postmortem Drug Screening by Non-Targeted and Targeted Ultra-Performance Liquid Chromatography-Mass Spectrometry Technology. Journal of Analytical Toxicology 2011; 35: 411–423.
3. Roberts M and Wood M. Forensic Toxicology Screening sing the ACQUITY I-Class System with the Xevo TQD. 013. Waters Application Note, 720004602EN.
4. Xevo TQ-S micro Product Brochure. 2014 Waters Marketing Brochure, 720005046EN.
5. European Workplace Drug Testing Society Guidelines. http://www.ewdts.org (accessed 11 Jan 2016).

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ACQUITY UPLC I-Class PLUS System <https://www.waters.com/134613317>

Xevo TQ-S micro Triple Quadrupole Mass Spectrometry <https://www.waters.com/134798856>

Quadrupole MS Solutions for Forensic Laboratories <https://www.waters.com/10011568>

TargetLynx <https://www.waters.com/513791>

ACQUITY UPLC Columns <https://www.waters.com/513206>

Available for Purchase Online

ACQUITY UPLC HSS C18 Column, 100Å, 1.8 µm, 2.1 mm X 150 mm, 1/pkg <https://www.waters.com/waters/partDetail.htm?partNumber=186003534>

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