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QDa QC Reference Material

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I. INTRODUCTION

Quality Control (QC) Reference Materials contain mixtures of standards specifically chosen to provide an easy and reliable way to monitor the performance of chromatographic systems.1 Using a QC Reference Material, you can be assured that your instrument and columns are ready to analyze your samples. Regular use of QC Reference Material's provides an opportunity to benchmark your chromatographic systems and track performance over time, making it easier to proactively identify problems and resolve them faster.

The QDa® QC Reference Material is a 9 component mix used to provide a comprehensive reference standard for use with the ACQUITY® QDa Detector with a wide variety of conditions and methods.

The compounds in this mix give a mixture of responses in:

- ESI (+ -) and APCI+
- Covers a wide range of m/z
- Optimized concentration to provide a more equal response by component in ESI+ mode
- Provides a separation in a range of chromatographic conditions used to benchmark instrument performance

Table 1. Individual Components in the QDa QC Reference Material

Component	Empirical formula	Exact mass (as [M+H]+)	Exact mass (as [M+H]–)	Concentration for analysis (µg/mL)
Acetaminophen	$C_8H_9NO_2$	152.0712	—	100
Caffeine	$C_8H_{10}N_4O_2$	195.0882	—	45
Sulfaguanidine	$C_7H_{10}N_4O_2S$	215.0603	213.0446	50
Sulfadimethoxine	$C_{12}H_{14}N_4O_4S$	311.0814	309.0658	10
Val-Tyr-Val	$C_{19}H_{29}N_3O_5$	380.2185	378.2029	25
Verapamil	$C_{27}H_{38}N_2O_4$	455.2910	—	6
Terfenadine	$C_{32}H_{41}NO_2$	472.3216	—	6
Leucine-Enkephalin	$C_{28}H_{37}N_5O_7$	556.2771	554.2615	25
Reserpine	$C_{33}H_{40}N_2O_9$	609.2812	—	19

II. STORAGE AND STABILITY

The standard comes in a flame sealed amber ampoule. It contains 1 mL in a matrix of 23.5% acetonitrile/76.5% water/0.007% formic acid. Due to the higher organic concentration, it is recommended upon opening the ampoule to immediately transfer the contents to a closed vial or container. It is recommended to use Waters TruView™ LCMS Certified vials with pre-slit septum for best results with the ACQUITY QDa Detector.

The standard mix is shipped at ambient temperatures. It is highly recommended that upon receipt, the standard should be refrigerated at 2-8 °C for short term and for long term stored frozen (-15 °C +/- 10 °C). The compounds used in this product are stable in their original packaging, through the expiration date listed as provided before opening. The integrity of the standard is not defined when stored after initial use. Standard integrity and stability after opening must be determined based on your storage and use method.

Note: If any undissolved material is visible inside the ampoule/ vial, sonicate the unopened ampoule/vial until the material is completely dissolved

NOTE: Expiration date valid for unopened ampoule stored in compliance with the recommended conditions

III. QC REFERENCE MATERIAL USAGE

A QC Reference Material is used to benchmark, qualify and troubleshoot a chromatographic system:

- Benchmarking is the acquisition of data, using a mixture of standards such as a QC Reference Material, on a properly functioning chromatographic system with one or more new columns to determine normal performance parameter values (e.g., peak retention times, widths, intensities, areas, and tailing/asymmetry). Before benchmarking, a chromatographic system is confirmed to be in a properly functioning state by successfully completing [1] component level calibrations for all instrument modules and then [2] system level calibrations for the entire chromatographic system.[2] System benchmarking is done by performing replicate analyses of the QC Reference Material and calculating the mean and standard deviation for the desired performance parameter values. Upper and lower control limits (UCL, LCL) are then set. After benchmarking, these control limits are used to determine success or failure of system qualification. Benchmarking is generally completed on each new chromatographic system after it is installed and then repeated on each existing chromatographic system after it is calibrated.[4]
- Qualification is the acquisition of data, using a mixture of standards such as a QC Reference Material, on a benchmarked chromatographic system to determine if that system is still functioning properly and therefore is still "qualified" to receive analytical samples. When the QC Reference Material performance parameter values measured during qualification are within the control limits determined during benchmarking, the system passes qualification and is deemed ready for use. Qualification is performed on each benchmarked chromatographic system at regular intervals and after any maintenance or repair. Setting a minimum qualification interval of "every workday morning" or "the first workday morning of the week" is strongly recommended. Labs that have a high sample load are encouraged to also do bracketing qualification runs. This is where qualification is done before and after each block of samples, especially during unmonitored runs (e.g., nights, weekends). When the "before" and "after" qualifications pass, there is high confidence that data is trustworthy for the bracketed block of samples. The data from benchmarking and subsequent qualification runs can also be entered into a control chart, allowing the analyst to evaluate the system performance over time.[3]
- Troubleshooting is the sequence of activities performed to ascertain and correct deviations in chromatographic system performance. A qualification failure should trigger troubleshooting. The changes in performance parameter values (e.g., retention time shifts, and peak shape/area changes), observed using a QC Reference Material can facilitate more rapid determination of the root cause of qualification failure. Use of a QC Reference Material can thereby guide and accelerate the troubleshooting effort. After successful troubleshooting, a repeat of the qualification should then pass unless significant changes were made during troubleshooting. In such cases, re-calibration and re-benchmarking are likely needed.

IV. EXAMPLES OF USING THE QDA QCRM

The ACQUITY QDa Detector is available in standard and performance configurations. Based on instrument sensitivity, the response of the QDa QC Reference Material may be outside the linear dynamic range of the detector. If saturation is observed, the sample can be diluted between 2 to 10-fold with 90/10 water/acetonitrile. Dilution of the sample with 90/10 water/acetonitrile may also be required to minimize solvent effects that can degrade the peak shape of the early eluting components (sulfaguanidine and acetaminophen).

Shown in Figure 1 is a representative MS Spectrum under the following conditions.

Conditions:

System:	AQUITY UPLC H-Class System with ACQUITY PDA
Detector:	ACQUITY QDa
Flow rate:	0.6 mL/min
Column:	ACQUITY UPLC BEH C_{18}, 1.7 µm, 2.1 x 50 mm
Column temp.:	40 °C
Dilution:	1:5 with 90/10 water/acetonitrile
Injection vol.:	1 µL
Mobile-phase composition:	0.1% formic acid, pH 3, prepared using Auto•Blend™
Line A:	1% formic acid pH 3
Line B:	Water
Line C:	Acetonitrile
Gradient:	5–90% acetonitrile in 5 min

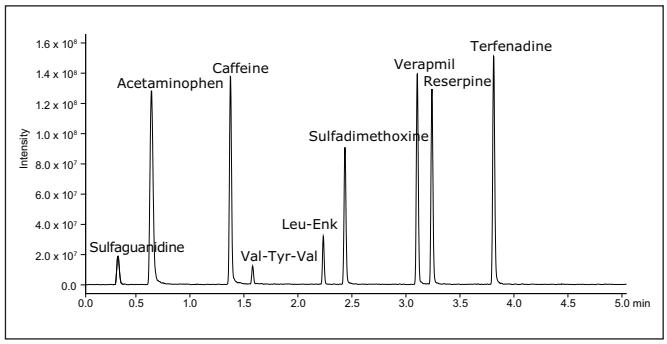

Figure 1. QDa QC Reference Material, ESI + Extracted Ion Chromatogram.

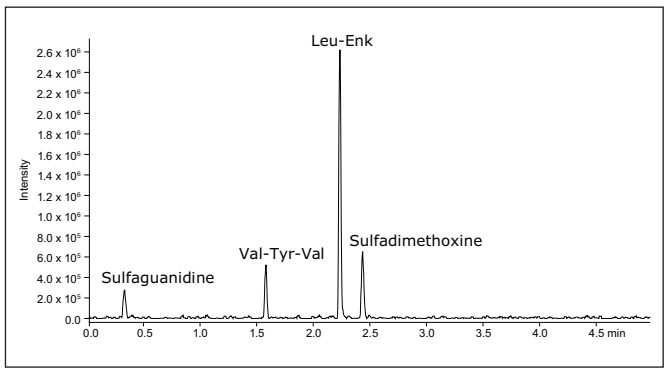

Figure 2. QDa QC Reference Material, ESI - Extracted Ion Chromatogram.

V. SUMMARY

Quality Control Reference Materials are specifically designed to provide a controlled, consistent, and reliable way of monitoring system performance. Regular use of QC Reference Materials to benchmark and qualify systems gives assurance that chromatographic results are high quality. Troubleshooting with QC Reference Materials also minimize system downtimes.

VI. ORDERING INFORMATION

Description	Part Number
QDa QC Reference Material	186007345
LCMS QC Reference Standard	186006963
Neutrals QC Reference Material	186006360
Reversed-Phase QC Reference Material	186006363
Preparative Chromatography QC Reference Material	186006703
Quad LCMS QC Reference Material	186007362
HILIC QC Reference Material	186007226
UPC^2 QC Reference Material	186007950
AutoPurification™ System Standard	716000765

References

1. A "chromatographic system" consists of the installed instrument components including all detectors (PDA, ELS, MS, etc.) plus the installed columns.
2. All calibrations are done as specified in the instrument manufacturer's protocols. In some cases, there may be no system level calibration whereupon Benchmarking occurs directly after component level calibrations.
3. Benchmarking control limits are determined by each lab according to their data precision and reproducibility needs. Setting control limits of + 3 standard deviations about the mean value is a common practice. For more information on control limits and control charts, see Mullins, E.; *Introductionto Control Charts in the Analytical Laboratory, Analyst* 1994, 119, 369–375.
4. Consult the chromatographic system manufacturer's recommendations regarding the frequency of calibration.

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