Environmental Volatile Organic Compounds (VOCs) by Headspace Trap with GC–MS

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This application note demonstrates the use of a new sample-introduction technology (PerkinElmer® TurboMatrix™ HS-110 Trap) for U.S. EPA Method 8260B. The TurboMatrix HS Trap is an enhanced static-headspace system with a built-in trap that pre-concentrates and focuses VOCs prior to injection into the GC.

U.S. EPA 8260B is a performance-based method used in a majority of U.S. and many international environmental laboratories for the analysis of VOCs. It is a complex method that requires multiple quality criteria be passed throughout the analysis. As demonstrated here, the PerkinElmer Clarus® 500 GC/MS system configured with a PerkinElmer TurboMatrix HS-110 Trap meets all the 8260B method requirements. This includes, but is not limited to: instrument tuning, minimum-detection limits, initial calibration, surrogate recovery, and system-performance checks.

Experimental Conditions

The sample concentrator (PerkinElmer TurboMatrix HS-110 Trap) was set with the following conditions: needle temperature 90 °C; transfer-line temperature 120 °C; oven temperature 80 °C; trap-low temperature 40 °C; trap-high temperature 280 °C; dry purge 5 min; trap hold 6 min; desorb time 0.5 min; thermostatting time 10 min; pressurization time 1 min; decay time 2 min; outlet split 20 mL/min; column pressure 25 psi; vial pressure 35 psi; and desorb pressure 10 psi.

The gas chromatograph and mass spectrometer (PerkinElmer Clarus 500 GC/MS) were set up to standard U.S. EPA 8260B method requirements.

Results and Discussion

A minimum of five calibration levels is required for 8260B. All calibration samples must be above the minimum detection limits, yet bracket the expected concentrations of the real samples. This application provided data for 77 volatile compounds. The U.S. EPA methods require all component calibrations to be less than 15% RSD (relative standard deviation). The headspace trap demonstrated all components of interest to be below 15%. A representative section of the calibration list is shown in Figure 1.

The method detection limits (MDLs) for this method were calculated using the procedure outlined in Chapter One of SW-846 analytical methods (Figure 1).

For this application, the TurboMatrix HS Trap offers the following advantages:

- Easy and convenient sample preparation
- Good response with poor purging compounds
- Increased sample throughput by overlapping the thermostating
- No risk of sample foam contaminating purge-and-trap device
- No cross-contamination of samples from using the same purge vessel

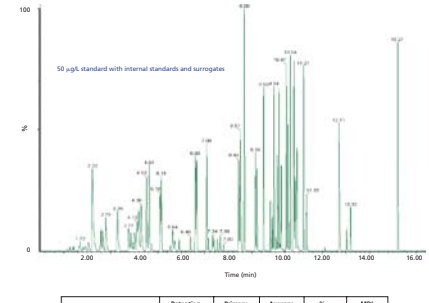
Conclusions

This application demonstrates the successful use of headspace-trap technology to perform the sample handling required for 8260B. All compounds tested passed the %RSD requirements, the detection limits were met, the surrogate recoveries passed, and all SPCCs (system performance check compounds) met their minimum RF values.

In addition to 8260B, other VOC methods may also be run using this configuration. For example, U.S. EPA Method 524.2 for VOCs in drinking water and fuel oxygenates are both similar methods with lower detection limits that would also benefit from this technology.

References

(1) *Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)* (U.S. Environmental Protection Agency, Washington, D.C., EPA Report SW-846 Method 8260B, rev. 2, 1996).



Compound Name	Retention time	Primary ion	Average RF	% RDS	MDL (ppb)
1,1,2-Trichloroethane	7.38	97	0.17	9.05	0.25
Ethyl methacrylate	7.43	69	0.19	11.83	0.25
Dibromochloromethane	7.58	129	0.16	10.38	0.14
1,3-Dichloropropane	7.71	76	0.23	8.73	0.16
1,2-Dibromoethane	7.84	107	0.12	13.50	1.00
Clorobenzene-d5 (IS)	8.47	117	N/A	N/A	N/A
Ethylbenzene	8.54	91	2.27	5.53	0.03
1,1,1,2-Tetrachloroethane	8.57	131	0.32	2.29	0.16
Chlorobenzene	8.49	112	0.99	1.25	0.08
p,m-Xylene	8.54	106	0.76	7.60	0.09
o-Xylene	8.72	106	1.74	9.45	0.07
Bromoform	9.25	173	0.12	3.09	0.50

Figure 1: Mid-point level 8260B calibration mix chromatogram – 20 µg/L per target analyte. Column Elite Volatiles – 30 m × 250 µm × 1.4 µm film. Demonstration of RSD factors for component list.

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