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APPLICATION NOTE

Low Level PPB Detection of 19 VOCs in Water Using the CMS5000 Monitoring System

INTRODUCTION

On-site monitoring of volatile organic compounds (VOCs) in water is essential for the timely evaluation of potential hazards throughout water system infrastructures. The CMS5000 Monitoring System utilizes purge-and-trap gas chromatography for separation, along with a Micro Argon Ionization Detector (MAID) for detection of potential VOC contaminants that may be found in water supplies. Unlike Total Organic Carbon (TOC) analyzers, which provide data on the total organic content only, the CMS5000 provides more actionable data through identification and quantitation of individual volatile organic compounds in water systems.

In this application, a 19 component VOC specialty mix from SPEX CertiPrep is used to demonstrate the quantitative accuracy of the CMS5000. This VOC specialty mix is composed of commonly monitored carcinogens and other toxic contaminants found in water. Table 1 shows the list of analytes. Accuracy is reported as the percent recovery from the theoretical concentration.

Replicate analyses of a benzene standard were used to determine the CMS5000 precision, reported as the percent relative standard deviation (%RSD) of the average response factor (RF) of benzene.

EXPERIMENTAL

Calibration standards were prepared at 1.0, 5.0, and 10.0 ppb by spiking 2 L of VOC-free water with 1.0, 5.0, and 10.0 µL of the VOC specialty mix, respectively. The analytes were purged with argon from the calibration standards into the headspace formed in the sample collection tube of the CMS5000. The headspace sample was collected for 1 minute onto the on-board Tri-Bed concentrator. The analytes were thermally desorbed from the concentrator and separated on a capillary column using a 20 minute method with column temperature programming. A three-point calibration curve with quadratic fit was generated from the data.

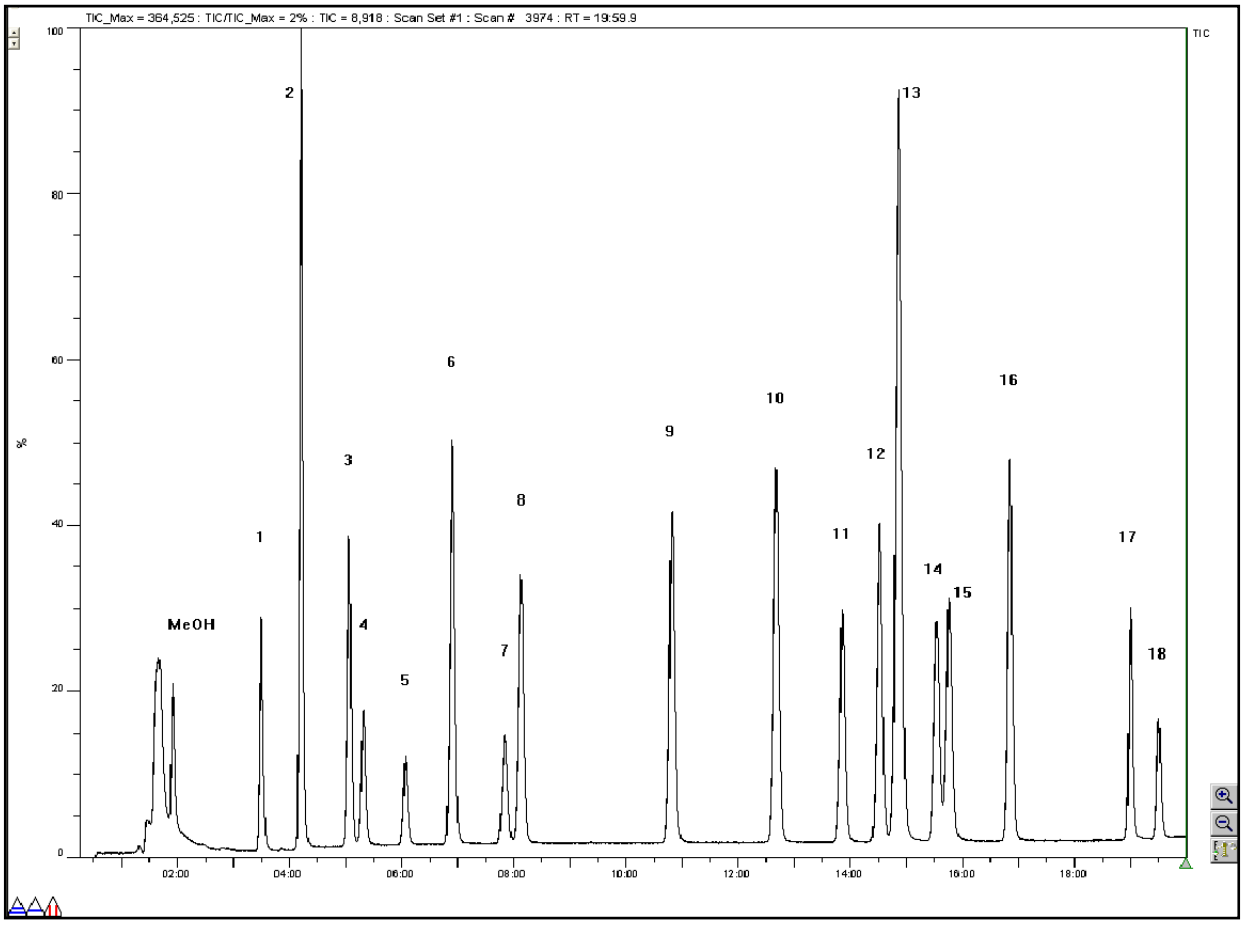
Calibration accuracy was measured by analyzing a 5.0 ppb calibration verification standard and calculating the percent recovery for each of the 19 compounds. (Note: *m*, *p*-xylene co-elute.) Figure 1 shows a chromatogram of the 19 component VOC specialty mix. See Table 1 for the percent recovery.

A 1.0 ppb benzene standard was prepared by injecting 1.0 µL of a 2000 µg/mL benzene standard into 2.0 L of VOC-free water. Precision was determined by performing five replicate analyses of the 1.0 ppb benzene standard and calculating the % RSD of the average RF, as reported in Table 2.

CONCLUSION

Online instrumentation needs to be robust and reliable without sacrificing accuracy and precision. The data resulting from this exercise demonstrates the sensitivity, accuracy, and precision that can be expected from the CMS5000.

Figure 1. Chromatogram of the 19 Analytes in the VOC Specialty Mix at 5.0 ppb



Column: HP-1MS, 30 m, 0.32 mm id, 4.0 µm df, *Conc. Fill:* 1 min.
Temperature Profile: 60 °C (hold 1 min.) to 90 °C at 4 °C/min., to 135 °C at 6 °C/min., to 200 °C at 20 °C/min. (hold 45 sec)

Table 1. % Recovery of the 19 Analytes in the VOC Specialty Mix

Peak No.	Analyte	% Recovery
1	Methylene Chloride	104
2	*trans*-1,2-Dichloroethene	104
3	*cis*-1,2-Dichloroethene	106
4	Chloroform	106
5	1,2-Dichloroethane	103
6	Benzene	104
7	1,2-Dichloropropane	104
8	Trichloroethene	104
9	Toluene	104
10	Tetrachloroethene	97
11	Chlorobenzene	101
12	Ethylbenzene	94
13	*m*-Xylene, *p*-Xylene	100
14	Styrene	102
15	*o*-Xylene	96
16	Isopropylbenzene	97
17	1,4-Dichlorobenzene	101
18	1,2-Dichlorobenzene	102

Table 2. % RSD of Average RF of Benzene Standard Replicates.

Analyte	RSD of Average RF
Benzene	2.7%

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