INFICON

APPLICATION NOTE

Continuous Air Monitoring for BTEX Using a CMS5000 Monitoring System

INTRODUCTION

Benzene, toluene, ethylbenzene, and the three xylene isomers are collectively referred to as BTEX. These substances are commonly found in industrial processes: burning coal or oil, motor vehicle exhaust, or leaking underground storage tanks. Chronic exposure to these compounds poses significant health risks including neurological problems and increased cancer risk. The Agency for Toxic Substances and Disease Registry (ATSDR), a federal public health agency of the United States Department of Health and Human Services, has established acceptable chronic exposure limits of 3 ppb, 60 ppb, 80 ppb, and 50 ppb for benzene, ethylbenzene, toluene, and the xylenes, respectively. In addition to worker safety, the U.S. Environmental Protection Agency (EPA) set thresholds for BTEX emissions at the perimeter of refineries and petrochemical plants to ensure public safety. Due to the potentially hazardous health effects of BTEX, on-site detection and quantitation of these compounds is imperative.

The INFICON CMS5000 Monitoring System, consists of a gas chromatograph (GC) and sampling capabilities ideally suited for continuous air monitoring. Due to fluctuating levels of BTEX during manufacturing processes, frequent monitoring of BTEX levels is beneficial to ensure consistent compliance with EPA and ATSDR standards. The CMS5000 Monitoring System has the ability to collect, analyze, quantify, and report volatile organic compound concentrations in air samples continuously over several months, without human intervention. The instrument can be installed in difficult to access locations within or at an industrial plant. This application note describes a method developed specifically for continuous BTEX monitoring in air using a CMS5000 Monitoring System.

EXPERIMENTAL

Using a liquid BTEX standard, a five-point calibration was created by injecting the appropriate amount of standard into a sample bag containing 1 L of air. Quadratic-fit curves with points ranging from 2.5 to 125 ppbv for benzene, 2.1 to 106 ppbv for toluene, and 1.8 to 92 ppbv for ethylbenzene and the xylenes were created. The standards were sampled directly from the bag, for two minutes each, onto the internal Tri-Bed concentrator. The compounds meta-xylene and para-xylene co-elute and appear as a single peak in the sample chromatogram. After analyzing the standards, a calibration library was established and stored to the method file using the CMS IQ software.

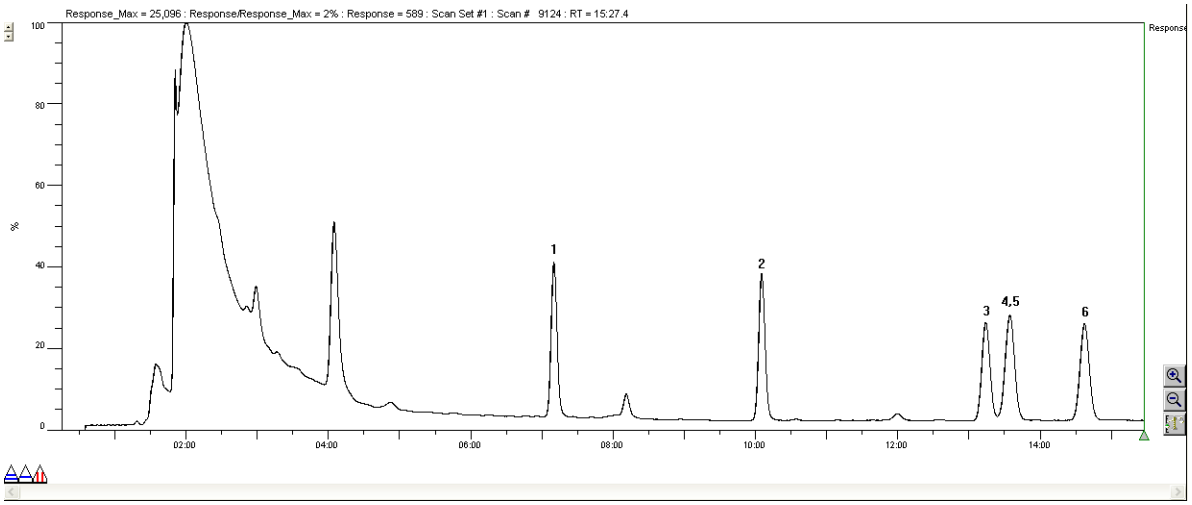
DATA

The CMS5000 was calibrated for each of the BTEX compounds with an RSD of RF% of 30% or less. A known standard was analyzed to verify that all compounds were quantified within 20% of the expected concentration. Analyte recoveries, ranging from 92.6% to 100.0% of the expected value, were obtained. Figure 1 displays an example chromatogram of the BTEX analytes using the calibrated method. Table 1 lists the retention times, expected and actual concentrations of the known standard, and the percent recovery.

CONCLUSION

The CMS5000 using the BTEX method is suitable for use to monitor industrial processing sites and petrochemical plants where these compounds may be present at potentially hazardous levels. The system is designed to operate for extended periods of time without user intervention. This ensures unsafe air quality conditions are identified on-site, so they may be addressed in a timely fashion.

Figure 1 Chromatogram of BTEX standard



Column: DB-1, 30 m, 0.32 mm ID, 4.0 µm df;
Temperature Profile: 60ºC (hold 5 min) to 100ºC @ 25ºC/min (hold 1 min) to 120ºC @ 7ºC/min (hold 5 min)

Table 1 Percent recovery of analytes

Peak #	Compound	Retention Time (min:s)	Expected Concentration (ppbv)	Actual Concentration (ppbv)	Recovery (%)
1	benzene	07:10	92	89	96.7
2	toluene	10:05	78	76	97.4
3	ethylbenzene	13:14	68	68	100.0
4, 5	meta, para-xylene	13:34	68	63	92.6
6	ortho-xylene	14:37	68	66	97.1