INFICON

APPLICATION NOTE

Continuous Monitoring of Treated Drinking Water for Trihalomethane (THM) Disinfection By-products Using a CMS5000 Monitoring System

INTRODUCTION

Trihalomethanes (THMs) are a group of four compounds (chloroform, bromoform, bromodichloromethane, and dibromochloromethane) formed as by-products when either chlorine or bromine is used as a drinking water disinfectant to control microbial contamination. These THMs, commonly referred to as disinfection by-products, are the result of the disinfectant reacting with naturally occurring organic matter (i.e. decaying vegetation) found in untreated water. The THMs produced may have adverse health effects at high concentrations. As a result, the USEPA issued regulations limiting the levels permissible in drinking water. This limit is expressed as the total concentration of THMs, or total trihalomethanes (TTHMs), and is set at 80 parts per billion (ppb) in finished water. Due to the potentially hazardous effects of THMs, on-site detection and quantitation of these compounds is necessary to determine the quality, and therefore suitability, of treated drinking water for human consumption.

INFICON has developed a fully automated CMS5000 Monitoring System, consisting of a gas chromatograph (GC) and purge and trap sampling device particularly useful in this type of application. Due to constantly fluctuating amounts of organic matter in water supplies, it would be advantageous to test for TTHMs frequently to ensure drinking water quality is consistently in compliance with USEPA standards. The CMS5000 Monitoring System has the ability to collect, analyze, quantify and report volatile organic compound concentrations in water samples many times per day over several months, without human attention, at locations within a treatment plant or at points along a water distribution system. This application note describes a method developed specifically for continuous TTHM monitoring with a CMS5000 Monitoring System.

EXPERIMENTAL

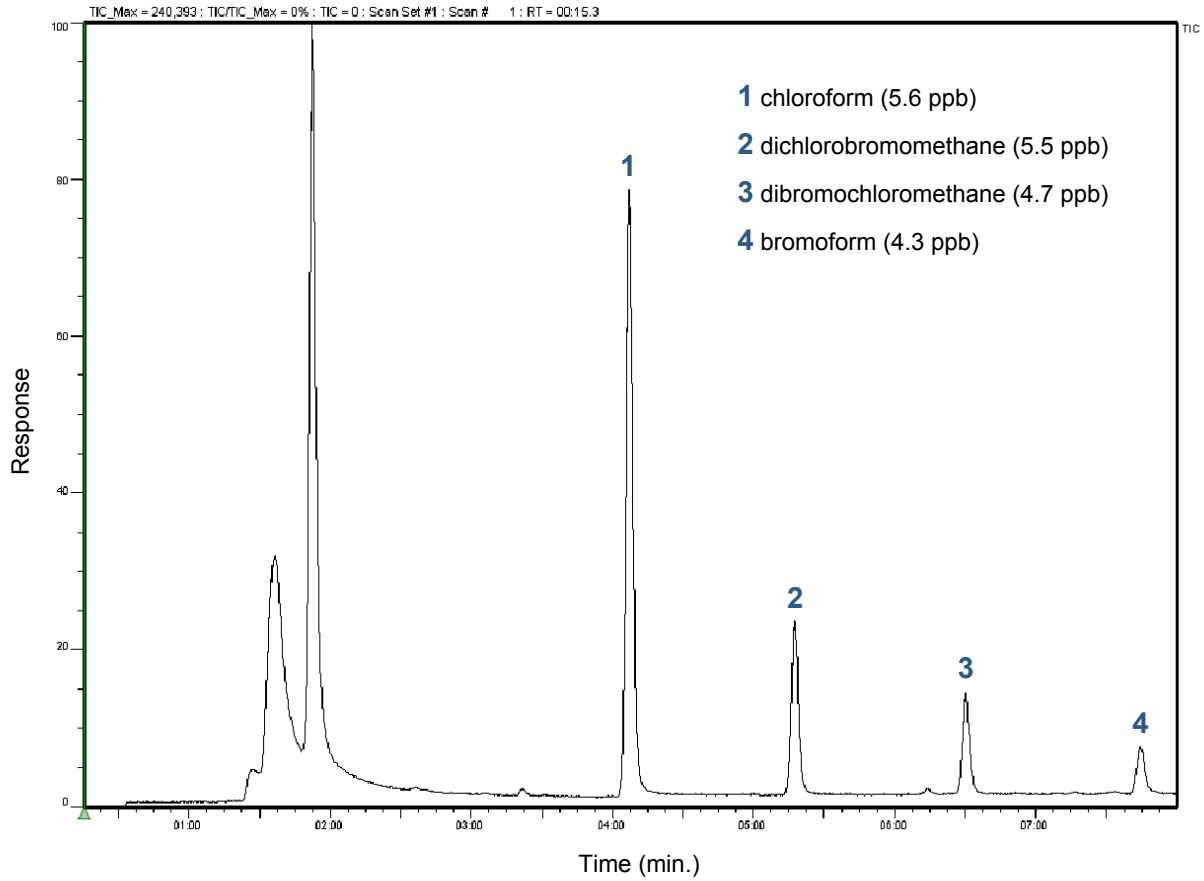
Calibration standards were created at 1, 5, and 10 ppb by spiking 2 L of VOC-free water with the appropriate amount of a 400 µg/mL THM mixture in methanol. The THMs were purged with argon gas into the sampling tube purge and trap headspace, collected on a carbon concentrator for one minute and separated using an 8-minute method with variable column temperature programming. A quantitative method with a three-point, quadratic fit calibration curve library was created from these standards.

As a check of calibration curve accuracy, a 5 ppb THM (20 ppb TTHM) verification standard was created from an independent THM source and the percent recovery of each compound in the standard was determined. A chromatogram of the verification standard, along with the concentrations found for each of the four compounds, is shown in Figure 1. The percent recoveries of the individual THMs (labeled 1 - 4 in Figure 1.) were 112%, 110%, 94% and 86% respectively, and TTHM percent recovery was found to be 105%.

CONCLUSION

The CMS5000 Monitoring System has been demonstrated to be a useful tool for accurately determining the concentration of THMs. As a result, the instrument is an excellent option for continuous on-site monitoring of THM levels in treated drinking water. Plant operators with an installed CMS5000 Monitoring System can be secure in the knowledge that TTHM loads will be less than the 80 ppb maximum allowable concentration before the treated water leaves the plant.

Figure 1: Chromatogram of a 5 ppb THM Mix Check Standard



GC Conditions *Column:* HP-1MS, 15 m, 0.32 mm id, 4.0 µm df; *Conc. Fill:* 1 min.; *Temperature Profile:* 60 °C (hold 1 min.) to 180 °C at 20 °C/min (hold 1 min.).