INFICON

APPLICATION NOTE

Continuous Monitoring of Dichloromethane in Manufacturing Cooling Water Using CMS5000

OVERVIEW

This application note describes the benefits of using the fully automated on-site CMS5000 Monitoring System to identify, analyze, report and alert users when dichloromethane in manufacturing cooling water exceeds acceptable limits.

INTRODUCTION

Given its abundance and proximity, water is often used as a coolant in manufacturing facilities[1]. If this water is discharged to a public water source, the manufacturer must ensure that contaminants have not been added to the water during the cooling process.

Dichloromethane is a common manufacturing by-product frequently found in cooling water. It is used as a solvent in the production of paint stripper, pharmaceuticals and electronics[2]. Dichloromethane is a potential carcinogen and may also cause damage to the central nervous system[3]. Most world governments have maximum exposure limits set for dichloromethane[4]. The USEPA has set an exposure limit of 5 ppb in drinking water[5]. Due to the hazardous effects of dichloromethane, on-site detection and quantitation are necessary to ensure human safety.

CMS5000 employs Situ-Probe™ purge-and-trap sampling technology, gas chromatographic separation, and Micro-Argon Ionization Detection (MAID) to reliably monitor concentrations of volatile organic compounds, including dichloromethane, in water. The unit is designed to operate autonomously, analyzing numerous samples per day over several months without user supervision, and is ideally suited for monitoring of continuous manufacturing operations. The software allows an operator to view concentration data in real time with minimal effort. Data collected from the calibrated CMS5000 allows users to make informed decisions about their water coolant treatment processes. Alarms can be set to indicate when user-defined concentration thresholds are exceeded.

EXPERIMENTAL

Calibration standards were prepared at 1, 50, 100, 200 and 500 ppb by spiking 2 L of VOC-free water with the appropriate amount of a 1000 µg/mL dichloromethane standard in water (SPEXCertiPrep). The 1 ppb standard was created by injecting 2 µL of the 1000 µg/mL standard into 2 L of water and setting the concentrator fill time to 10 seconds. The other standards were created by injecting 100 µL of the 1000 µg/mL standard into 2 L of water setting the concentrator fill time to 10, 20, 40 and 100 seconds.

Figure 1 shows a chromatogram of the 100 ppb calibration standard. Using argon carrier gas, the analyte was purged from the calibration standard into the sampling tube headspace. The headspace sample was collected onto the Tri-Bed Concentrator. The analyte was thermally desorbed from the concentrator and then separated on a capillary column using a 10 minutes, 30 seconds temperature programmed method. The retention time of dichloromethane was 4 minutes, 10 seconds. A five point calibration curve with quadratic fit was generated from the data.

The calibration curve was validated by analyzing a known sample at 75 ppb. Recovery was measured at 92.8%.

CONCLUSION

The fully automated CMS5000 Monitoring System is ideally suited to continually monitor dichloromethane concentrations in manufacturing cooling water at ranges of 1 ppb to 500 ppb. Upon implementation, this unit provides actionable dichloromethane alerts to plant operators, reducing discharge risks and improving peace of mind.

REFERENCES

1 Center for Climate and Energy Solutions, "Cooling Water Intake Structures" http://www.c2es.org/federal/executive/epa/Cooling-Water-Intake-Structures

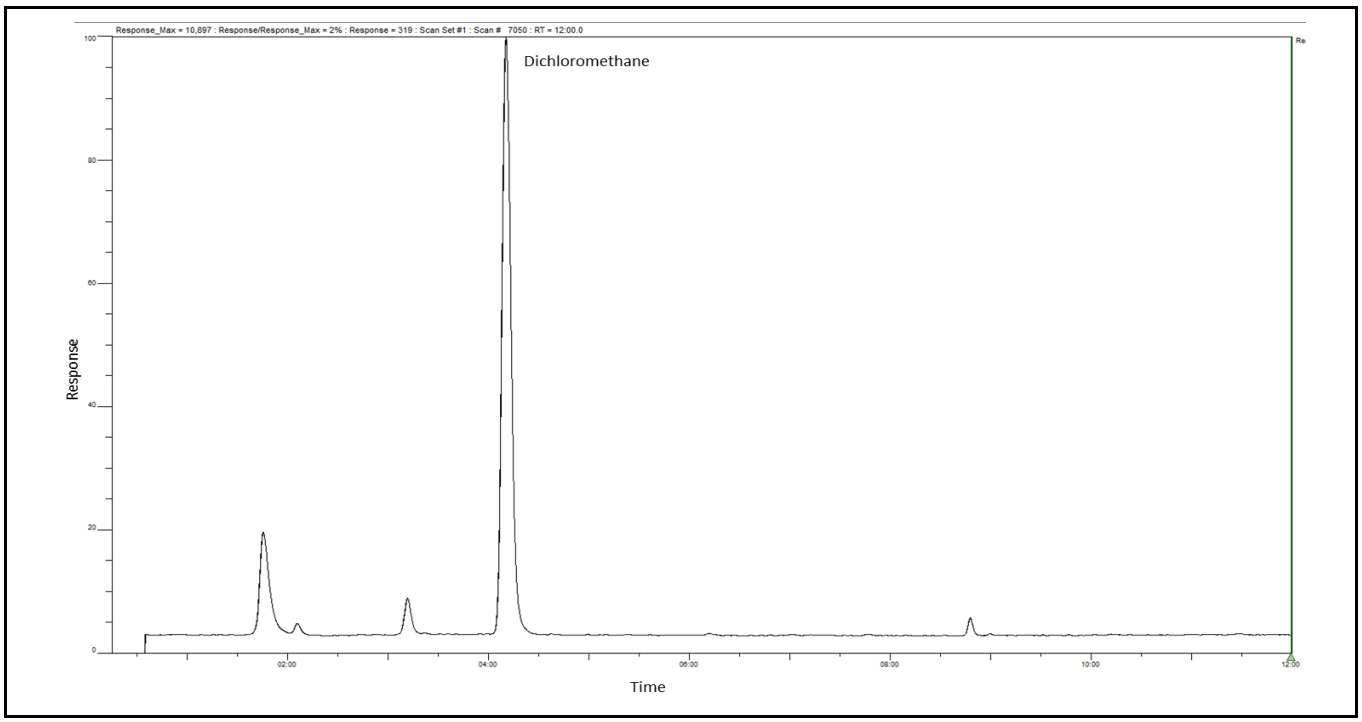
2 EPA US Environmental Protection Agency, "Health Effects Notebook for Hazardous Air Pollutants" https://www3.epa.gov/airtoxics/hlthef/methylen.html

3 EPA US Environmental Protection Agency, "Health Effects Notebook for Hazardous Air Pollutants" https://www3.epa.gov/airtoxics/hlthef/methylen.html

4 World Health Organization, "Dichloromethane in Drinking-water: Background document for development of WHO Guidelines for Drinking-water Quality." 2003.

5 EPA US Environmental Protection Agency, "What are EPA's drinking water regulations for dichloromethane?" https://safewater.zendesk.com/hc/en-us/articles/212076937-4-What-are-EPA-s-drinking-water-regulations-for-dichloromethane-

Figure 1 Chromatogram of 100 ppb Dichloromethane Calibration Standard



Column: DB-1, 30 m, 0.32 mm id, 4.0 µm df; Conc Fill: 40 s;
Temperature Profile: 50 °C (hold 4 min. 30 s) to 200 °C at 30 °C/min (hold 1 min)