TECHNICAL DATASHEET

Analysis of Haloacetic Acids and Dalapon in Water

Overview

ALS Environmental can provide analytical testing for haloacetic acids and dalapon in water to reporting limits of <1µg/L. Haloacetic acids (HAAs) and dalapon are disinfection by-products (DBPs) produced in drinking water as a result of the reaction between free chlorine and bromide with natural organic matter such as humic acid. HAAs are second to trihalomethanes as the most commonly detected DBPs in surface drinking water. HAAs have been linked to possible human health effects.

In the UK there is an increased focus on the analysis of haloacetic acids derived from their risk as potential human carcinogens and their inclusion in the revised EU Drinking Water Directive. In response to this ALS Environmental have developed a method capable of analysing haloacetic acids and dalapon at trace levels.

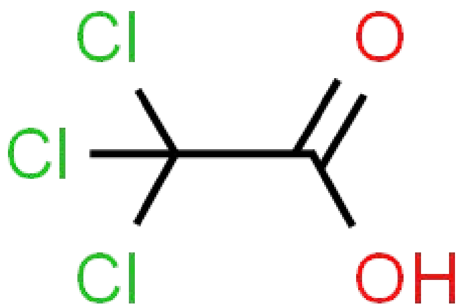
Haloacetic Acids and Dalapon

Water disinfectants, such as chlorine, are used to protect public health. They attack, deactivate and kill all sorts of micro-organisms that could threaten water consumer health. Disinfection is a major factor in reducing health risks from pathogens, however disinfection is a double-edged sword. Disinfectants themselves can react with organic materials in water to form unintended disinfection by-products which pose health risks such as haloacetic acids.

Water companies are responsible for ensuring the drinking water they supply is clean and wholesome. Disinfection by-products are monitored by water companies to ensure they are producing water that is wholesome. For water to be considered wholesome it must not contain any substance which alone or in conjunction with any other substance constitutes a potential danger to human health. Haloacetic acids are highly soluble in water and toxic to humans, animals, plants and algae. Haloacetic acids are also found in industrial wastes and in other fields such as drugs, dyes and chemicals.

Haloacetic acids are classified as monohalogenated acetic acids (monochloroacetic acid (MCAA) and monobromoacetic acid (MBAA)), dihalogenated acetic acids (dichloroacetic acid (DCAA), dibromoacetic acid (DBAA) and bromochloroacetic acid (BCAA)) and trihalogenated acetic acids (trichloroacetic acid (TCAA), bromodichloroacetic acid (BDCAA), dibromochloroacetic acid (DBCAA) and tribromoacetic acid (TBAA)).

Figure 1: Structure of Trichloroacetic acid ($C_2HCl_3O_2$, CAS: 76-03-9).



Haloacetic Acids and Dalapon Regulatory Guidelines

Considering their potential carcinogenicity in humans, a Maximum Contaminant Level (MCL) of 60 µg/L has been established by the U.S. Environmental Protection Agency for the sum of five haloacetic acids in drinking waters, HAA5: monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid.

In the UK there is currently no specific regulatory standard for the concentration of haloacetic acids and dalapon. However, haloacetic acid and dalapon concentrations must be kept as low as possible without compromising the effectiveness of the disinfection. Water utilities that are making changes to their treatment processes may want to collect data on the formation of all nine HAAs. This is because some treatment changes cause the speciation of HAAs to shift to the more brominated compounds. Information regarding these changes provides the water utilities with a better understanding of their water quality in relation to DBPs.

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Analysis of HAAs in drinking water is challenging due to the high levels of matrix ions that co-elute and interfere with the analytes of interest. Since these compounds are polar, strongly acidic, and sparingly volatile, when GC is chosen a derivatization reaction is required. Single quadrupole GC-MS analysis provides good sensitivity and selectivity from common interferences found in drinking waters, but where ultra-trace detection limits are required LC-MS/MS gives the most reliable results using the smallest possible sample size.

ALS Environmental have developed a low volume direct aqueous injection method utilizing reversed phase liquid chromatography coupled to a tandem quadrupole mass spectrometer. This approach eliminates the need for sample extraction and derivatization and the risk of potential analyte losses associated with each. This LC-MS/MS triple quadrupole method raises the bar for ease of use, robustness and data quality compared to the conventional single quadrupole GC-MS test method. The range of application for the method is up to 150 µg/L.

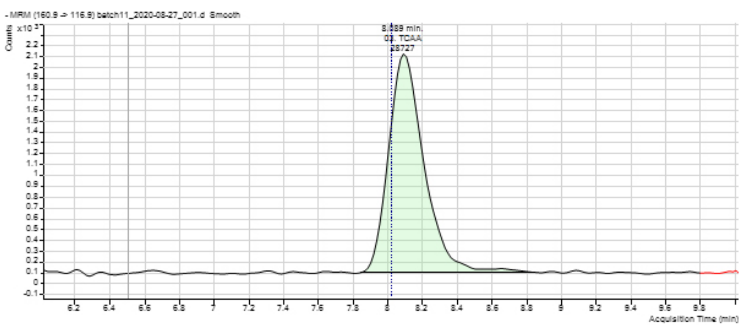
Table 1: Haloacetic Acids and Dalapon Performance Summary for ALS Method WPC75.

Compound	CAS Number	Recovery from Water at 30 µg/L	Limit of Quantitation (LOQ)
Chloroacetic acid	79-11-8	98.4 %	1.6 µg/L
Dichloroacetic acid	79-43-6	102.1 %	1.8 µg/L
Trichloroacetic acid	76-03-9	99.3 %	2.2 µg/L
Bromoacetic acid	79-08-3	100.9 %	1.5 µg/L
Dibromoacetic acid	63-64-1	100.8 %	1.5 µg/L
Bromochloroacetic acid	5589-96-8	106.4 %	2.3 µg/L
Bromodichloroacetic acid	71133-14-7	98.3 %	2.1 µg/L
Dibromochloroacetic acid	5278-95-5	101.0 %	1.7 µg/L
Tribromoacetic acid	75-96-7	103.8 %	2.1 µg/L
Dalapon	75-99-0	99.1 %	1.5 µg/L

Accreditation

ALS Environmental were the first UK Environmental laboratory to develop, validate and accredit all 9 HAA compounds. The LC-MS/MS Haloacetic acids and Dalapon method is accredited to ISO 17025:2017 Drinking Water Testing Specification.

Figure 2: Chromatogram of Trichloroacetic acid calibration standard at 6 µg/L.



General Sampling & Preservative Requirements

Bottle: 250 mL coloured glass bottle preserved with ammonium chloride.
Storage: Stored at 1-5°C.
Holding Time: Samples are 10 days

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