Determination of Haloacetic Acids in Water by GC/μECD and Strong Anion Exchange SPE

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The most widely used method for disinfecting water for public consumption is chlorination. During chlorination, oxidizing agents such as hypochlorite can react with any natural organic matter or bromide present in the raw water to form disinfection byproducts (DBPs). Many of these DBPs have classified as possible human carcinogens are regulated by the US Environmental Protection Agency (EPA) under Stage 1 Disinfectants/Disinfection Byproducts Rule. Haloacetic acids (HAAs) make up the second largest group of DBPs, after the trihalomethanes (THMs). There are nine HAAs (HAA9) recommended for monitoring. Five of the acids are grouped and regulated as the sum HAA5, which has an established maximum contaminant level (MCL) of 60 ng/mL. Although no current MCL has been estrablished for the remaining acids, monitoring for all nine Haloacetic acids (HAA9) is encouraged. EPA Method 552.3 is currently used for compliance monitoring of HAA9, along with the chlorinated herbicide dalapon in drinking water.

Although liquid-liquid extraction (LLE) is typically used for HAAs analysis, solid-phase extraction (SPE) offers several advantages, including high selectivity, high capacity, reduced solvent use, reduced preparation time, and reduced cost per analysis. Recent studies have shown successful utilization of SPE for HAAs extraction. Because Haloacetic acids are anionic at pH values above their pKa, a strong anion exchanger (SAX) can be used effectively to retain and preconcentrate these analytes. In this application, a silica-based quaternary ammonium strong anion exchanger was used as the SPE sorbent. A dual column GC/μECD approach provided consistent and sensitive analysis for the derivatized HAAs. The detection limit for most of the HAAs was 0.05-0.05 ng/mL. Analyte recoveries at three fortifications levels (0.2-2, 1-10, 4-40 ng/mL) ranges from 82-116% with relative standard deviations (RSDs) < 3.5%.