Fact Sheet

DISINFECTION BY-PRODUCTS

Regulated DBPs

Health Concerns and Disinfection By-Products

Quick Facts

- Of the hundreds of disinfection by-products, only 11 are currently regulated.
- DBPs are formed when natural organic matter reacts with chlorine or other disinfectants.
- DBPs are associated with increases in cancer in humans and animals, and concerns regarding human reproduction and development.
- The EPA has mandated monitoring of certain DBPs.

Overview

Disinfection by-products (DBPs) are formed when natural organic matter (NOM) reacts with chlorine or other disinfectants. Although hundreds of DBPs have been reported as occurring in drinking water (Weinberg et al. 2002), only 11 are currently regulated: four trihalomethanes (THMs), five haloacetic acids (HAAs), bromate, and chlorite. The U.S. Environmental Protection Agency (EPA) has established maximum contaminant levels for these DBPs in order to limit consumer exposure and protect public health.

Formation of DBPs in Water Systems

The types and concentrations of DBPs formed during water treatment are affected by several water quality factors, including the characteristics of natural organic matter in the water system, type and dose of disinfectant, contact time, temperature, and pH.

THMs are typically more dominant than HAAs, and, in general, DBPs that react with chlorine are more prominent than other types. pH is often the main factor controlling the relative distribution of THMs and HAAs in treated drinking water. Low pH favors the formation of HAAs, whereas high pH favors the formation of THMs (Speitel et al. 2004).

Bromate is formed when ozone, now commonly used as a water system disinfectant, is applied to bromide-bearing water. Other DBPs formed during ozonation, such as aldehydes, ketones, and carboxylic acids, are

biodegradable. Chlorite is typically formed from chlorine dioxide treatment.

DBPs and Public Health

Studies have reported associations between exposure to regulated DBPs and cancers (e.g., bladder, colon, rectal), both in humans and animals. In addition, chlorite has been shown to cause anemia. There also are concerns about the relationship between DBPs and human reproduction and development. To reduce the risk of possible health effects, U.S. regulations to date have focused on THMs and HAAs, as they are the most prevalent in drinking water and serve as surrogates for other DBPs (EPA 2015).

Analyzing and Monitoring DBPs

Beginning in mid-2012, the EPA, through its Stage 2 Disinfectants and Disinfection Byproducts Rule (DBPR), began requiring water utilities to monitor DBPs in drinking water (EPA 2015). The EPA has published a list of approved methods under the Information Collection Rule (ICR) and DBPR (EPA 2016):

- THMs: EPA Methods 502.2, 524.2, and 551.1
- HAAs: EPA Methods 552.1 and 552.2, and Standard Method 625.1
- Bromate: EPA Method 300.1
- Chlorite: EPA Methods 300.0 and 300.1

References

EPA (U.S. Environmental Protection Agency). 2015. "Drinking Water Requirements for States and Public Water Systems: Stage 1 and Stage 2 Disinfectants and Disinfection Byproducts Rules." Accessed April 6, 2012. https://www.epa.gov/dwreginfo/stage-1-and-stage-2-disinfectants-and-disinfection-byproducts-rules.

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