Evaluation of bromide incorporation into THMs and DHANs from chlorination of algal organic matter

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ABSTRACT

Many brominated disinfection by-products (DBPs) have higher toxicity or potential health risks than their chlorinated analogues, hence, the formation of brominated DBPs in chlorination is the focus of much concern. The frequent occurrence of algal bloom in bodies of freshwater causes algal organic matter (AOM) to serve as the precursor of DBPs. In this study, the incorporation of bromide into AOM was investigated under different chlorination conditions through analyzing the molar concentration, species distribution, and bromine substitution factor (BSF) of trihalomethanes (THMs) and dihaloacetanilides (DHANs). The formation of THMs and DHANs in chlorination of AOM had many characteristics being different from that in chlorination of natural organic matter. In chlorination of AOM, the formation and speciation of THMs and DHANs were highly time-dependent. The total concentration of THMs and the proportion of bromine-containing THMs increased with contact time, while the THM–BSF values were stable after the contact time of 12 or 24 h. High pH increased the concentration of THMs and the percentage of brominated ones in THMs. Increasing the bromide concentration did not enhance the formation of total THMs in short contact times (1–6 h), but did in a long contact time (48 or 72 h). The THM–BSF value could have a maximum value of approximately 0.8 in chlorination of AOM. The concentration of DHANs had a first increasing and then decreasing pattern with contact time. The influence of bromide on the speciation of DHANs was highly time-dependent. The DHAN–BSF values increased with pH (within the contact time of 1–24 h) and bromide concentration (within the contact time of 1–72 h).

Keywords: Disinfection by-products; Chlorination; Algal organic matter

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