Trihalomethane formation by chlorination of ammonium- and bromide-containing groundwater in water supplies of Hanoi, Vietnam

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Abstract: The occurrence and the fate of trihalomethanes (THMs) in the water supply system of Hanoi City, Vietnam was investigated from 1998 to 2001. The chlorination efficiency, THM speciation, and, THM formation potential (THMFP) was determined in the water works and in tap water. With regard to THM formation, three types of groundwater resources were identified: (I) high bromide, (II) low bromide, and (III) high bromide combined with high ammonia and high dissolved organic carbon (DOC) concentrations. Under typical treatment conditions (total chlorine residual 0.5-0.8mg/L), the total THM formation was always below WHO, EU, and USEPA drinking water standards and decreased in the order type I>type II>type III, although the THMFP was >400μg/L for type III water. The speciation showed >80% of bromo-THMs in type I water due to the noticeable high bromide level (≤140μg/L). In type II water, the bromo-THMs still accounted for some 40% although the bromide concentration is significantly lower (≤30μg/L). In contrast, only traces of bromo-THMs were formed (5%) in type III water, despite bromide levels were high (≤240μg/L). This observation could be explained by competition kinetics of chlorine reacting with ammonia and bromide. Based on chlorine exposure (CT) estimations, it was concluded that the current chlorination practice for type I and II waters is sufficient for ≥2-log inactivation of Giardia lamblia cysts. However, in type III water the applied chlorine is masked as chloramine with a much lower disinfection efficiency. In addition to high levels of ammonia, type III groundwater is also contaminated by arsenic that is not satisfactory removed during treatment. N-nitrosodimethylamine, a potential carcinogen suspected to be formed during chloramination processes, was below the detection limit of 0.02μg/L in type III water. © 2003 Elsevier Science Ltd. All rights reserved.

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