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Occurrence of trihalomethane in relation to treatment technologies and water quality under tropical conditions

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Abstract

Distribution of most prevalent disinfection by-products, trihalomethanes (THMs) in relation to treatment technology and common water quality parameters (turbidity, conductivity, color, pH, and residual chlorine) was examined for two water supply schemes (WSS) in Sri Lanka (locations: Greater Kandy-WSS (GKWSS) (80.56–80.66 °E, 7.28–7.38 °N) and Kandy South-WSS (KSWSS) (80.49–80.63 °E, 7.21–7.30 °N). In both treatment plants, only $CHCl_3$ and $CHCl_2Br$ were detected in appreciable concentrations and total THMs (TTHMs) values were well below the WHO limits (80 μg/L). TTHMs variations ranged from 0 to 16 μg/L and 0 to 54 μg/L in GKWSS and KSWSS, respectively. Highest TTHM value (54 μg/L) was found in KSWSS which employs pulsation treatment technology. Correlations between $CHCl_3$ and $CHCl_2Br$ in both water schemes are noteworthy, but THM levels relate to most of the water quality parameters ambiguously. However, a distinct relationship is observed between THM levels and degree of chlorination, resident time, pipeline corrosion, and temperature. THM formation increased towards the boundaries of most of the sub-water supply schemes (SWSS).

Key words: disinfection by-products, Sri Lanka, THM, TTHM, water quality

INTRODUCTION

Chlorination is the most common disinfection method used to destroy pathogenic microorganisms in potable water (Morris & Levin 1995). Although the exact chemical structures of natural organic matter (NOM) are unresolved to date, they are ubiquitous in natural waters. It is well known that upon chlorination, the NOM often acts as a precursor in the formation of disinfection by-products (DBPs) (Rook 1974; Li & Mitch 2018). The most prevalent DBP classes are $CHCl_3$, $CHCl_2Br$, $CHClBr_2$, and $CHBr_3$; the sum of them are designated as total trihalomethanes (hereafter TTHMs) (Rook 1974; Krasner *et al.* 2006).

During the past four decades, many researchers have examined DBP levels in water (Hu *et al.* 2010), their formation pathways (Wang *et al.* 2017), biotoxicity, and mitigation methods (Ashbolt 2004). Epidemiologic studies have shown a relationship between long-term exposure to DBPs and increased cancer risks and adverse reproductive effects (IARC 1991; Singer 1999; Gordon *et al.*