



Formation potential of *N*-nitrosamines during the disinfection of treated wastewaters with sodium hypochlorite

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Received 15 June 2012; Accepted 9 April 2013

ABSTRACT

This study investigated the formation of eight *N*-nitrosamines (*N*-nitrosodimethylamine (NDMA), *N*-nitrosomethylethylamine (NMEA), *N*-nitrosodiethylamine (NDEA), *N*-nitrosodipropylamine (NDPA), *N*-nitrosomorpholine (NMOR), 1-nitrosopyrrolidine (NPYR), 1-nitrosopiperidine (NPIP), and *N*-nitrosodibutylamine (NDBA)) after the chlorination (with NaOCl) of wastewater effluents from two wastewater treatment plants (WWTPs) located in North East Spain. Two different WWTPs, one with nitrification-denitrification process (CB1) and the other without (CB2) have been chosen. The concentrations of individual *N*-nitrosamines in non-chlorinated tertiary treated wastewater effluents ranged from <LOD to 75 ng L⁻¹. That range increases to 114 and 1092 ng L⁻¹ after chlorinating tertiary-treated wastewater samples at 5 and 15 mg L⁻¹ of free chlorine, respectively. NDEA and NMEA are the most abundant compounds in both non-chlorinated and chlorinated secondary and tertiary-treated wastewater effluents. The disinfection of tertiary treated wastewater at 5 mg L⁻¹ of free chlorine gave a total *N*-nitrosamines concentration of about 300 ng L⁻¹ in samples from the two studied WWTPs. Total *N*-nitrosamine concentrations in chlorinated secondary treated wastewater samples were significantly higher than those obtained from the chlorination of tertiary treated wastewaters ($p < 0.05$). This may be due to the capacity of the tertiary treatment processes for removing *N*-nitrosamines precursors. The experiments have revealed that in addition to NDMA, relatively high concentrations of other *N*-nitrosamines are produced when treated wastewater effluents are disinfected with chlorine for agricultural irrigation purposes.

Keywords: Chlorination; Disinfection by-products; *N*-nitrosamines; Reclaimed water

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