COMPARISON OF CHLORINATION AND OZONATION FOR REMOVING ORGANIC WASTEWATER-RELATED CONTAMINANTS AT A DRINKING-WATER-TREATMENT PLANT

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Abstract

The U.S. Geological Survey, in cooperation with the New Jersey Department of Environmental Protection, conducted a study to evaluate the effectiveness of various treatments for removing organic wastewater-related contaminants (OWCs) from source waters at a drinking-water-treatment plant. During 3-week periods in the Fall of 2003 and 2004, twelve 24-hour composite samples of water were collected at the surface-water intake, and at various locations along the treatment process (clarification, disinfection, filtering, and in finished water entering the distribution system). Between the 2003 and 2004 sampling periods, the plant switched from sodium hypochlorite disinfection to ozone disinfection. No other changes were made to the water-treatment process during this period. All water samples were filtered and analyzed for more than 130 OWCs including pharmaceuticals, fragrances, flavorants, plasticizers, pesticides, flame retardants, detergent metabolites, and polyaromatic hydrocarbons.

Fifty five of the 130 OWCs were detected in samples of raw water. Thirty six OWCs were detected in 20% or more of these samples and nine were detected in 75% or more samples. Concentrations of most OWCs in raw-water samples were typically 1 *u*g/L or less, and the total sum of all concentrations were usually less than 10 *u*g/L. Because data were collected over a year apart there were differences in the number of OWCs detected and their concentrations in raw water entering the treatment plant. However, comparison of frequencies of detection and concentrations indicate that ozone disinfection was more effective at removing OWCs and reducing their concentration than chlorine disinfection. Chlorination removed about 22 percent of the OWCs present, whereas ozonation removed about 43 percent. Similarly, the total sum of all concentrations were reduced on average by about 10 percent following chlorination, and 65 percent following ozonation. Filtration with granular activated carbon was highly effective at removing many of the OWCs that remained following disinfection by both processes. Thus, for both years the number of OWCs detected and their concentrations in finished water were similar. Only 12 of the 55 OWCs detected in raw water were detected in finished water. Detection frequencies in finished water for these 12 compounds were substantially reduced and concentrations of remaining OWCs were reduced by 75 to 90 percent from initial concentrations.

Keywords: drinking water contaminants, organic wastewater contaminants,

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