Comparing potassium permanganate, chlorine dioxide, and chlorine oxidation for manganese control of a volcanic island surface water treated with a conventional coagulation, sedimentation, and filtration process

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ABSTRACT
A comparison of the effectiveness of potassium permanganate (KMnO₄), chlorine dioxide (ClO₂), and chlorine (Cl₂) oxidation pretreatment for manganese (Mn) control from a surface water reservoir on the volcanic island of Guam has been completed. Source water dissolved Mn content was determined to be 7.34 μg/L at a reservoir intake depth of 10 ft, 9.85 μg/L at a depth of 20 ft, 41.6 μg/L at a depth of 30 ft, and 775 μg/L at a 40 foot depth. For the intake depth of 10 ft, it was found that a ClO₂ dose of 1.1 mg/L reduced Mn by an average of 98.7%, as compared to an average of 95.9% using a KMnO₄ dosage of 1.75 mg/L. Cl₂ was found not to reduce dissolved Mn to any extent at dosages of 1.25 mg/L. It was determined that pink water formation occurred with less than 0.5 mg/L of a permanganate overdose. Additionally, a 1.1 mg/L ClO₂ dose produced an average chlorite and chlorate by-product concentration of 780–1,080 μg/L, respectively. Results demonstrated that ClO₂ would be the preferred oxidant for Mn control as compared to KMnO₄ or Cl₂ for the volcanic water supply evaluated in this study. The research also verified that a 0.10-micron filter produced more accurate dissolved Mn results than the standard method use of 0.45-micron filter in laboratory procedures.

Keywords: Oxidation; Manganese; Chlorine; Chlorine dioxide; Potassium permanganate; Surface water

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