Environmental Science

INACTIVATION OF *NITROSOMONAS EUROPAEA* BY CHLORINE AND MONOCHLORAMINE IN DRINKING WATER, Curtis D. Smith , Christian P. Chauret* , Indiana University Kokomo , Department of Natural, Informational, and Mathematical Sciences, Kokomo, IN 46904-9003, cchauret@iuk.edu

The introduction of monochloramine (NH_2Cl) as a disinfectant used in water treatment facilities has led to some concern about the viability of ammonia oxidizing bacteria (AOB) in the distribution system. Presence of AOB, such as *Nitrosomas europaea* (ATCC 19718), is a potential health threat that is especially dangerous for young children. In drinking water, AOB use ammonia-based compounds as their principle electron acceptor, and by oxidation produce nitrite (NO_2^-). Nitrite oxidizes iron in hemoglobin producing methemoglobin, which cannot properly transport oxygen. Adults and children older than six months generally produce enough NADH diaphorase, the enzyme that reduces methemoglobin back to hemoglobin, to prevent illness, but it has been shown that infants less than six months old have lower concentrations of this enzyme. An increase in the nitrite concentration in the blood stream can lead to a disorder known as methemoglobinemia, or “blue baby syndrome”, which can be fatal if not properly treated. The goals of this research were to determine how effectively monochloramine and free chlorine inactivate *N. europaea*, and whether particulate matter within the distribution system has any effect upon disinfectant capacity. Inactivation experiments were conducted using both free chlorine and monochloramine. The capability of both disinfectants to inactivate *N. europaea* was also tested in the presence of sterile corrosion, soil and waste water debris to assess the effects of these types of contamination on the inactivation kinetics. Results were examined graphically using the logarithm of bacterial reduction on the ordinate, and the concentration of the residual free chlorine multiplied by the time the sample was taken (*Ct*) in the abscissa. The data was also compared statistically to reveal any deviation from an experimental control.

Free chlorine in control experiments was able to produce six logs of inactivation (a reduction from 10^7 cfu/mL to 10^1 cfu/mL) for a *Ct* of 1.33 mg·min/L. Monochloramine was capable of producing a reduction of four logs, but did so with a *Ct* of 10.54 mg·min/L. Monochloramine inactivation in the presence of waste water debris also provided four logs of inactivation for a *Ct* of 10.99 mg·min/L. The same reduction was seen in soil contaminated reactors with a *Ct* value of 10.54 mg·min/L. The data produced from this series of experiments were analyzed and found not to be statistically different ($p < 0.05$). This leads us to believe that monochloramine is effective but less so than free chlorine in the inactivation of *N. europaea*, and the presence of contamination debris has no effect upon the inactivation kinetics involved with either disinfectant.

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