FREE RADICAL CHEMISTRY OF CHLOROPICRIN: LINKING CHEMISTRY, KINETIC MODELING AND POSSIBLE HEALTH EFFECTS

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Abstract

Disinfectants used in water/wastewater treatment or treatment of water intended for reuse, such as chlorine, chloramines, and ozone, react with organic matter to form what are collectively referred to as disinfection-by-products (DBPs). One class of DBPs that appear to have potentially high adverse health effects are the halonitromethanes (HNMs). Of the HNMs, trichloronitromethane or chloropicrin appears to be the most common; however, eight other halonitromethane's have also been found in waters. When pre-ozonation was followed by chloramination, the concentrations of HNMs were found to increase and TCNM was observed up to 180 nM in US drinking waters. Most water intended for reuse is disinfected and usually contains significant concentrations of nitrogen based compounds and may in some cases have small concentrations of bromide ion present. We are using cytotoxicity and genotoxicity to guide our priorities for detailed studies of DBPs. The results of these toxicity studies clearly demonstrate that the nitrogen containing DBPs are much more toxic that the carbonaceous DBPs. By studying the free radical chemistry of these compounds we may obtain a better understanding of the potential mechanisms of toxicity and link that information to health effects associated with these and other chemicals. These studies will also inform engineers on possible optimization approaches for water treatment.