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ABIOTIC TRANSFORMATION OF CHLORPYRIFOS TO CHLORPYRIFOS OXON IN CHLORINATED WATER

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In vivo transformation of chlorpyrifos to chlorpyrifos oxon is believed to be a prerequisite for this insecticide to display acute toxicity to organisms. We discovered that active chlorine dispersed in water causes the rapid abiotic transformation of chlorpyrifos to chlorpyrifos oxon. The proposed mechanism for the transformation is an electrophilic attack by hypochlorous acid (HOCl) on the thion (P=S) double bond of chlorpyrifos followed by desulfuration of chlorpyrifos to its oxon analog. The pH of a Cl₂-aqueous solution controls the speciation of HOCl and hypochlorite (OCl⁻) in water and thereby influences the transformation process. Chlorpyrifos oxon is a potent anticholinesterase that is about 1,000 times more toxic than chlorpyrifos. Because chlorination is commonly used for treatment of domestic water supplies, the findings raise a new concern about the safety of domestic use of chlorpyrifos products.

Keywords: Chlorpyrifos, Chlorpyrifos oxon, Toxicity, Transformation, Tap water

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