The influence of ligand on soluble Mn(III)-sulfite system for methyl parathion

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The ligand-stabilized soluble Mn(III) recognized as active intermediate can potentially mediate the attenuation of contaminants. In this study, the abiotic degradation behaviors of methyl parathion in the ligand stabilized Mn(III)-sulfite system were investigated. The results showed that the yield of soluble Mn(III) produced from the redox reaction of MnO_2 and oxalic acid was dependent linearly on the dosage of MnO_2 and caused the decomposition of methyl parathion up to 50.1% in Mn(III)-sulfite system after 30 minutes. The fitted pseudo-first order reaction constants of methyl parathion degradation increased with increasing the amount of produced Mn(III) but was not effected linearly by the addition of sulfite. Other ligands, including pyrophosphate and oxalic acid, acted as effective complexing agents to stabilize soluble Mn(III), and exhibited competitive effect on methyl parathion degradation with sulfite. The formation of Mn(III)-sulfite complexes is the critical step in the system to produce abundant reactive oxygen species identified as SO3•- to facilitate methyl parathion degradation. The hydrolysis and oxidation of methyl parathion were acknowledged as two primary transformation mechanisms in Mn(III)-sulfite system. These findings indicate that naturally ligands-stabilized soluble Mn(III) can be generated that could oxidative decompose organophosphate pesticides such as methyl parathion.