UV/ferrate(VI) oxidation of profenofos: efficiency and mechanism

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ABSTRACT

The elimination of organophosphorus pesticide profenofos was investigated in the UV/ferrate(VI) solution. The oxidation of profenofos was pH dependent and increased in the order of pH 6.0 < 7.0 < 8.0 < 10.0 < 9.0. The degradation of profenofos increased with increasing ferrate(VI) dosage and decreased profenofos concentration. The UV254 was first found to exhibit a synergistic effect on the oxidation of profenofos by ferrate(VI). Up to 19.1% enhancement was observed with the introduction of ultraviolet light to the ferrate solution. The removal rate of profenofos increased via two-step addition of ferrate(VI) to the reaction solutions. By ESI-MS and MS/MS analysis, the main degradation product of profenofos in UV/ferrate(VI) solution was identified. The oxidation of profenofos proceeded via de-ethylation and de-propylation, leading to O-4-bromo-2-chlorophenyl O,S-dihydrogen phosphorothioate. The subsequent cleavage of C–O bond gave rise to the release of orthophosphate and possible generation of 4-bromo-2-chlorophenol. The results suggest that UV/ferrate(VI) is a good alternative for the treatment of organophosphorus pesticides in aqueous solution.

Keywords: Profenofos; UV/ferrate(VI); Synergistic effect; Products

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