

Stable carbon isotope fractionation during photodegradation of triclosan in the aqueous phase

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Triclosan (5-chloro-2-(2,4-dichlorophenoxy)phenol, TCS) is a common antibacterial agent as well as a widespread water contaminant. Direct photolysis of TCS is an important degradation process, but it also produces various toxic products, such as 2,8-dichlorodibenzodioxin and 2,4-dichlorophenol. Compound specific isotope analysis (CSIA) is a powerful tool to characterize different degradation pathways of organic contaminants. In our study, reaction kinetics and bond-cleavage pathways of TCS photodegradation were investigated. The phototransformation experiments were conducted by varying pH, initial TCS concentration as well as by adding humic substances. The results reveal that humic acid inhibites the photodegradation of TCS, which is consistent with the photochemical model predictions obtained by using the APEX software. Moreover, different extent of stable carbon isotope fractionation of TCS were observed at different pH values and initial concentrations, indicating that the preferential degradation pathways are linked with cleavage of certain chemical bonds. The results obtained with CSIA are also confirmed by the analysis of the reaction products. Therefore, CSIA facilitates the understanding of TCS phototransformation mechanisms, and it might also serve as a tool to differentiate TCS photodegradation from other degradative processes.