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Comparative Metabolism of Organophosphorus Pesticides in Water-Sediment Systems

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The aerobic aquatic soil metabolism of three ¹⁴C-labeled organophosphorus pesticides was examined in French lake water-sediment systems to estimate factors controlling their behavior in the natural aquatic environment. The more hydrophobic tolclofos-methyl and butamifos rapidly distributed between the aqueous and sediment phases even in the early stage of incubation, while partition of cyanophos to the sediment was found to be more gradual. The three pesticides were degraded in the water-sediment systems with half-lives of 8.8 to 24.5 days. Tolclofos-methyl and cyanophos commonly underwent cleavage of the P-O-methyl and P-O-aryl linkages the latter with a stepwise hydration of the cyano group, while butamifos was degraded to many unknown compounds each with less than 1.4% of the applied radioactivity. The evaporative loss of tolclofosmethyl and butamifos possibly due to azeotropic co-distillation was observed. The behavior of pesticides in the water-sediment system was considered to be mainly controlled by the balance among partition, degradation and evaporative processes, at least in part due to their chemical structures and physico-chemical properties.

Keywords:

biodegradation of organophosphorus pesticides, water-sediment system, ester hydrolysis, oxidative desulfuration

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