Pesticides dissipation at the water-sediment interface

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The global occurrence of pesticides in the environment jeopardizes the health of freshwater. Despite a decade of pesticide research, knowledge of the extent and pathways of pesticide dissipation and their accumulation in hydrological systems is currently limited. Pesticide concentrations in water or sediment do not allow differentiation between non-degradative processes and degradative processes at the water-sediment interface. Here we examine the degradation kinetics and pathways of Atrazine, S-Metolachlor, Terbutryn, Acetochlor and Metalaxyl at the water-sediment interface. Microcosms were set-up under both oxic and anoxic conditions to evaluate pesticide degradation in water and sediment using pesticide compound-specific isotope analysis that relies on changes of stable isotope (C, N) ratios. For example, Alachlor degradation was faster under oxic condition (half life: 30.3±6.8 days) than under anoxic condition (half life: 160±30 days) in water and sediment. The isotopic fractionation (ε_C=-4.1±0.4‰) suggests a nucleophile substitution mechanism of degradation. We anticipate our results as a preliminary step prior to incorporation of CSIA data into a reactive transport model. This approach will allow us to further interpret pesticide dissipation both in-stream and at the catchment scale, and to evaluate the contribution of non-degradative processes versus degradative processes.