CLEANING UP PESTICIDE-CONTAMINATED SOIL WITH IRON METAL

P.J. Shea, S.D. Comfort, and T.A. Marharek
School of Natural Resource Sciences, University of Nebraska-Lincoln, Lincoln, NE 68588; Phone: (402)472-1533; Fax: (402)472-7904.

ABSTRACT

Spills at agricultural cooperatives and farmsteads can result in ground and surface water contamination by pesticide and fertilizer products. Finely ground iron metal (zerovalent iron, Fe^0 can be used to promote rapid degradation of many chlorinated and nitrogenated compounds, including common agrochemicals. When Fe^0 is added to soil under anaerobic conditions, corrosion (oxidation) of the iron can be effectively coupled to reductive dechlorination and nitro group reduction. We conducted a field demonstration at a Nebraska farm cooperative on soil contaminated with metolachlor (>1400 mg kg^{-1}), atrazine (>250 mg k^{-1}), alachlor (>90 mg k^{-1}), pendimethalin (>90 mg k^{-1}), chlorpyrifos (>15 mg kg^{-1}), and nitrate-N (>900 mg kg^{-1}) Contaminated soil was placed in windrows and mixed with a high-speed mixing and fractionation implement. Soil windrows were treated with Fe^0, Fe^0+ aluminum sulfate, and/or acetic acid and incubated under clear plastic at a soil water content >35%. Within 90 d, pesticide concentrations decreased by as much as 99% (metolachlor, adachlor, pendimethalin), 96% (atrazine), and 96% (chlorpyrifos), while nitrate-N concentration decreased by >90%, Laboratory experiments using radio-labeled metolachlor indicate that the Fe^0 treatments can result in products that are more biodegradable. These results combined with the relatively low cost of Fe^0 support its use for field-scale treatment of pesticide-contaminated soil, especially when land spreading or landfilling is prohibitive.

Key Words: remediation, zerovalent iron, chemical reduction, dechlorination, abiotic degradation