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Leaching of pesticides and implications for pesticide screening

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The fraction of applied pesticide that leaches beyond the phreatic ground water level controls the long term build up of pesticide concentrations in ground water. Hence, this fraction has been recognized as vital with regard to admittance policies of authorities, that aim at preventing too large concentrations. In our study, we considered the leached fraction for pesticides that adsorb to the soil matrix and that degrade in the soil solution only. The sorption process may be described with either linear or nonlinear functions of the local resident concentration in solution. Transport of pesticides was modeled by solving the CDE, accounting for both sorption and first order degradation. The modeling was done both numerically and analytically, using approximations that follow from asymptotic balancing. The results of numerical and analytical modeling appear to be in excellent agreement. Both type of model results reveal, that sorption affects the time of breakthrough at the ground water level, but it does not affect the leached fraction. The immediate consequence is, that to assess or predict the leached fraction, both sorption and the type of sorption model (linear, nonlinear, equilibrium or kinetic) are unimportant. With regard to pesticide admittance policies, this result implies that it is important to assess whether or not pesticide degradation occurs only in the solution phase, or also in the sorbed phase. If it occurs only in the solution phase, research should focus rather on quantifying degradation rates, rather than on identifying how sorption should be described and quantifying sorption parameters. In addition, screening for hydrologically complicated situations becomes significantly simpler and cost effective.