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Pesticide convection dispersion with temperature effect

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Abstract

A convection-dispersion equation, which is denominated DAPESTE model, of one-dimensional evolution to simulate pesticide leaching in soil with sinusoidal function to describe the annual variation of daily average soil temperature at different depths will be presented. In numerical simulation, the Finite Elements Method (FEM) will be used for the space semi-discretization and the Regressive Eüler Method (REM) for time discretization. It will be used appropriated FEM for convection-dispersion problems in which the convective transport predominates over the dispersive transport. Let us suppose that the pesticide diffusivities in the gaseous and aqueous soil phases depend on the soil temperature and that the soil temperature, itself, varies with depth and time. In this way, the effective hydro dynamic dispersion coefficient of the convection-dispersion equation will depend on the soil temperature. The pesticide air-water partition coefficient of the Henry law, varying with the soil temperature, will be determined by the Clausius-Clapeyron equation. The van't Hoff equation will be used to determine the temperature dependence of the pesticide sorption coefficient in the soil organic and inorganic matter. The Arrhenius equation will be used to estimated the effect of the soil temperature on the pesticide degradation rate. These temperature dependence relationships between the parameters of the model and the soil temperature, although they increase the level of difficulty for obtaining analytical solutions for the convection-dispersion equation of the DAPESTE model, can help comprehend the pesticide behavior in the soil under different scenarios of daily average soil temperatures, especially in pesticide concentration leaching and its half-life
in soil.

Keywords: DAPESTE, convection, dispersion, temperature, pesticide, leaching.

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