

Mathematical models for undisturbed soil-column experiments

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When some kinds of pollutants infiltrate into an aquifer, the pollutants need to traverse a zone of unsaturated soil containing liquid, solid and gas. To prevent and remedy any soil and groundwater pollutions, it is important to understand the physical and/or chemical reactions and mechanisms of solute transport in the unsaturated region. An effective way to reveal the process is to perform soil-column experiment.

Consider an actual undisturbed soil-column experiment with sub-clays carried out in Zibo, Shandong Province. From the results of experiment, it had been found that the measured BTCs for main solute ions do not behave as expected increasing curves. The real curves went up rapidly at the initial stage but then came down gradually. The concentration of the initial out-flowing liquor was almost double than the infiltrating flow. As time went on, the solute concentration of the out-flowing became lower, and moved up and down near the initial infiltrating concentration till the end of waste water infiltration. It is obvious that this column experiment demonstrated a nonlinear adsorbing/degrading process which varied with the experimental time between the liquid and the solid phases.

In summary, the pollutants contained in the column dissolved rapidly and nonlinearly at the initial stage. The absorbed capability of the soil increased gradually until the solute transport behaviors arrived at an asymptotical equilibrium.

A problem to be addressed in the Workshop is how to derive an appropriate mathematical model to explain the phenomena observed in the experiment.