11 Characterization of Solute Transport Through Miscible Displacement Experiments

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11.1 CHARACTERIZATION OF SOLUTE TRANSPORT

The characterization of solute transport processes in subsurface systems has received increased attention by environmental science researchers in recent decades, especially concerning the fate of pollutants in soils. There are numerous reasons for the increased attention to the vadose zone processes, as they play a key role in the behavior of subsurface contaminants (see Chapter 1). Characterization of water and solute transport processes in soils is a complex task, which requires the coupling of mechanistic models and corresponding appropriate data generation on water contents and solute concentration (and, eventually, heat fluxes). Mathematical models describing the most relevant processes that govern solute transport, including the advection-dispersion equation and nonequilibrium during transport, were introduced in Chapter 3. In addition, *ad hoc* experimental methodologies for monitoring water and solute concentration have been described in Chapters 5, 9, and 10. Here, the development of methodological approaches for the characterization of solute transport processes is described. Thus, experimental strategies to elucidate transport mechanisms are discussed, without description of the monitoring techniques that can be used to generate the data.

Miscible displacement experiments are perhaps the most important among the available methodological approaches for characterizing solute transport. When such experiments are properly designed, they can provide valuable information about processes that affect solute movement, such as hydrodynamic dispersion, adsorption, degradation, and transformation phenomena (Ersahin et al., 2002). These consist in applying a solute at a specific point of