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# 11 Characterization of Solute Transport Through Miscible Displacement Experiments

*J. Álvarez-Benedí*

Instituto Tecnológico Agrario de Castilla y León,  
Valladolid, Spain

*C. M. Regalado and A. Ritter*

Departamento de Suelos y Riegos, Instituto Canario de  
Investigaciones Agrarias (ICIA), Ctra. del Boquerón s/n,  
Valleguerra, Tenerife, Spain

*S. Bolado*

Universidad de Valladolid, Valladolid, Spain

## CONTENTS

11.1	Characterization of Solute Transport.....	392
11.2	The Breakthrough Curve.....	395
11.2.1	The Miscible Displacement Experiment and Its Mathematical Description.....	395
11.2.1.1	Flux, Resident, and Time-Averaged Concentrations .....	397
11.2.1.1.1	The Transport Equation.....	397
11.2.1.1.2	Flux, Averaged, and Time Resident Concentrations .....	398
11.2.1.2	Boundary Conditions.....	400
11.2.1.2.1	Inlet Boundary Conditions.....	400
11.2.1.2.2	Outlet Boundary Conditions .....	402
11.2.1.3	Tracers.....	403
11.2.2	Analysis of the Breakthrough Curve .....	404
11.2.2.1	The Effect of Transport Mechanisms on the BTC .....	404
11.2.2.2	Moment Analysis .....	406

11.2.2.3	Characterizing Transport Mechanisms Through Inverse Modeling .....	408
11.2.2.4	Application for Sorbed Solutes: The Estimation of the Retardation Factor .....	410
11.2.3	Beyond the BTC.....	412
11.3	Techniques for Characterizing Nonequilibrium During Solute Transport in Soils .....	414
11.3.1	Techniques Based on Breakthrough Curves .....	414
11.3.1.1	Effect of Variation of the Pore Water Velocity..	416
11.3.1.2	Single and Multiple Tracers .....	417
11.3.1.3	The Flow-Interruption Technique .....	417
11.3.2	Estimation of Nonequilibrium Parameters From Simple Experiments.....	423
11.3.2.1	Single Tracer .....	424
11.3.2.2	Sequential Tracer Technique.....	425
11.4	Recommendations and Future Research.....	426
	Acknowledgments .....	427
	References .....	428

## 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