
MISCIBLE VISCOUS FINGERING IN CHROMATOGRAPHIC COLUMNS: INFLUENCE ON THE DISTRIBUTION OF A RETAINED ANALYTE

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Miscible viscous fingering (VF) is an interfacial fluid flow instability that occurs when a less viscous fluid displaces another more viscous miscible one in a porous medium, leading to the formation of finger-like patterns at the interface of both fluids. In liquid chromatography (LC), which is used to separate the chemical components of a sample by passing it through a porous medium, VF can be of concern when the sample solvent has a viscosity different from that of the displacing fluid. In chromatography this situation can occur for polymeric analytes of relatively large molar mass as the intrinsic viscosity of polymers increases with their molar mass. In most liquid chromatographic analyses, the sample analytes have however a relatively low molar mass, hence a too low intrinsic viscosity to induce a VF phenomenon affecting dispersion characteristics. However, in order to increase the solubility of the components to be analyzed, the analytes are often diluted in a solvent whose chemical nature and viscosity differ from those of the displacing fluid. Then, VF may develop at the unstable solvent/eluent interface and affect the possible retained analyte zones. Here, we investigate numerically the influence of VF due to the difference in sample solvent and displacing fluid viscosities on the evolution of an analyte initially contained in the sample. To do so, we study a three component system by considering Darcy's law for the fluid velocity coupled with a mass-balance equation for the sample solvent and solute concentrations. A linear isotherm model is used for the adsorption of the passive analyte onto the porous matrix. The influence of parameters that control VF and of the retention parameter κ is analyzed. The results highlight recent experimental evidences showing that the peak shapes of analytes eluted under reversed-phase liquid chromatographic conditions are significantly dependent on the nature and/or composition of the sample solvent.