Miscible viscous fingering of finite width samples with adsorption
M. MISHRA, Center for Nonlinear Phenomena and Complex Systems, Université Libre de Bruxelles, CP 231, 1050 Brussels, Belgium, M. MARTIN, PMMH-ESPCI, 10 rue Vauquelin, 75231 Paris Cedex 05, France, A. DE WIT, Center for Nonlinear Phenomena and Complex Systems, Université Libre de Bruxelles, CP 231, 1050 Brussels, Belgium — Influence of adsorption on miscible viscous fingering of a finite width sample of higher viscous fluid displaced by a lower viscous fluid is studied in porous media. We assume that the viscosity of the sample depends on the mobile phase concentration c_m of a given solute. This concentration c_m is related to the stationary phase concentration c_s of the solute adsorbed onto the porous matrix by a linear adsorption isotherm model. The model equations governed by Darcy's law coupled with the evolution equation for c_m incorporating a retention factor K are numerically integrated using a Fourier spectral method. In the presence of adsorption, fingering similar to that of the non-adsorptive case is observed but appears on a slower time scale and with a different wavelength. The fingering pattern with adsorption adopts a traveling wave solution with a speed which depends on the adsorption parameter K. Fingering contributes transiently to the broadening of the peak in time by increasing its variance in both adsorptive and non-adsorptive cases but the variance with adsorption is always smaller than without adsorption. Relevance of the results is discussed in relation with transport of viscous samples in chromatographic columns with retention.

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