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Salinity effects during immiscible displacement in porous media: electrokinetic stabilization of viscous fingering MOHAMMAD MIRZADEH, MARTIN BAZANT, MIT — Interfacial instabilities are ubiquitous in Fluid Mechanics and have been one of the main the subjects of pattern formation. However, these instabilities could lead to inefficiencies which are undesired in many applications. For instance, viscous fingering results in residual trapping of oil during secondary recovery when a low-viscosity fluid, e.g. water, is used for injection. In their seminal work, Saffman and Taylor showed that the onset of this instability is controlled by the viscosity ratio of the two fluids. However, other physiochemical processes could enhance or suppress viscous fingering. Here we consider the role of salinity effects on the front stability. Our recent theory suggests that viscous fingering could be controlled, and even suppressed, by appropriately injecting electric currents. However, even in the absence of any external currents, strong electrokinetic coupling (present in small pores when the electric double layers overlap) can reduce viscous fingering by increasing the "effective viscosity" of the injected fluid. These findings suggest that it might be possible to improve extraction efficiencies by appropriately controlling the salt concentration of the injected fluid.

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