

Active Saffman–Taylor Viscous Fingering

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Adding swimming bacteria to a liquid causes its effective shear viscosity to decrease, eventually reaching a regime of zero viscosity. We examined whether this property leads to viscous finger-like displacement fronts like those observed when a less viscous fluid displaces a more viscous liquid. Our study revealed that this system exhibits more complex dynamic characteristics than the classical Saffman–Taylor instability. We discovered that this instability occurs when the bacterial volume fraction exceeds a critical value, and the imposed shear rate is below a critical value, for which the viscosity of the suspension is zero.

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