Hydrodynamic dispersion in porous media enhances reaction in spherical fronts

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Résumé

Reaction fronts, characterized as the region in which two miscible fluids, one of which displaces the other one, react with each other, are typically sustained by fluid mixing and play a central role in a large range of porous media systems and applications (1,2), an important example being remediation of aquifers by injecting biological entities (microbes) that consume the contaminant by reacting with it to form a less-toxic or potentially neutral product (3). In many cases, point-wise continuous injection of a reactant that displaces a resident reactant in three dimensions leads to a growing spherical reaction front. While such configurations have until now been studied under the assumption of a constant diffusion coefficient, in porous media the dominant diffusive process at the continuum scale is hydrodynamic dispersion, which depends linearly on the flow velocity.

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