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Predicting Dead Pore-Volume of Pores in a Porous Media from Single Tracer Experiment

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Tracer studies are used to characterize the porous media for flow paths of different phases, pore volume and flow surface area in reactors or oil reservoirs. The stagnant or dead pore volume interacts with the tracer leading to a tailing effect in the tracer breakthrough curve. Therefore, the effluent concentration profile from a single tracer test is not sufficient to characterize the porous medium. Generally, numerical simulation of the effluent concentration profile with parameter fitting is used to determine and separate the effect of dead pore volume from other tracer behavior in the porous medium such as dispersion or adsorption. In laboratory experiments, the tracer test is done at various flow conditions to determine the effect of dead pore volume. Numerical simulation of huge reactors and reservoirs is computationally expensive and imposing different flow conditions is difficult at industrial scale. The goal of this work is to develop a model for determination of dead pore volume from a single tracer experiment for homogeneous, one-dimensional flow in porous media.

The effluent concentration profiles of the tracer from numerical experiments of tracer transport in porous media are used to arrive at the model to determine the dead pore volume and the surface area associated. Mechanistic models of tracer transport in porous media are used in the simulations.

The pore volumes injected, flow rate, axial dispersion and tracer diffusivity in the dead pore volume are found to be the governing parameters for determining the fraction of dead pore volume in the porous media using single tracer test. Conventionally, numerical simulations with parameter fitting to match the effluent tracer concentration have been used to characterize the porous medium for effective porosity and mobile porosity by modeling the tracer's flow and chemical behavior in the sediments. The model developed here can be directly used to infer the reservoir parameters of mobile porosity from the tracer's effluent concentration profile from single tracer experiment.

Country/Organization invited to participate

India

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