Experimental study of non-Fickian transport in a sand-filled fracture

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It is commonly assumed that solute transport experiments conducted in heterogeneous geological formations can be described by the advective-dispersive (AD) or single-rate mobile-immobile (MIM) transport model[1-2]. The basis of the assumption is that the groundwater flow obeys Darcy's Law. To investigate this, experimental setup is established, a parallel plates fracture with the size: 1.00 m long, 0.06 m wide, and 0.30 m high, is formed filled with two kinds of different sands, respectively. The groundwater flow type is analyzed and the non-reactive transport through in a single sand-filled fracture is studied. Main results are drawn: (1) Non-Fickian behaviors are found to dominate transport at this scale, with long breakthrough curve (BTC) tailing persistent over the end of fracture length tested. (2)Under the experimental condition, the conventional advective-dispersive equation is failure to describe the solute transport behavior. (3) The non-Fickian behaviors are affected by lots of factors, such as initial head, flow length and the size of sand diameter. The mechanism of non-Fickian transport is needed to study further. This study will serve as a basis for investigating solute transport in more complicated fractured media under the non-Darcian flow in the future.

Keyword: non-Fickian transport; a sand-filled fracture; experimental study

References

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