

Anomalous solute transport in a cylindrical two-zone medium with fractal structure

ABSTRACT

In this paper, a problem of anomalous solute transport in a coaxial cylindrical two-zone porous medium with fractal structure is posed and numerically solved. The porous medium is studied in the form of cylinder with two parts: macropore—with high permeability characteristics in the central part and micropore—with low permeability around it. Anomalous solute transport is modeled by differential equations with a fractional derivative. The solute concentration and pressure fields are determined. Based on numerical results, the influence of the fractional derivatives order on the solute transport process is analysed. It was shown that with a decrease in the order of the derivatives in the diffusion term of the transport equation in the macropore leads to a “fast diffusion” in both zones. Characteristics of the solute transport in both zones mainly depend on the concentration distribution and other hydrodynamic parameters in the macropore.

Keyword: Porous medium; Solute transport; Fractional derivative; Diffusion