NAPL DISOLUTION IN AN HETEROGENEOUS POROUS MEDIUM: EXPERIMENTAL AND NUMERICAL STUDY

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Abstract

This study deals with the dissolution of a NAPL trapped in a water saturated heterogeneous porous medium (stratified medium with flow normal to the strata).

The experimental study consists in injecting pure water in a stratified porous medium made of five strata of two different porous media wherein a pollutant (TCE) has been trapped under capillary forces. Pollutant concentration in effluent water is measured using a gas chromatography device, while local saturation is measured using a gamma ray attenuation apparatus. The experimental data show a slow dissolution of the pollutant at a concentration lower than the equilibrium concentration. This typical non equilibrium is attributed to the macroscopic heterogeneity of the porous medium and to the microscopic heterogeneity of the strata.

A numerical study has been performed to analyse the experimental data. The non equilibrium physical model solved numerically allows a satisfactory description of the experimental data using correlations for the mass exchange coefficient of each medium similar to those reported in the literature. The macroscopic modelisation of dissolution in the stratified formation using the “equivalent homogeneous medium” approach has been explored. Although, a very good agreement between experimental and numerical data is observed using a macroscopic non-equilibirum model with adjusted effective properties, direct estimation of these properties remains rather complex.