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Shear dispersion in combined pressure-driven and electro-osmotic flows in a channel with porous walls

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HIGHLIGHTS

Analytical expression is derived for combined pressure-driven/electro-osmotic flows in a porous-walled channel.

Interaction between channel and porous medium should be considered.

Dispersion is a function of Debye-Hückel parameter, Poiseuille contribution fraction, and Péclet number.

Optimum Poiseuille contribution fraction that minimizes dispersion is always negative.

ABSTRACT

We present an analytical expression for the shear dispersion during transport of a neutral non-reacting chemical species within a channel with porous walls, which has not been addressed in previous studies, under the combined effects of pressure-driven and electro-osmotic flows. The continuity of concentrations and mass fluxes at the interface between the channel and the porous medium is applied to obtain the dispersion coefficient by considering a sufficiently low wall or zeta potential. The obtained dispersion coefficient is a function of the Debye-Hückel parameter, Poiseuille contribution fraction, and Péclet number. Results reveal that it is essential to include the exchange of chemical species between the electrolyte inside the channel and the porous medium. The results of this

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