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Influence of a Pulsatile Electroosmotic Flow on the Dispersivity of a Non-Reactive Solute through a Microcapillary

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Abstract : The influence of a pulsatile electroosmotic flow (PEOF) at the rate of spread, or dispersivity, for a non-reactive solute released in a microcapillary with slippage at the boundary wall (modeled by the Navier-slip condition) is theoretically analyzed. Based on the flow velocity field developed under such conditions, the present study implements an analytical scheme of scaling known as the Theory of Homogenization, in order to obtain a mathematical expression for the dispersivity, valid at a large time scale where the initial transients have vanished and the solute spreads under the Taylor dispersion influence. Our results show the dispersivity is a function of a slip coefficient, the amplitude of the imposed electric field, the Debye length and the angular Reynolds number, highlighting the importance of the latter as an enhancement/detrimental factor on the dispersivity, which allows to promote the PEOF as a strong candidate for chemical species separation at lab-on-a-chip devices.

Keywords : dispersivity, microcapillary, Navier-slip condition, pulsatile electroosmotic flow, Taylor dispersion, Theory of Homogenization
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