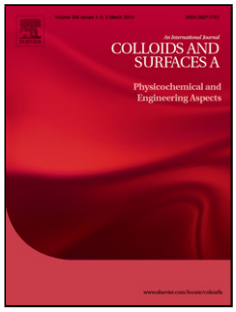

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Transientelectroosmosis in the transverse direction of a fibrous porous medium

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Graphical abstract

Highlights

- The start-up of transverse electroosmosis in a fiber matrix is analyzed.
- A unit cell model accounts for the hydrodynamic interaction among fibers.
- The electroosmosis in the thin but finite double layers evolves with time.
- The time scale of flow growth is smaller for a matrix with a lower porosity.
- The electroosmotic flow increases with a decrease in double-layer thickness.

Abstract

The transientelectroosmotic response in theporous medium constituted by a homogeneous array ofparallel, charged,circular cylindricalfibers filled with an electrolyte solution to the step application of an electric field in the transverse direction is analytically studied. The thickness of the electric double layers surrounding thedielectric cylinders is assumed to be small relative to the radius of the cylindersand the gap width between two adjacent cylinders, butthe effect oftime-evolving electroosmosis within the thin but finite double layers is incorporated. Through the use of a unit cell