

Accepted Manuscript

Pulsatile electroosmotic flow in a microchannel with asymmetric wall zeta potentials and its effect on mass transport enhancement and mixing

I. Medina, M. Toledo, F. Méndez, O. Bautista

PII: S0009-2509(18)30185-4
DOI: <https://doi.org/10.1016/j.ces.2018.03.051>
Reference: CES 14125

To appear in: *Chemical Engineering Science*

Received Date: 18 November 2017
Revised Date: 5 March 2018
Accepted Date: 26 March 2018



Please cite this article as: I. Medina, M. Toledo, F. Méndez, O. Bautista, Pulsatile electroosmotic flow in a microchannel with asymmetric wall zeta potentials and its effect on mass transport enhancement and mixing, *Chemical Engineering Science* (2018), doi: <https://doi.org/10.1016/j.ces.2018.03.051>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Pulsatile electroosmotic flow in a microchannel with asymmetric wall zeta potentials and its effect on mass transport enhancement and mixing

I. Medina^a, M. Toledo^a, F. Méndez^b, O. Bautista^{c,*}

^a*ESIME Zacatenco, Instituto Politécnico Nacional, Av. Luis Enrique Erro S/N, Zacatenco, Ciudad de México 07738, Mexico*

^b*Departamento de Termofluidos, Facultad de Ingeniería, UNAM. Ciudad de México, Mexico*

^c*ESIME Azcapotzalco, Instituto Politécnico Nacional, Av. de las Granjas No. 682, Col. Santa Catarina, Del. Azcapotzalco, Ciudad de México 02250, Mexico*

Abstract

In this work, we analyze theoretically the mass transport of a neutral solute in a pulsatile electroosmotic flow (PEOF), circulating in a parallel flat plate microchannel whose walls are characterized by asymmetric zeta potentials. The microchannel is connected to a two reservoirs having different concentrations. To analyze the mass transport in the PEOF, the Debye-Hückel approximation is assumed, and the electric potential in the Debye length is obtained from the Poisson-Boltzmann equation. Then, using the momentum and concentration equations, the flow and concentration fields are analytically determined for the periodic stage. Such field distributions depend principally on three dimensionless parameters: an angular Reynolds number, the Schmidt number, and the ratio between the half height of the channel and the Debye length. For obtaining insight on the physical aspects of the studied phenomenon, an asymptotic solution is additionally obtained in the limits of small and large values of the angular Reynolds number. Some important results derived from this analysis show the conditions for which the mass transport of a neutral solute can be enhanced and the circumstances whereby mixing of species is achieved.

*corresponding author

Email address: obautista@ipn.mx, Tel (+52) 55 57296000 ext 64482 (O. Bautista)

Download English Version:

<https://daneshyari.com/en/article/6588521>

Download Persian Version:

<https://daneshyari.com/article/6588521>

[Daneshyari.com](https://daneshyari.com)