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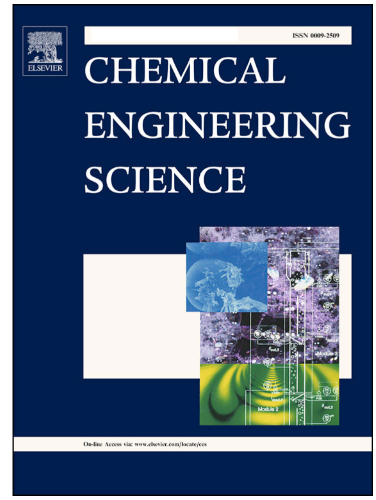

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Hamed Helisaz, Masoud Babaei, Arman Sadeghi

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Theoretical modeling of transient reaction-diffusion dynamics in electrokinetic Y-shaped microreactors

Hamed Helisaz [a], Masoud Babaei [b], Arman Sadeghi [c,1]

[a] *Department of Mechanical Engineering, The University of British Columbia, Vancouver BC V6T 1Z4, Canada*

[b] *School of Chemical Engineering & Analytical Science, University of Manchester, Manchester M13 9PL, United Kingdom*

[c] *Department of Mechanical Engineering, University of Kurdistan, Sanandaj 66177-15175, Iran*

Highlights

- We perform a theoretical study on transient reaction-diffusion kinetics in Y-microreactors.
- Governing equations are solved using a 3D finite-volume based numerical algorithm.
- It is shown that the short-term behavior may be different from the steady-state response.

Abstract

We perform a theoretical study on transient reaction-diffusion kinetics in an electrokinetic Y-shaped microreactor. The flow is assumed to be both steady and fully developed. The governing equations are solved in dimensionless form utilizing a 3D finite-volume-based numerical algorithm, assuming a second-order irreversible reaction between the components. Analytical solutions are also obtained for cross-stream diffusion without reaction under a uniform velocity distribution. It is shown that the well-known butterfly-shaped form of the product concentration profile is not immediately created and it is established only after the system is sufficiently close to its steady-state. Furthermore, the inclination of the concentration peak toward the component of lower diffusivity or inlet concentration is less significant at the earlier stages of the production. Finally, it is demonstrated that the short-term influence of the

[1] Corresponding author
E-mail addresses: hamedhelisaz@alumni.ubc.ca (H. Helisaz), masoud.babaei@manchester.ac.uk (M. Babaei), a.sadeghi@eng.uok.ac.ir (A. Sadeghi)

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