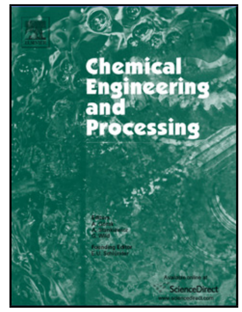
Accepted Manuscript



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PII: S0255-2701(18)30552-X
DOI: https://doi.org/doi:10.1016/j.cep.2018.08.021
Reference: CEP 7369

To appear in: *Chemical Engineering and Processing*

Received date: 14-5-2018
Revised date: 27-7-2018
Accepted date: 30-8-2018

Multi-criteria optimization of curved and Baffle-Embedded micromixers for bio-applications

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Abstract

Micromixers are key components of microfluidic devices in many bio-applications namely, cell analysis, nanoparticle synthesis, and polymerase chain reaction (PCR). The shared challenges in designing a micromixer are low mixing efficiency or/and high-pressure drop. Improving one of these performance parameters is usually concurrent with deteriorating in the other. In biological contexts, further constraints like compatibility or viability in shear stress and pressure add to the complications of mixer designing. Exploiting the layout optimization method to design passive micromixers decreases dependence on the experience of designers. In this paper, a curved micromixer was studied with obstacles to create normal advection and curved microchannels to generate Dean vortices. Five geometric parameters including radius of microchannel, angle of baffles, height of baffles, thickness of baffles, and aspect ratio of the channel were considered as design parameters. The mixing efficiency and the pressure drop in the mixing channel were designated as the design objectives and evaluated for biologically-pertinent Reynolds numbers of 3, 27, and 81, through the integration of 3D Navier-Stokes and convection-diffusion equations in a CFD platform. Design nodes were systematically appointed by Taguchi design of experiments method and a polynomial response surface model was fitted on these points to

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Preprint submitted to Chemical Engineering and Processing - Process Intensification September 7, 2018