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Computational Modeling of Microfluidic Rapid-Mixing Device Used in Infrared Micro-Spectroscopy MARK DICKINS, University of Texas at Austin, JARMILA GUIJARRO, AIHUA XIE, Oklahoma State University — Microfluidic rapid-mixing device is employed to chemically trigger biological functions of proteins for time-resolved Fourier transform Infrared (FTIR) micro-spectroscopic study. There are two criteria for the optimal design of such devices: (i) minimizing the mixing time (thus better time-resolution) and (ii) minimizing the consumption of protein samples. Computational modeling has been performed on the Poiseuille and diffusional flow patterns. Due to the low-Reynolds number of microfluidic flow in study, finite-difference methods for the Navier-Stokes and advection-diffusion equations are employed in our computational modeling. The viscosity of the fluids is related to the pressure gradient required to achieve maximum velocity according to Pouisulle flow. Several mixing channels are modeled in order to determine the optimal dimensions for our microchip according to the design criteria. We will report our computational modeling results and their relevance to the optimal design of rapid-mixing devices used in time-resolved infrared micro-spectroscopy.

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