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Flow fraction in charged rectangular microchannel to optimally design hydrodynamic filtration chip for cell sorting[1] MYUNG-SUK CHUN[2], SOHYUN JEONG, JAE HUN KIM, Korea Institute of Science and Technology (KIST), National Agenda Research Div., Seoul, TAE SEOK LEE, Harper International Corp., NY14225 — Among the passive separations, hydrodynamic filtration (HDF) can perform the fractionation of cells or particles by selective extraction of streamlines controlled by the flow fraction at each branch. Only the stream near the sidewall enters the branches as the focusing, with the amount of fluid leaving the main channel being determined by the flow distribution related to the hydraulic flow resistances. Its understanding is important, but in-depth consideration has not been treated until now. The virtual boundary of the fluid layer should be first specified, and the parabolic velocity profile starts to form from the steady state flow with high Péclet numbers. We computed the 3-dimensional flow profile at the rectangular cross-section with any aspect ratios, by considering electrokinetic transport coupled with the Poisson-Boltzmann and Navier-Stokes equations. The chip was designed with the parameters rigorously determined by the complete analysis of laminar flow for flow fraction and complicated networks of main and multi-branched channels for cell sorting into the finite number of subpopulations. For potential applications to the precise sorting, our designed microfluidic chip can be validated by applying model cells consisting of heterogeneous subpopulations.

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[2]Prof. Dr.

Myung-Suk Chun
Korea Institute of Science and Technology (KIST),
National Agenda Research Div., Seoul

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