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Numerical Simulation and Performance Optimization of a Magnetophoretic Bio-separation chip. MATIN GOLOZAR, JEFF DARABI, MAJID MOLKI, Southern Illinois University Edwardsville — Separation of micro/nanoparticles is important in biomedicine and biotechnology. This research presents the modeling and optimization of a magnetophoretic bio-separation chip for the isolation of biomaterials, such as circulating tumor cells (CTCs) from the peripheral blood. The chip consists of a continuous flow through microfluidic channels that contains locally engineered magnetic field gradients. The high gradient magnetic field produced by the magnets is spatially non-uniform and gives rise to an attractive force on magnetic particles that move through the flow channel. The computational model takes into account the magnetic and fluidic forces as well as the effect of the volume fraction of particles on the continuous phase. The model is used to investigate the effect of two-way particle-fluid coupling on both the capture efficiency and the flow pattern in the separation chip. The results show that the microfluidic device has the capability of separating CTCs from their native environment. Additionally, a parametric study is performed to investigate the effects of the channel height, substrate thickness, magnetic bead size, bioparticle size, and the number of beads per cell on the cell separation performance.

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