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Numerical Simulation of the Continues Biomagnetic Separation in a Two-dimensional Channel

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Abstract: Numerical simulation of magnetically mediated separation of labeled biospecies from a native fluid flowing through a two dimensional channel is presented. The transport of the magnetic biospecies is modeled by coupling the fluid flow with an Eulerian advection?convection concentration equation. A magnetic field is imposed in the separator that causes an accumulation of the magnetic labeled species in the vicinity of the higher magnetic field region. The accumulation of the magnetically labeled species in the highest magnetic field zone presents a scheme for the collection of these species from the heterogeneous samples under the simulation conditions. The axial magnetic forces, as resulted from a dipole-like magnetic field, is found to play a major role in the vortex formation and it complement the downward vertical force in confining the particles to a small region near the point with the highest magnetic strength. The interplay between the particle transfer mediated by magnetophoresis forces and that by normal diffusion is analyzed for high and low inertia flows. The present study predicts that the generated viscous shear stress levels in the interior region of the channel provide a safe transport mechanism for biological cells from the solution.