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Simulating cross stream migration of hard spheres in a dilute suspension NILANKA I. K. EKANAYAKE, JOSEPH D. BERRY, ANTHONY D. STICKLAND, DAVID E. DUNSTAN, The University of Melbourne, STEVEN K. DOWER, INEKE L. MUIR, CSL Limited, DALTON J. E. HARVIE, The University of Melbourne — In flowing suspensions, hydrodynamic forces can move particles across the streamlines and cluster at certain radial positions within a pipe. In the biological flow context, this cross-stream migration is widely used in cell sorting microfluidic applications to separate diseased cells based on size and other physical characteristics. This study employs a multi-fluid model to predict the solid concentration profiles of a mono-disperse suspension of hard spheres flowing at low particle Reynolds numbers. The lateral migration is modelled using wall-shear and shear rate gradient hydrodynamic lift forces and inter-particle hydrodynamic collision forces. Brownian and shear induced diffusion forces are modelled as functions of solid concentration gradients and shear rate gradients. The effect of bulk concentration on solid distribution is examined and compared against experimental data. At highly dilute conditions particles accumulate at 0.6 radius away from the centerline exhibiting the "tubular pinch" effect caused by lift forces. With increasing bulk concentration, particles gradually move towards the centerline due to diffusion forces. This study demonstrates that the bulk concentration has a significant impact in determining solid distribution profiles.

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