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Shear-induced hydrodynamic diffusion of a flowing suspension of elastic capsules MARCUS HWAI YIK TAN, DUC VINH LE, KENG-HWEE CHIAM, Mechanobiology Institute, National University of Singapore and A*STAR Institute of High Performance Computing — In flowing suspensions of soft and deformable elastic capsules, the shear flow causes hydrodynamic interaction among the capsules, resulting in an effective hydrodynamic diffusion that is not Brownian in origin. Recent experiments have suggested that hydrodynamic diffusion of red blood cells may play an important role in the pathophysiological processes of vasoocclusion and thrombosis. To study hydrodynamic diffusion further, we have developed accurate three-dimensional numerical simulations based on the immersed boundary method and thin shell theory to study the deformation of a large number of elastic capsules enclosed by thin shells moving in a shear flow. Using these simulations, we have calculated the effective hydrodynamic diffusion coefficient and showed how it varies with bulk flow velocity and capsule properties such as the volume fraction, size, and stiffness of spherical and biconcave capsules. We also compared them to scaling arguments and experimental measurements done for red blood cell suspensions.

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