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Mechanism of flow induced segregation in suspensions of binary mixtures of deformable capsules based on rigidity in confined geometries
AMIT KUMAR, MICHAEL GRAHAM, University of Wisconsin - Madison — Flow induced segregation in mixtures of deformable particles based on rigidity is relevant in many biological and technological applications. For example, this property can be employed in the detection or separation of stiffened RBCs in various diseased states like malaria in a point of care microfluidic device. We numerically study here neo-Hookean capsule suspensions subjected to pressure driven flows in a slit geometry using an accelerated implementation of the boundary integral method. The effect of a wide variety of parameters like volume fraction, capillary number, confinement ratio, number fraction of the floppy particle (X), and the rigidity ratio between the two components of the mixture were explored. In pure suspensions, the mean wall normal position of the stiff and the floppy particles were comparable; however, in mixtures, the stiff particles were found to be increasingly displaced towards the walls with increasing X. Simple model studies involving pair collisions between stiff and floppy particles qualitatively explain the above behavior. Numerical results are further incorporated in the Fokker-Planck equation, which is found to correctly model the particle motion and predict the segregation behavior. The drift and diffusion terms in the Fokker-Planck equation are consistent with the results of pair collision.

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