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Characterizing particle transport due to actuated cilia with adhesive tips AMITABH BHATTACHARYA, Department of Chemical Engineering, University of Pittsburgh, GAVIN BUXTON, Department of Science, Robert Morris University, ALEXANDER ALEXEEV, Department of Mechanical Engineering, Georgia Institute of Technology, O. BERK USTA, Harvard Medical School, ANNA C. BALAZS, Department of Chemical Engineering, University of Pittsburgh — Biological tissues and organisms commonly utilize arrays of cilia to manipulate microparticles of different sizes. Motivated by biology, we use numerical simulations to study the interaction of microparticles with an array of actuated cilia, immersed in fluidic microchannel. For each cilium in the array, one end is tethered to the wall, while the other end is actuated by an external periodic force. Also, an adhesive force is introduced between the cilia tip and the microparticle. The simulations are performed using the Lattice Boltzmann Method for the flow, with a chain of point-forces, connected by springs, used to represent each cilium. We observe that a combination of hydrodynamic and adhesive forces can lead to size-specific control of microparticle transport. For instance, for certain adhesion strength and particle sizes, it is possible to trap and release particles by varying the actuation frequency. Also, for a given actuation frequency, the average particle speed is maximized at a particular adhesion strength. We will present the parameter range where we can observe the above behavior.

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