

Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Size based separation of micro-particles using adhesive ciliated surfaces: Mimicing the behaviour of suspension feeders ANURAG TRIPATHI, Dept. of Chemical and Petroleum Engineering, University of Pittsburgh, AMITABH BHATTACHARYA, Dept. of Mechanical Engineering, Indian Institute of Technology Bombay, Mumbai, India, ANNA BALAZS, Dept. of Chemical and Petroleum Engineering, University of Pittsburgh — Separation of different size micro-particles in microfluidic devices is important for many biomedical applications. Inspired by the selective intake of small food particles by marine suspension feeders, we propose a novel separation mechanism of micro-particles using active cilia arrays with adhesive tips. By means of Lattice Boltzmann simulations, we show that mixture of two different size particles with size ratio greater than or equal to two can be nearly completely separated by tuning adhesion strength and cilia stiffness. The proposed technique can be used even at low Reynolds number ($Re \ll 1$) where separation mechanisms based on inertial effects will be of little use. For a given cilia-particle interaction, the balance of hydrodynamic and adhesive forces favors capture of particles below a critical size, which can be predicted by a simple analytical model.

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Date submitted: 02 Nov 2012

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