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Designing "catch and release" systems by utilizing functionalized oscillating fins YONGTING MA, University of Pittsburgh, Pittsburgh, PA 15261, AMITABH BHATTACHARYA, Indian Institute of Technology Bombay, Mumbai, 400076, OLGA KUKSENOK, University of Pittsburgh, Pittsburgh, PA 15261, XIMIN HE, JOANNA AIZENBERG, Harvard University, Cambridge, MA 02138, ANNA C. BALAZS, University of Pittsburgh, Pittsburgh, PA 15261 — Designing a biomimetic "catch and release" device for the selective removal of target species from the surrounding solution is critical for developing many useful sensors and sorters. Via computational modeling, we simulate an array of oscillating fins that are localized on the floor of a microchannel and immersed in a two-fluid stream. The fins reach the upper fluid when they are upright and are located entirely within the lower stream when they are tilted. We introduce specific adhesive interactions between the fins and particulates in the solution and determine conditions where the oscillating fins can selectively bind ("catch") target nanoparticles within the upper fluid stream and then release these particles into the lower stream. Using our hybrid computational approach, which combines the lattice Boltzmann model for binary fluids and a Brownian dynamics model for the nanoparticles, we isolate systems parameters (e.g., frequency and amplitude of fins' oscillations) that lead to the efficient extraction of target species from the upper stream and placement into the lower fluid. Our findings provide fundamental insights into the system's complex dynamics, as well as a unique solution for detection, separation, and purification of multi-component mixtures.

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