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Utilizing Chemo-mechanically Functionalized Oscillating Fins to “Catch and Release” Nanoparticles in Binary Flow YA LIU, OLGA KUK-SENOK, University of Pittsburgh, AMITABH BHATTACHARYA, Indian Institute of Technology Bombay, YONGTING MA, Virginia Commonwealth University, XIMIN HE, JOANNA AIZENBERG, Harvard University, ANNA BALAZS, University of Pittsburgh — In biomimetics, designing an effective “catch and release” device for the selective removal of target species from the surrounding solution is critical for developing autonomous sensors and sorters. Using computer simulations, we model an array of oscillating fins that are tethered on the floor of a microchannel and immersed in a mixture of binary fluid stream and binary nanoparticles. During the oscillation, the fins with the specific chemical wetting reach the upper fluid when they are upright and are entirely immersed within the lower stream when they are tilted. We introduce specific interaction between the fins and particulates in the solution and determine conditions where the oscillating fins can selectively “catch” target nanoparticles within the upper fluid stream and then release these particles into the lower stream. We isolate the effects of wetting contact angle between fins and fluid and the mode of fins’ oscillations that lead to the efficient extraction of target species from the upper stream and their placement into the lower fluid. These studies provide fundamental insights into the system’s complex dynamics and mechanism for detection, separation, and purification of multi-component mixtures.

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