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Harnessing Fluid-Driven Vesicles to Pick Up and Drop Off Janus Particles XIN YONG, ISAAC SALIB, EMILY CRABB, NICHOLAS MOELLERS, GERALD MCFARLIN, OLGA KUKSENOK, ANNA BALAZS, Chemical Engineering Dept, University of Pittsburgh — Using dissipative particle dynamics (DPD) simulations, we model the interaction between nanoscopic lipid vesicles and Janus nanoparticles in the presence of an imposed flow. Both the vesicle and Janus nanoparticles are localized on a hydrophilic substrate and immersed in a hydrophilic solution. The fluid-driven vesicle successfully picks up Janus particles on the substrate and transports these particles as cargo along the surface. The vesicle can carry up to four particles as its payload. Hence, the vesicles can acts as nanoscopic "vacuum cleaners", collecting nanoscopic debris localized on the floors of the fluidic devices. Importantly, these studies reveal how an imposed flow can facilitate the incorporation of nanoparticles into nanoscale vesicles. With the introduction of a hydrophobic domain on the substrate, the vesicles can also robustly drop off and deposit the particles on the surface. The controlled pickup and delivery of nanoparticles via lipid vesicles can play an important step in the bottom-up assembly of these nanoparticles within small-scale fluidic devices.

Xin Yong
Chemical Engineering Dept, University of Pittsburgh

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