Abstract Submitted
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Interfacial deflection and jetting of a paramagnetic particle-laden fluid IAN GRIFFITHS, Mathematical Institute, University of Oxford, SCOTT TSAI, Ryerson University, ZHENZHEN LI, ESPCI, PILNAM KIM, KAIST, HOWARD STONE, Princeton University — Arsenic removal from contaminated water is a formidable challenge in the water-purification industry. A promising technique to remove such contaminants utilizes magnetic separation, whereby arsenic adsorbs onto magnetic nanoparticles that are dispersed in the contaminated water. These magnetically tagged clusters are then collected safely using a magnetic field gradient that pulls the aggregates to the liquid–air interface, which induces an interfacial deflection before transitioning into a jet of magnetic material. We present experiments that are motivated by the applications of collecting aggregates of magnetic material, in which colloidal magnetic particles are first mixed with water, then collected at a liquid-air interface by an applied magnetic field from a permanent magnet. We derive a mathematical model that predicts the interfacial deflection and ejection of magnetic material, and compare the results with the experimental observations. The model is reduced by exploiting the small interfacial deflection for low magnetic fields and is used to make predictions that are more difficult to glean from the experimental observations alone. We draw conclusions on the model's ability to offer a route to design optimization for water purification strategies.

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