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Authors: Ahmed Munaz, Muhammad J.A. Shiddiky, Nam-Trung Nguyen



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Magnetophoretic separation of diamagnetic particles through parallel ferrofluid streams

Ahmed Munaz,^a Muhammad J. A. Shiddiky,^{a,b} and Nam-Trung Nguyen,^{*a}

^aQueensland Micro- and Nanotechnology Centre, Griffith University, Brisbane, QLD 4111, Australia

**Email: nam-trung.nguyen@griffith.edu.au*

^bSchool of Natural Sciences, Griffith University, Nathan Campus, QLD 4111, Australia

Highlights

- Separation of nonmagnetic particles with a magnetic field.
- Parallel streams of ferrofluid with different concentrations to minimize accumulation of magnetic nanoparticles.
- Separation of diamagnetic particles with small size difference.
- Three-stream Flow-focusing configuration results in more efficient separation

Abstract: Particle separation based on microfluidic technology offers a simple, reliable, and low-cost approach for the diagnosis of diseases. The separation concept can be extended to genetic engineering, cell transplantation, and immunology. This paper reports a simple microfluidic platform for the separation of diamagnetic particles of different sizes utilizing parallel ferrofluid streams. The ferrofluid streams with predefined concentrations of magnetic nanoparticles promote negative magnetophoresis and are able to separate a particle mixture with a subtle size variation. Numerical simulation was used to optimise the magnetic field gradient, e.g. the number and position of the external permanent magnets. The effect of flow rate ratio and the concentration distribution were analyzed by the simulation and validated by experiments. Furthermore, two-stream and three-stream ferrofluid configurations were evaluated to find the optimum separation performance. The experimental results show a

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