Improving magnetophoresis for continuous biochemical separations

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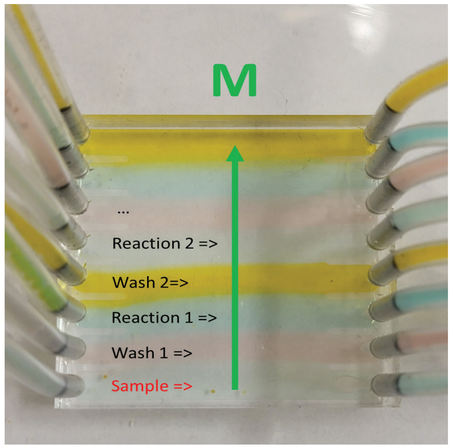
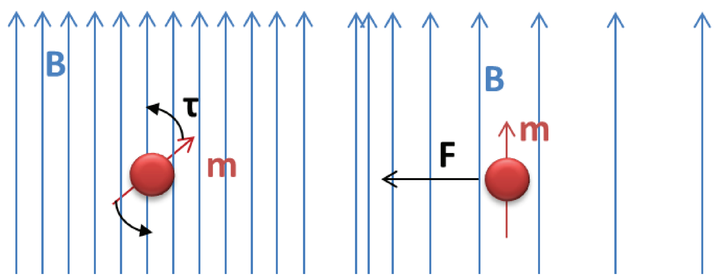
Introduction

Magnetophoresis is a popular separation method in the preparative field of biochemistry. This method can be used for batch and continuous-flow separations of cells, proteins, or DNA. In most cases, a simple bar magnet is used to remove surface-functionalized magnetic nanoparticles from the solution. A common permanent magnet bar generates a non-linear magnetic field gradient. Non-linear magnetic field gradients result in increasing magnetic force along the separation trajectory. An excessive magnetic force near the magnet's surface can overcome electrostatic repulsion and cause irreversible aggregation of biomolecules or rupture of cellular membranes. This work demonstrates how new geometric arrangements of permanent magnets can generate a constant magnetic force by linear-gradient magnetic fields and improve continuous magnetophoretic separations in life sciences.





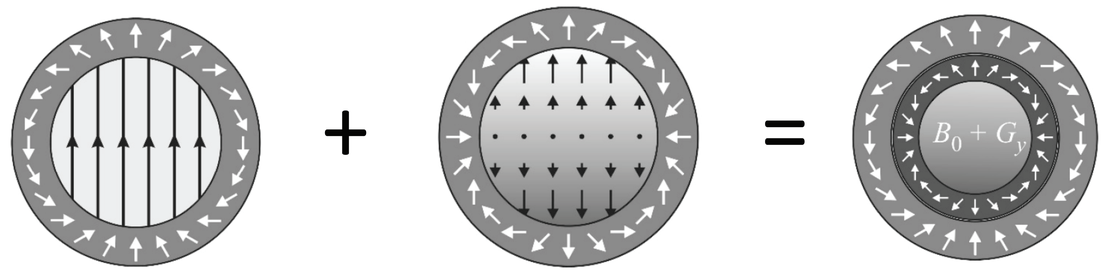
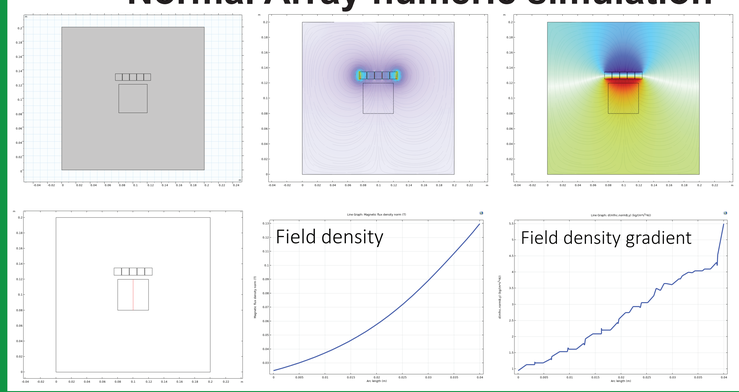
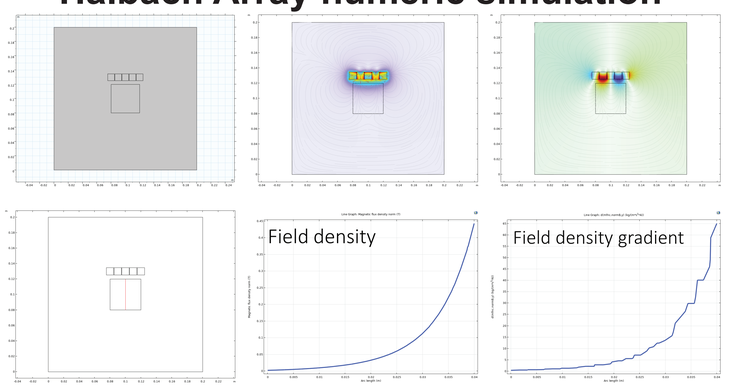


Figure adapter from the following paper*

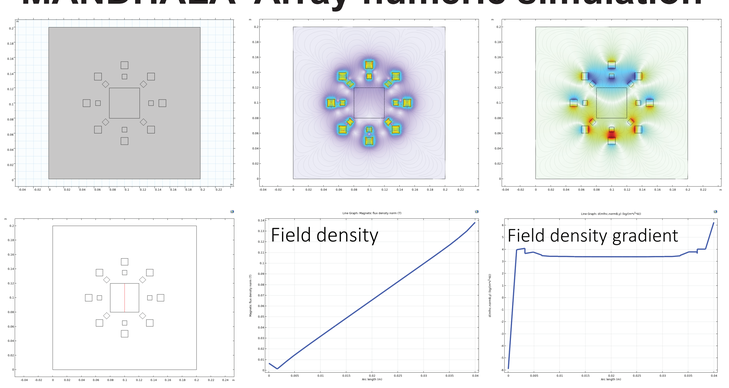
Normal Array numeric simulation



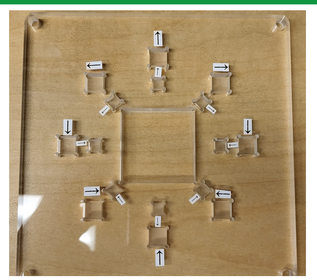
Halbach Array numeric simulation

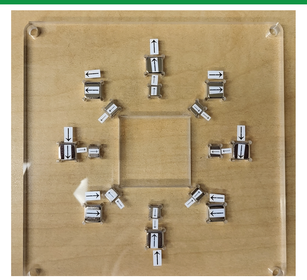


MANDHALA Array numeric simulation



Practical implementation





Relevant Publications

***BlüMler, P. (2016). Proposal for a permanent magnet system with a constant gradient mechanically adjustable in direction and strength. *Concepts in Magnetic Resonance Part B: Magnetic Resonance Engineering*, 46(1), 41-48.**

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