Electronic Supplementary Information (ESI) for Lab on a Chip

Measuring magnetic susceptibility of subtle paramagnetic solution using diamagnetic repulsion of polymer microparticles

Bong Hwan Jang[a,‡], Seyong Kwon[a,‡], and Joo H. Kang[a,*]

[a] Department of Biomedical Engineering, School of Life Sciences, Ulsan National Institute of Science and Technology (UNIST), 50 UNIST-gil, Eonyang-eup,Ulju-gun, Ulsan, Republic of Korea 44919.

SUPPLEMENTARY FIGURE LEGENDS

Fig. S1 Theoretical prediction of the magnetic flux density gradients implemented by the FEMM modeling. All physical parameters of the materials were provided by the FEMM software. (e.g. magnets material: NdFeB magnets with 52 grade MGOe, surrounding material: air) (a) Theoretical prediction of the magnetic flux density gradients around the Halbach magnetic array (top) and the conventional alternating magnetic array (bottom). (b) the magnetic flux density gradients were plotted using the simulation results obtained from panel (a).

Fig. S2 The diamagnetic repelling velocity of the PS particles suspended in the MNP solution at the concentrations of 0.01 mg/mL, 0.05 mg/mL, 0.1 mg/mL, 0.2 mg/mL, 0.5 mg/mL, 0.7 mg/mL (clear circles with error bars) were plotted, which corresponded with the theoretically predicted repelling velocities (dotted line) in the concentration range of 0.01 mg/mL to 5.0 mg/mL.

Fig. S3 The M/H curves of the paramagnetic solutions (MNP and Gd-DTPA) at each concentration were presented. The magnetization gradients refer to differential magnetic susceptibility and the peak susceptibility was shown in Fig. 4.

Figure S1

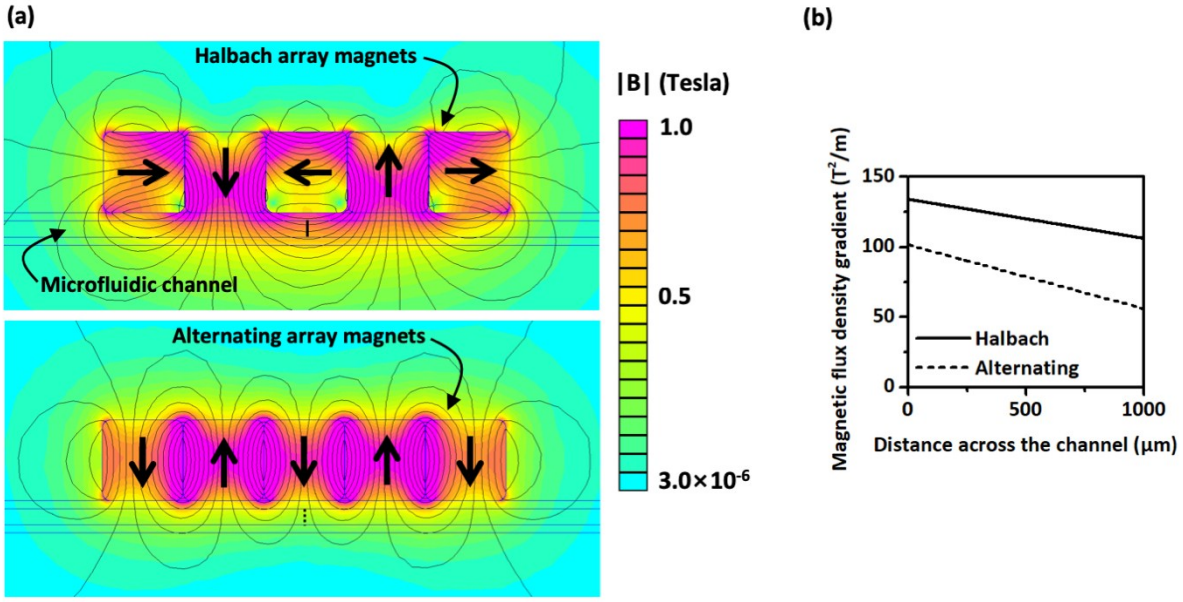

(a)
Halbach array magnets
Microfluidic channel
Alternating array magnets
|B| (Tesla)
1.0
0.5
3.0×10-6
(b)
Magnetic flux density gradient (T2/m)
150
100
50
0
0
500
1000
Halbach
Alternating
Distance across the channel (μm)

Figure S2

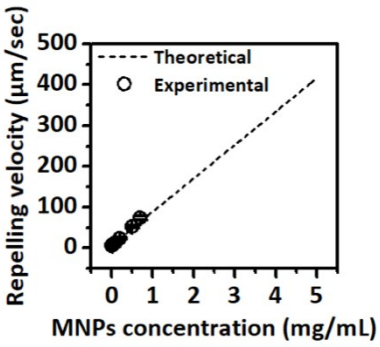
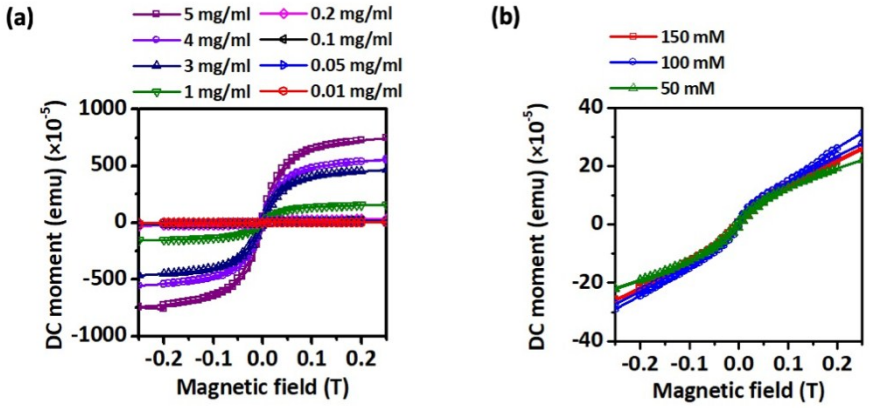

Repelling velocity (μm/sec)
500
400
300
200
100
0
Theoretical
Experimental
0
1
2
3
4
5
MNPs concentration (mg/mL)

Figure S3


(a)
5 mg/ml
4 mg/ml
3 mg/ml
1 mg/ml
0.2 mg/ml
0.1 mg/ml
0.05 mg/ml
0.01 mg/ml
DC moment (emu) (×10-5)
1000
500
0
-500
-1000
-0.2 -0.1 0.0 0.1 0.2
Magnetic field (T)
(b)
150 mM
100 mM
50 mM
DC moment (emu) (×10-5)
40
20
0
-20
-40
-0.2 -0.1 0.0 0.1 0.2
Magnetic field (T)