A Capillary Flow-Driven Microfluidic System for Microparticle-Labeled Immunoassay

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Figure S1. The photolithography of channel fabrication. (A) Photoresist (SU-8 2035) is spin coated onto the silicon wafer. (B) After the patterned mask is aligned, the surface is exposed to UV. To achieve a high side-wall quality, a PL-360LP photolithography mask aligner filter is used. (C) The photoresist is washed with an SU-8 developer. (D) A PDMS base material and a curing agent are mixed in a 5:1 ratio, poured onto the channel mold, and then cured. (E) The PDMS layer is peeled off. (F) The PDMS layer is bonded to the functionalized glass substrate.
Figure S2. Forces on a single magnetic particle bonded to the capture antibody under laminar shear flow.
Figure S3. Flow velocity measurements. Images extracted from the video of the flow movement were analyzed for flow characterization using MatLAB code. (A-D) The fluid movement at time steps \( t(i) \), \( t(i+1) \), \( t(i+2) \) and \( t(i+3) \), respectively. (E-G) The flow displacement for \( t(i+1)-t(i) \), \( t(i+2)-t(i+1) \), and \( t(i+3)-t(i+2) \), respectively.
Figure S4. Flow profiles for different channel heights. According to the Washburn equation, the velocity profiles in the buffer priming section are inversely proportional to the square root of passing time. Lines fitted to the experimental values show good agreement with the theoretical analysis. However, the power of “t” in the equations of the fitted curves are -0.525 to -0.581 depending on aspect ratio from 6.67 to 1.67 instead of -0.5. This power value increases with the increase of aspect ratio from the high aspect ratio assumption. Error bars represent standard deviation (SD) from three independent experiments.
Figure S5. The actual device selectively bio-functionalized with different concentrations of the capture antibody. 500 µg mL\(^{-1}\), 50 µg mL\(^{-1}\), 5 µg mL\(^{-1}\), 500 ng mL\(^{-1}\), 50 ng mL\(^{-1}\) and 5 ng mL\(^{-1}\) are designated by C1, C2, C3, C4, C5 and C6, respectively.