

Solute-Driven Colloidal Particle Manipulation in Continuous Flows Past Grooved Microchannels

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The integration of colloidal particle manipulation capabilities into microfluidic devices is a common feature of many lab-on-a-chip technologies for chemical and biological analysis. The most commonly employed strategies to perform particle operations, such as separation, filtration, trapping, focusing, and accumulation, are based on hydrodynamic, electrokinetic, acoustic, magnetic and optical effects. Recently there has been a growing interest in the use of diffusiophoresis – a phoretic phenomenon in which particle motion is induced by a solute concentration gradient – to manipulate colloidal particle in various applications [1-3]. The aim of this study is to explore diffusiophoresis to enable particle filtration, trapping, and accumulation within a microfluidic environment under continuous flow settings and in absence of any external force field. A Ψ -shaped microchannel, made of an optical adhesive glue and fitted with a micro-structured wall, was fabricated by photo-/soft-lithography techniques [4]. Electrolyte solutions were pumped into the device junction to generate steady-state salt concentration gradients enabling the manipulation of charged fluorescent colloidal particles. The spatial distribution of particles within the channel was characterised via fluorescence microscopy. This novel approach for particle handling by solute driven transport can unlock potential applications in point of care industry, drug delivery, biosensing and food industry.

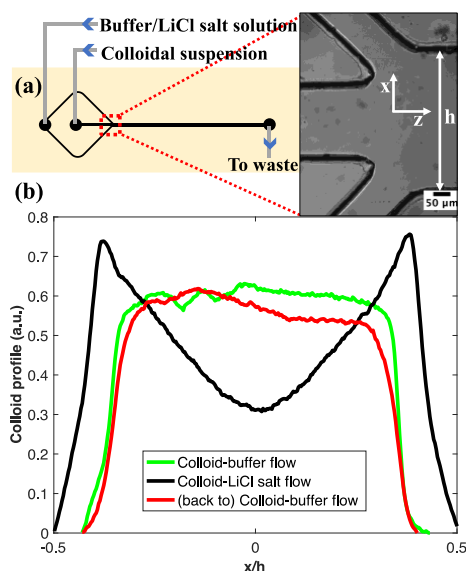


Figure 1. (a) A schematic of top view of microchannel fabricated using NOA 81 optical adhesive glue on a silicon substrate. Inset shows an optical micrograph of a junction of the lateral and central inlets through which a 10 mM Lithium Chloride (LiCl) salt solution and colloidal particle suspension (200 nm) in TRIS buffer (pH=9) are pumped respectively. (b) Experimental profiles of diffusiophoretic phenomenon in a microchannel on applying a LiCl salt gradient.

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