

Parallel Label-Free Trapping Particles Using Oscillating Microbubbles Array

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Background, Motivation and Objective:

Microbubble (MB), as an ultrasound contrast agent, can be utilized to enhance the ultrasound imaging quality due to the scattering effects. More importantly, the MB oscillating induced secondary acoustic radiation force at the resonance frequency can transport or manipulate microparticles effectively. The aim of this study is to design an oscillating microbubbles array (MBA) to trap label-free particles in a parallel manner.

Statement of Contribution/Methods:

By designing the circular structure array on the bottom surface, MBA can be generated when the fluid flowed through the circular structure due to surface tension. A piezoelectric transducer (PZT) was placed adjacent to the polydimethylsiloxane (PDMS) microfluidic device on the same glass substrate with ultrasound coupling gel; the width and depth of PDMS microchannel were 920 μm and 40 μm , respectively. A solution diluted 1:200 of polystyrene particles with the diameter of 10 μm was injected into the microchannel through syringe pump.

Results, Discussion and Conclusion:

When the MB was excited by the PZT at the resonant frequency, MB oscillated immediately and a symmetrical flow pattern around the MB was observed. Fig. 1(a) shows the particles could be trapped at the surface of the MB due to the secondary acoustic radiation force induced by the MB oscillation. Moreover, the MB array with the same diameter could be simulated to oscillating independently. Almost all the particles could be trapped and the trapping rate could reach $98.23 \pm 2.45\%$, as depicted in Fig. 1(b), Providing an alternative to tap and sort cancer cells from blood. Flow is 10 nl/s and from left to right.

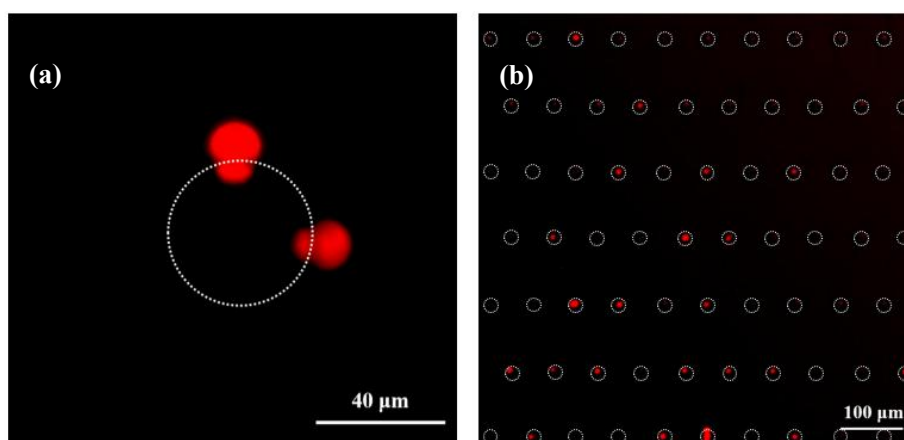


Fig. 1. Micrographs of the areas of interest (a) Single MB trapping PS particles; (b) oscillation MBA when PZT was working was trapping all discrete particles.