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Microfluidic Integrated Acoustic Waving for Manipulation of Cells and Molecules

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ABSTRACT

Surface acoustic wave (SAW) technology with its simple and low-cost fabrication, rapid and localized fluid actuation, compatibility with microfluidic components, and biocompatibility for cellular studies, has been extensively integrated into microfluidics to provide on-chip microdevices for a variety of applications in biology, bioengineering and chemistry. Among different applications, noninvasive manipulation of cells and biomolecules are significantly important, which are addressed by SAW-based microfluidics. Here in this paper, we briefly explain the principles and different configurations of SAW acoustic streaming for the manipulation of cells and molecules and overview its applications for single cell isolation, cell focusing and sorting, cell washing and patterning, cell-cell fusion and communication, and tissue engineering. We further discuss the application of SAW-based microfluidic systems for the mixing and transport of liquids, manipulation of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) molecules, followed by explanation on the present challenges of SAW-based microfluidics for the handling of cells and molecules, and highlighting the future directions.

Keywords: Surface acoustic wave; Microfluidics; Acoustofluidics; Manipulation of single cells and molecules

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