Effects of light size and intensity on photoconductive effect-based optically-induced dielectrophoresis for three-dimensional manipulation

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Abstract

In this paper, the effect of light size and intensity on photoconductive effect-based optically-induced dielectrophoresis (ODEP) for three-dimensional manipulation of cells is studied. The photoconductive effect-based ODEP enabled the three-dimensional manipulation of multiple cells, whether normal cells or cancer cells. When the light spot size is similar to the cell and the photoconductive layer resistance is about 150 MΩ, the spot repels other cells after manipulating a single cell. When the light spot size is much larger than the cell and the photoconductive layer resistance is about 120 MΩ, multiple cells are controlled inside the spot and distributes in the same plane. When the light intensity is increased and the photoconductive layer resistance is about 40 MΩ, the cells are manipulated in three-dimensions. Using a light spot similar in size to the cells to gather specific cells at different locations into a specific area, and then increasing the light intensity enabled three-dimensional manipulation. We find that the cells three-dimensional manipulation by ODEP is achieved only when the photoconductive effect induced by the light pattern reaches a higher intensity. The realization of ODEP-based three-dimensional manipulation is related to the spot size and the photoconductive layer resistance determined by light intensity.

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