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Abstract
Electrorotation has become a very powerful diagnostic technique for measurement of dielectric properties of cells. However, only few papers investigated in the electric-induced rotation of particles in a stationary alternating (AC) electric field instead of a rotating electric field. In this study, a microchip comprised top grounded electrode, flow chamber and bottom chess-type electrode arrays to construct a stationary nonuniform AC electric field for manipulation of cells by dielectrophoretic (DEP) force. We aimed at the discrepancy on electrorotation between metal (Au) and dielectric (SiO2) nanoparticles uptaken by the human promyelocytic leulcemia cells (HL-60). As experimental results, both the percentage of cells in rotation and the range of rotational frequency for uptaken-Au-nanoparticles cells were higher and wider than the case of SiO2 nanoparticles, respectively. In addition, the cell membrane for a continued rotating cell could be deformed and broken after 30 to 40 minutes. According to the rotational spectra (ROT), the membrane capacitance and membrane conductivity of HL-60 cells can be extracted, 9.95mF/m2 and 1460 S/m2 , respectively. In general, the electrorotation of cells in a stationary AC electric field can be attributed to the highly nonuniform electric field and nonuniform dispersion of nanoparticles within cells; therefore, the electrical properties of uptaken nanoparticles and the aggregation phenomenon have significant influences on resulting electrical torque. the membrane capacitance and membrane conductance of HL-60 cells can be calculated in this method without a rotating electric field excited by poly-phase AC voltages.
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