Counting Circulating Tumor Cell using Label-Free DC-impedance Detection

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Abstract

Counting the number of circulating tumor cells(CTCs) in blood samples provides valuable informations about cancer status as well as response to therapy in patients with metastatic cancer. Most of cell detection technologies on a microchip are based on two principles of immunoassay and Coulter counting. Alternating current (AC) impedance measurement with metal electrodes is often used to avoid the electrod-electrolyte junction capacitance for particle counting in microfluidic chips as well as unwanted redox reactions at the metal surface. However, at high frequency, size information from AC impedance of biological cells is imprecise. A DC impedance-based cell counter using the proprietary polyelectroylytic gel electrodes(PGEs) is applied for rare cell counting. Linearity in DC impedance signal to the particle volume was evaluated using commercial polymer microspheres (Bangs Lab, USA) with known sizes of 8um(equivalent to RBC size), 10um(equivalent to WBC size), and 15um. Biological sample test was also performed using WBCs and human ovarian cancer cells(OVCARs). A perfect linear response was obtained from the microbead test. Human ovarian cancer cells produced prominantly larger impedance signal compare to all other microbead particles. The proposed system showed a good discrimination power in cell size flowing through microfluidic channels, which offers excellent potential for point-of-care test type cancer diagnosis and monitoring systems in the near future.

References

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