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Minute-Level Speed Identification and Assessment of Bacteria/Cells Using Electrokinetic Assistance

I-Fang Cheng[1*], Tzu-Ying Chen[1], Wu-Chio Su[2]

[1]National Nano Device Laboratories, National Applied Research Laboratories, Tainan, Taiwan, ROC.

[2]Department of Internal Medicine, National Cheng Kung University College of Medicine and Hospital, Tainan, Taiwan, ROC.

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Abstract

Conventional techniques for detection and analysis of cells/bacteria use Western blot and ELISA kits that are high cost and long time consuming. An ideal advanced biosensor (molecular or whole cells detections) unit must have several important features: rapid detection time (<15 minutes), high sensitivity (10^2 cells/ml for whole cell detection or sub-nM concentration for molecular detection), high specificity, small, and inexpensive instrumentation/configuration. Two novel platforms will be introduced here, including an optofluidic system for the rapid on-chip detection of bacterial infection and a cell-based biochip for the label-free assessment of drug susceptibility on cancer cells. Rapid identification of rare pathogen from a very dense human blood sample is realized through combining the hybrid electrokinetic concentration with on-chip surface-enhanced Raman spectroscopy (SERS) identification of bacteria based on their detected SERS spectra. Compared to the current method in the hospital, this simple and rapid platform accelerated the detection time from 2 days to a few minutes. The cell-based biochip uses a novel, rapid, and label-free approach- AC electric field induced electro-rotation (eROT) to evaluate the drug susceptibility of cancer cells. The isolated lung cancer cells were successfully analyzed using eROT approach for the rapid and label-free assessment of the drug susceptibility of cancer cells. eROT spectra for different drug-treated cancer cells was successfully determined to the drug resistance and susceptibilities through their frequency-dependent rotation speeds. The relationship and trend between eROT method and conventional method are very agreement.

Keywords: identification, bacteria, surface-enhanced Raman spectroscopy, drug susceptibility

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* Corresponding author. Email: ifcheng@narlabs.org.tw

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