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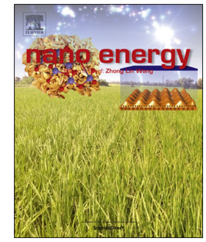

RAPID COMMUNICATION

Ultrasensitive self-powered cytosensor

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Abstract
We developed an ultrasensitive self-powered cytosensor based on biofuel cells (BFC) for the detection of acute leukemia CCRF-CEM cells. The core component of the BFC cytosensor was composed of an aptamer (Sgc8c)-functionalized cathode and a nitrogen-doped graphene/gold nanoparticles/glucose oxidase (NG/AuNPs/GOD) anode, which generated a maximum power output density (P_{max}) of 115 μW cm^{-2}. Once the negatively charged CCRF-CEM cells were captured by the cathode *via* aptamer recognition, their dramatic steric hindrance and electrostatic repulsion to the redox probe $[Fe(CN)_6]^{3-}$ efficiently blocked the electron transfer between the probe and the cathode surface, and thereby caused a remarkable decrease in power output of the BFC, which could be used to sensitively detect the cells. Notably, the power output density of the BFC cytosensor could be restored when the captured CCRF-CEM cells were released from the aptamer-functionalized cathode by raising the temperature of the cathode to alter the specific conformation of the aptamer. Then the re-activated cathode could capture CCRF-CEM cells once again achieving the regeneration of the BFC cytosensor. This self-powered BFC cytosensor showed a linear relationship between the P_{max} and the logarithm of the cell numbers over a range of 5–50,000 cells (r=0.9979) with a detection limit of 4 cells (S/N=3), which is expected to have potential application as a powerful point-of-care tool for the early detection of circulating tumor cells.
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Introduction

Biofuel cells (BFC) have attracted considerable interest recently because of their ability to provide sustainable energy from renewable fuel sources in mild conditions

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