Electrochemical Biosensor Constituted of Bi_2Se_3/Au/mDNA Hybrid Material for H_2O_2 Detection

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The hydrogen peroxide (H_2O_2) biosensor composed of the bismuth selenide nanoparticle (Bi_2Se_3 NP), gold (Au) and eight silver-ion mediated double-stranded DNA (mDNA) is fabricated for enhancement of electrochemical signal and stability. For the first time, the synthesized Bi_2Se_3 NP is immobilized uniformly on the gold electrode by self-assembly. Additionally, the Au layer is deposited on the Bi_2Se_3 NP layer to increase the stability of the electrochemical signal (Bi_2Se_3/Au). Then, to detect H_2O_2, the mDNA is immobilized on the Bi_2Se_3/Au layer by Au-thiol bonding (Bi_2Se_3/Au/mDNA). The immobilized Bi_2Se_3 induces the efficient electron transfer to the mDNA and Au electrode. To investigate H_2O_2 detection performance of the fabricated biosensor in real sample, the phorbol 12-myristate 13-acetate (PMA) is treated to the two breast cancer cell.The prepared biosensor successfully classifies two breast cancer cell through the amount of released H_2O_2. The fabricated biosensor provides the high electrochemical signal compared to the biosensor without Bi_2Se_3/Au. This proposed hybrid material can be used as the platform to develop biosensor for high selectivity and low detection limit.