Chemiresistive biosensor based on carbon nanotubes for label-free detection of DNA sequences derived from avian influenza virus H5N1

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We developed a chemiresistive biosensor based on semiconducting single wall carbon nanotubes (sc-SWCNTs) and nitrogen-doped multi-walled carbon nanotubes (N-MWCNTs) for highly sensitive and fast detection of single stranded DNA sequences derived from avian influenza virus (AIV) subtype H5N1. Sc-SWCNTs and N-MWCNTs were applied as active materials, which were horizontally positioned on well-defined areas of either flexible or rigid substrate (polyimide foils or quartz) through dry contact-printing method, followed by the deposition of Au/Cr interdigitated electrodes with an interspacing of 3 µm. The nanotubes were functionalized with DNA probe sequences, which were non-covalently attached to the sidewalls of the CNTs via π–π interaction. The sensing is based on the resistance change after DNA probe detachment when hybridized with complementary DNA target. This functionalized sensor could easily and quantitatively detect complementary DNA with concentration ranging from 2 pM to 2 nM in 15 min under dry conditions at room temperature. Our CNT-based chemiresistive DNA sensors are small, flexible, disposable, low-cost, and highly sensitive, which hold a high potential for practical applications and clinical diagnosis.