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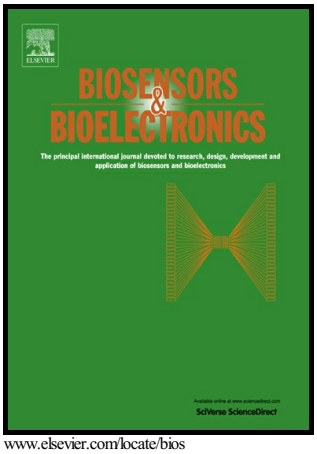

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ABSTRACT

A novel enhanced photoelectrochemical DNA sensor, based on a TiO_2/Au hybrid electrode structure, was developed to detect target DNA. The sensor was developed by successively modifying fluorine-tin oxide (FTO) electrodes with TiO_2 nanoparticles, gold (Au) nanoparticles, hairpin DNA (DNA1), and CdSe-COOH quantum dots (QDs), which acted as signal amplification factors. In the absence of target DNA, the incubated DNA1 hairpin and the CdSe-COOH QDs were in close contact with the TiO_2/Au electrode surface, leading to an enhanced photocurrent intensity due to the sensitization effect. After incubation of the modified electrode with the target DNA, the hairpin DNA changed into a double helix structure, and the CdSe QDs moved away from the TiO_2/Au electrode surface, leading to a decreased sensitization effect and photoelectrochemical signal intensity. This novel DNA sensor exhibited stable, sensitive and reproducible detection of DNA from 0.1 μM to 10 fM, with a lower detection limit of 3 fM. It provided good specificity, reproducibility, stability and is a promising strategy for the detection of a variety of other DNA targets, for early clinical diagnosis of various diseases.

Keywords: photoelectrochemistry; DNA sensor; CdSe quantum dots; tumor diagnosis