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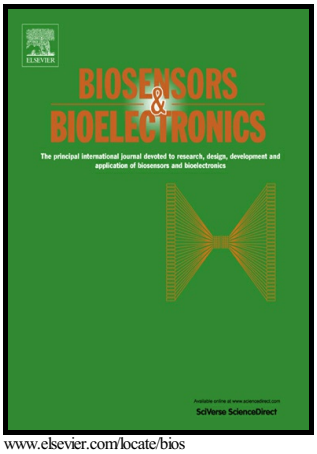

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A novel nonenzymatic cascade amplification for ultrasensitive photoelectrochemical DNA sensing based on target driven to initiate cyclic assembly of hairpins

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ABSTRACT: A novel cascade photoelectrochemical (PEC) signal amplification biosensing tactics was developed for DNA detection based on a target-driven DNA association to induce cyclic hairpin assembly. In the circulatory system there are two ssDNA (A and B) and two hairpins (C and D). The hybridization of these ssDNA led to the formation of an A–target–B structure. The close proximity of their toehold and branch-migration regions was able to induce the cyclic hairpin assembly. Afterwards, the assembly result further causes the separation of a double-stranded probe DNA (Q:F) to switch the PEC signal via toehold-mediated strand replacement. As such, the signal stranded DNA-CdS QDs (F) as the signal tag was released in the presence of the target DNA. The signal DNA-CdS QDs was then coated to F-doped tin oxide (FTO) electrode leading to the "signal-on" PEC signal. The designed biosensing strategy showed a low detection limit of 21.3 pM for target DNA and a broad linear range from 50 pM to 100 nM. This signal amplification PEC sensing method exhibited a potential application to detect protein molecules, RNA or metal ions via changing the sequence of A and B recognition.

Keywords: DNA assemble; photoelectrochemical; signal amplification; target driven; biosensing