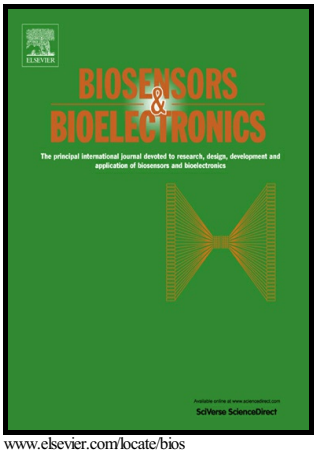

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Electrochemically mediated *in situ* growth of electroactive polymers for highly sensitive detection of double-stranded DNA without sequence-preference

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Abstract

The ability to directly detect double-stranded DNA (dsDNA) without sequence-preference continues to be a major challenge. Herein, we report an electrochemical method for the direct, highly sensitive detection of dsDNA based on the strand replacement of dsDNA by peptide nucleic acid (PNA) and the *in situ* growth of electroactive polymers through the surface-initiated electrochemically mediated atom transfer radical polymerization (SI-eATRP). Thiolated PNA molecules are firstly self-assembled onto gold electrode surface for the specific recognition of target dsDNA (dsDNA-T), which in turn leads to the formation of a high density of PNA/DNA heteroduplexes on the electrode surface for the subsequent attachment of ATRP initiators *via* the phosphate-Zr^{4+}-carboxylate chemistry. By applying a negative potential to the electrode, the air-stable Cu^{II} deactivators can be reduced into the Cu^{I} activators so as to trigger the surface-initiated polymerization for the *in situ* growth of electroactive polymers. Due to the strand replacement of dsDNA by PNA, dsDNA can be directly detected without sequence-preference. Besides, the growth of polymers enables the modification of numerous electroactive probes, thereby greatly improving the electrochemical signal. Under optimal conditions, a good linearity between the electrochemical signal and the logarithm of dsDNA-T concentration over the range from 1.0 fM to 1.0 nM, with a detection limit of 0.47 fM, can be obtained. Results indicate that it is highly selective, and holds high anti-interference capability in the presence of human serum samples. Therefore, this method offers great promises in providing a universal and efficient solution for the direct detection of dsDNA.