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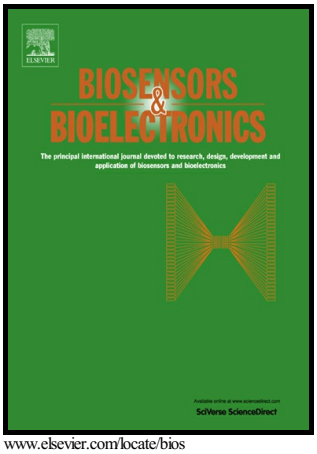

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Abstract

In this work, a simple and highly sensitive label-free electrochemical aptasensor for adenosine detection was developed based on target–aptamer binding triggered nicking endonuclease-assisted strand-replacement DNA polymerization and rolling circle amplification (RCA) strategy. The magnetic beads (MB) probe, which was attached the aptamer of adenosine and mDNA, was firstly fabricated. In the presence of adenosine, mDNA was released from MB upon recognition of the aptamer to target adenosine. The released mDNA as the primer activated autonomous DNA polymerization/nicking process and accompanied by the continuous release of replicated DNA fragments. Subsequently, numerous released DNA fragments were captured on the working electrode, and then as initiators to trigger the downstream RCA process leading to the formation of a long ssDNA concatemer for loading large amounts of $Ru(NH_3)_6^{3+}$. Therefore, a conspicuously amplified electrochemical signal through the developed dual-amplification strategy could be achieved. This method exhibited a high sensitivity toward adenosine with a detection limit of 0.032 nM. Also, it exhibited high selectivity to different nucleoside families and good reproducibility. This design opens new horizons for integrating different disciplines, presenting a versatile tool for ultrasensitive detecting organic small molecules in medical research and clinical diagnosis.

Keywords

Electrochemical sensor; Aptamer; Adenosine detection; Strand-replacement DNA polymerization; RCA