Dual-signal Amplification Strategy Aptasensor Based on Exonuclease III and Ordered Mesoporous Carbon-Gold Nanocomposites for Tetracycline Detection in Milk

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In this paper, a screen-printed aptasensor based on a dual-signal amplification strategy with enzyme-assisted target circulation and modification with ordered mesoporous carbon (OMC)-gold nanoparticle (AuNP) nanocomposites was used to detect tetracycline (TET) in milk. Exonuclease III (Exo III), an enzyme, is known to recognize double-stranded DNA nonspecifically. To take advantage of this intrinsic property, Exo III was selected to facilitate the target circulation and amplify the signal. Furthermore, OMC and AuNP nanocomposites formed a unique sensing film with a large surface area and good electronic conductivity, amplifying the current signal for tetracycline detection with excellent sensitivity. A TET-binding aptamer was self-assembled onto the surface of screen-printed carbon electrodes (SPCEs) modified with the nanocomposites to form a sensing layer. Additionally, Exo III sheared the hybridized double chain selectively, releasing the tetracycline target. The released target and the remaining hairpin probe hybridized again. After each cycle of digestion, the target was recycled, leading to amplification. Moreover, real milk samples were directly measured after diluting the milk 3 times. The results showed that the present dual-signal amplification strategy for tetracycline analysis exhibited a detection limit of 3.0 µg/L with high specificity and demonstrated its applicability for detecting tetracycline residues in milk samples.

Keywords: Aptasensor; Screen-printed carbon electrodes; Ordered mesoporous carbon; Tetracycline residues; Real-time field detection

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