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Ultrasensitive microfluidic paper-based electrochemical/visual biosensor based on spherical-like cerium dioxide catalyst for miR-21 detection

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Abstract

In this work, an electrochemical biosensor based on Au nanorods (NRs) modified microfluidic paper-based analytical devices (μ PADs) were constructed for sensitive detection of microRNA (miRNA) by using cerium dioxide - Au@glucose oxidase (CeO_2 -Au@GOx) as an electrochemical probe for signal amplification. Au NRs were synthesized by in-situ growth method in μ PADs surface to enhance the conductivity and modified hairpin probe through Au-S bonds. The construction of “the signal transducer layer” was carried out by GOx catalyzing glucose to produce H_2O_2 , which was further electrocatalyzed by CeO_2 . After the biosensor was constructed, an obvious electrochemical signal was observed from the reduction of H_2O_2 . In order to make the detection more convincing, the visual detection was performed based on the oxidation of 3,3',5,5'-tetramethylbenzidine by H_2O_2 with the help of Exonuclease I. The electrochemical biosensor provided a wide linear range of 1.0 fM to 1000 fM with a relatively low detection limit of 0.434 fM by the electrochemical measurement.

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