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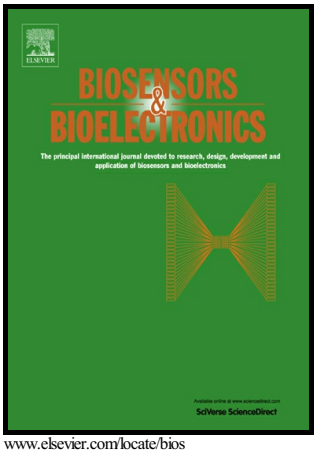

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Planar intercalated Copper (II) complex molecule as small molecule enzyme mimic combined with Fe_3O_4 nanozyme for bienzyme synergistic catalysis applied to the microRNA biosensor

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Abstract

Enzyme mimics have been developed for bioassay of nucleic acids, with some of them involving complicated labeling. Herein, we report a label-free bioassay for ultrasensitive electronic determination of microRNA at an ultralow concentration based on target-triggered long-range self-assembly DNA-based hybridization chain reaction (HCR) protocol coupled with bienzyme mimics synergistic catalysis strategy. In this work, a planar intercalation molecule, copper (II) complex, is applied for the first time as a small molecule enzyme mimic as well as intercalation molecule in microRNA biosensor for signal amplification. Fe_3O_4 nanozyme were used as a separate and enriched target under magnetic field, and also in combination with HCR protocol detected in 3,3',5,5'-tetramethylbenzidine+hydrogen peroxide (TMB+H_2O_2) system to improve the sensitivity of the biosensor. Under optimal conditions, these strategies present good electrochemical behaviors for the detection of microRNA with a wide range from 100 aM to 100 nM and at relatively low detection limit of 33 aM. This remarkable sensitivity can make this proposed approach a promising scheme for development of next-generation microRNA sensors without the need of enzyme labeling or fluorophore labeling.

Graphical abstract