A DNAzyme-based Electrochemical Impedance Biosensor for Highly Sensitive Detection of Cu²⁺ Ions in Aqueous Solution

Jikui Wu^{*}, Yali Yu, Shaohu Wei, Bin Xue, Junling Zhang^{*}

College of Food Science and Technology, Key laboratory of Genetic Resources for Freshwater Aquaculture and Fisheries, and Laboratory of Quality and Safety Risk Assessment for Aquatic Product on Storage and Preservation (Shanghai), Ministry of Agriculture, Shanghai Ocean University, Shanghai 201306, China

^{*}E-mail: jkwu@shou.edu.cn, jlzhang@shou.edu.cn

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We developed a simple, label-free, DNAzyme-based electrochemical impedance sensor for highly sensitive detection of Cu²⁺ ions in aqueous solution. A complex of Cu²⁺-dependent DNAzyme and its corresponding substrate was immobilized on the gold electrode surface through Au-S bond. In the presence of Cu²⁺ ions, the cleavage of DNAzyme resulted in a significant change in the charge transfer resistance signal intensity. The resistance signal change correlated with the concentration of Cu²⁺ ions. The proposed sensor showed excellent sensitivity and selectivity. The limit of detection of this sensor is 5 nM, which is far below the limit of Cu²⁺ ions (~20 μM) mandated by United States Environmental Protection Agency (EPA). A series of metal ions, such as Ca²⁺, Mg²⁺, Mn²⁺, Cr³⁺, Pb²⁺, Zn²⁺, Co²⁺, and Ni²⁺, have little interference with the detection of Cu²⁺ ions.

Keywords: Electrochemical sensor; Cu²⁺; DNAzyme; Electrochemical impedance spectroscopy (EIS)

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