A Simple Electrochemical Immunosensor for Highly Sensitive Detection of Aflatoxin B₁ Based on Gold Nanoparticle Decorated Carboxylated Graphene Oxide

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In this work, polycrystalline gold nanoparticles decorated carboxylated graphene oxide (Au-COOH-GO) nanohybrids have been prepared and were used to fabricate electrochemical immunosensor for detecting of aflatoxin B₁ (AFB₁). The obtained Au-COOH-GO nanohybrids are characterized by transmission electron microscope (TEM), X-ray photoelectron spectroscopy (XPS) and UV-vis absorption spectra. Each step of the immunoelectrode design is evaluated using cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS). The surface reaction mechanism of AFB₁ on Au-COOH-GO nanohybrids also has been investigated. The concentration and incubation time of antibody, pH, and immunoreaction time are optimized by square wave voltammogram (SWV). Under the optimal conditions, the detection limit of AFB₁ is 0.05 ng mL⁻¹ (S/N=3) with a linear AFB₁ concentration range of 0.05 to 25 ng mL⁻¹. The fabricated immunosensor shows a good reproducibility, stability, and selectivity and can successfully detect AFB₁ in real rice sample.

Keywords: Gold nanoparticles; Carboxylated graphene oxide; Aflatoxin B₁; Electrochemical immunosensor

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