Development of Electrochemiluminescence Immunosensor based Sandwich Structure Composites for Determination of Serum Insulin Level in Athletes

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The goal of this work was to develop an electrochemiluminescence (ECL) immunosensor based on the luminol-O₂ technology for measuring serum insulin levels in athletes. For construction of the sandwich-configuration electrochemiluminescence immunoassay, the Au and CeO₂ nanocomposite electrodeposited on functionalized CNTs (Au@CeO₂/f-CNTs) and combined with luminol (Lu/Au@CeO₂/f-CNTs), and the nanocomposite of dopamine@SiO₂ (DA@SiO₂) used as quencher of ECL signal. The primary antibody (Ab₁) and secondary antibody (Ab₂) modified the composite surface of DA@SiO₂ and Au@CeO₂/f-CNTs, respectively for enhancement of sensitivity of immunosensor. SEM and XRD analyses confirmed successful synthesis of DA@SiO₂ and Au@CeO₂/f-CNTs nanocomposites. The optimal condition were investigated for achievement of maximum ECL signal, and results showed under the optimal experimental conditions, immunosensor showed high sensitivity and anti-interference capability to determination of insulin, and the detection limit and linear range of immunosensor were obtained 17 ng/ml and 10-4 ng/ml to 50 ng/ml, respectively. The precision and applicability of the proposed ECL immunosensor to determination of insulin were investigated in blood serum specimens of athletes as real samples, and results indicated to the acceptable recovery (100.60 to 94.85%) and RSD (3.11 to 1.84 %) values, and verification of feasibility of the proposed ECL immunosensor for determination of serum insulin level in athletes.

Keywords: Insulin; Electrochemiluminescence immunosensor; Au nanoparticles; CeO₂ nanoparticles; functionalized CNTs; dopamine@SiO₂ nanocomposite

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