

Electrochemical synthesis of metal oxide nanoparticles for preparation of creatinine sensor

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Abstract

Electrochemical enzymless sensors are attractive by researchers due to their advantages including low fabrication cost, good selectivity and high stability. Transition metal oxides are a suitable materials for preparation of enzymless creatinine sensors due to their ability in interaction with creatinine. The present paper is devoted to an electrochemical synthesis of iron oxide nanoparticles for preparation of an impedance-based enzymless creatinine sensors. The electrodeposition of iron oxide on the surface was carried out through a constant potential method. The morphology of the prepared surface was studied by Field emission scanning electron microscopy (FESEM). Electrochemical impedance spectroscopy (EIS) was used as impedimetric method for determination of creatinine in samples. The results of EIS indicated an increasing trend in value of charge transfer resistance (R_{ct}) from 12.7 k Ω for 60 μ M creatinine to 14.45 k Ω for 80 μ M creatinine. The prepared sensor can be used in rapid detection of creatinine in real samples.

Keywords: Creatinine, Metal oxide, Electrochemical synthesis, Enzymless sensors, Nanotechnology

Experimental

Electrodeposition of iron oxide nanoparticles on the substrate was carried out using a potentiostat/galvanostat (Zive SP2, ZIVE LAB, Korea) coupled to a three-electrode system containing working electrode, an Ag/AgCl electrode (Metrohm) as the reference electrode and a Pt electrode (Metrohm) as the counter electrode immersed a solution containing Iron(II) chloride tetrahydrate. The electrodeposition process was performed by a constant potential deposition method in potential of 1.2 V and pH = 4.1. The prepared surface was washed with deionized water and dried with nitrogen gas. Finally, it was annealed at 520 °C for 30 min. Surface morphology of surface was evaluated using a MIRA3 LM, Tuscan field emission scanning electron microscope