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PII: S0039-9140(16)30311-3
DOI: http://dx.doi.org/10.1016/j.talanta.2016.04.061
Reference: TAL16544

To appear in: *Talanta*

Received date: 1 January 2016
Revised date: 22 April 2016
Accepted date: 29 April 2016

Cite this article as: Behzad Rezaei, Leila Shams-Ghahfarokhi, Elahe Havakeshian and Ali A. Ensafi, An electrochemical biosensor based or nanoporous stainless steel modified by gold and palladium nanoparticles fo simultaneous determination of levodopa and uric acid, *Talanta* http://dx.doi.org/10.1016/j.talanta.2016.04.061

An electrochemical biosensor based on nanoporous stainless steel modified by gold and palladium nanoparticles for simultaneous determination of levodopa and uric acid

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Abstract

In this paper, an electrochemical biosensor based on gold and palladium nano particles-modified nanoporous stainless steel (Au-Pd/NPSS) electrode has been introduced for the simultaneous determination of levodopa (LD) and uric acid (UA). To prepare the electrode, the stainless steel was anodized to fabricate NPSS and then Cu was electrodeposited onto the nanoporous steel by applying the multiple step potential. Finally, the electrode was immersed into a gold and palladium precursor's solution by the atomic ratio of 9:1 to form Au-Pd/NPSS through the galvanic replacement reaction. Morphological aspects, structural properties and the electroanalytical behaviour of the Au-Pd/NPSS electrode were studied using field emission scanning electron microscopy (FE-SEM), energy dispersive X-ray spectroscopy (EDX), X-ray diffraction (XRD), electrochemical impedance spectroscopy (EIS) and voltammetric techniques. Also, differential pulse voltammetry (DPV) was used for the simultaneous determination of LD and UA. According to results, the surface of Au-Pd/NPSS electrode contained Au and Pd nanoparticles with an average diameter of 75 nm. The electrode acted better than Au/NPSS and Pd/NPSS electrodes for the simultaneous determination of LD and UA, with the peak separation potential of about 220 mV. Also, the calibration plot for LD was in two linear concentration ranges of 5.0-10.0 and 10.0-55.0 $\mu mol.L^{-1}$ and for UA, it was in the range of 100-1200 $\mu mol.L^{-1}$. The detection limit for LD

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