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Bimetallic gold-nickel nanoparticles as a sensitive amperometric sensing platform for acetaminophen in human serum

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Abstract

Herein we demonstrate a facile amperometric sensor for acetaminophen without any help of electrochemically active redox mediators and enzymes using bimetallic gold-nickel (AuNi) nanoparticles (NPs). The AuNi NPs are directly deposited on a titanium (Ti) electrode surface (Ti/AuNi NPs) using an *in-situ* electrochemical deposition strategy under acidic medium. The as-fabricated Ti/AuNi NPs electrode exhibits an outstanding direct-electrochemical oxidation of acetaminophen through an improved charge carrier mobility and facile interface for the electron transfer process. The Ti/AuNi NPs electrode presents a ~2.5 and ~1.9 times superior electrocatalytic activity of acetaminophen oxidation than that of Ti/Ni NPs and Ti/Au NPs electrodes, respectively. The current amperometric acetaminophen sensor designed in this study demonstrates a high sensitivity (0.2 μA nM^{-1} cm^{-2}) with a correlation co-efficient (R^2) of 0.99 and an extensive linear range (0.0 - 1.75 μM) with a calculated lowest sensor limit (0.51 nM (S/N=3)). The Ti/AuNi NPs electrode shows a negligible response from the common interferences such as glucose, lactose and glycine. The practical capability of the developed system for sensing acetaminophen in human serum samples revealed that the AuNi NPs based