A Prussian Blue Zinc Oxide Carbon Nanotube Electrocatalyst for Monitoring Disease Biomarkers

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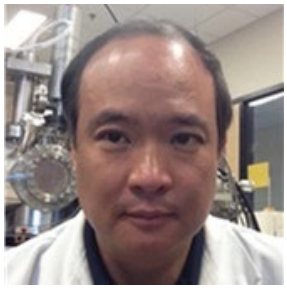
Abstract

A Prussian Blue (PB) zinc oxide (ZnO) nanoparticle carboxylic acid-functionalized multiwalled carbon nanotube (PB/ZnO/COOH-MWNT) composite was fabricated for the detection of dopamine (DA) and hydrogen peroxide. ZnO nanoparticles were tethered to COOH-MWNTs using sonication. Upon attachment of the PB to the ZnO/COOH-MWNTs, which consisted of ZnO nanoparticles 13 nm in diameter, the ZnO coalesced into larger clusters with an average diameter of 573±4 nm. Current response versus various concentrations of DA was measured using chronoamperometry. The optimum conditions for DA measurements were at pH 7.0 using the oxidation current. The sensor has a linear dynamic range from 10-to-900 μM with a limit of detection of 0.378±0.015 μM, suitable for practical neuroblastoma screening at the lower concentration range and process controls for polydopamine synthesis at the upper concentration range, important for modifying polymeric membranes for water purification. The standard addition method (SAM) was coupled with chronoamperometric sensing (CA) to overcome these obstacles. CA SAM showed the ability to accurately measure hydrogen peroxide within the 1-21 μM range, suitable for monitoring cancer cell apoptosis and offering analytical advantages over standard enzyme-linked immunosorbent assays (ELISA) for rapid, matrix-effect-free analysis..

Biography of Presenter



Charles Chusuei is an associate professor of Chemistry at Middle Tennessee State University (MTSU) who directs research on producing biosensing electrocatalysts (h-index 37; 5082 citations). Prior to MTSU, he received his BS at James Madison University, and his MS and PhD degrees in Chemistry at George Mason University. He was a postdoctoral fellow at Texas A&M U. (Prof. D. Wayne Goodman) and the Pacific Northwest National Laboratory (Dr. Allison A. Campbell).