

Synthesis of Pd@ Cu Core–Shell Nanowires by Galvanic Displacement of Cu by Pd²⁺ Ions as a Modified Glassy Carbon Electrode for the Simultaneous Determination of Dihydroxybenzene Isomers Speciation

Authors : Majid Farsadrouh Rashti, Parisa Jahani, Amir Shafiee, Mehrdad Mofidi

Abstract : The dihydroxybenzene isomers, hydroquinone (HQ), catechol (CC) and resorcinol (RS) have been widely recognized as important environmental pollutants due to their toxicity and low degradability in the ecological environment. Speciation of HQ, CC and RS is very important for environmental analysis because they co-exist of these isomers in environmental samples and are too difficult to degrade as an environmental contaminant with high toxicity. There are many analytical methods have been reported for detecting these isomers, such as spectrophotometry, fluorescence, High-performance liquid chromatography (HPLC) and electrochemical methods. These methods have attractive advantages such as simple and fast response, low maintenance costs, wide linear analysis range, high efficiency, excellent selectivity and high sensitivity. A novel modified glassy carbon electrode (GCE) with Pd@ Cu/CNTs core–shell nanowires for the simultaneous determination of hydroquinone (HQ), catechol (CC) and resorcinol (RS) is described. A detailed investigation by field emission scanning electron microscopy and electrochemistry was performed in order to elucidate the preparation process and properties of the GCE/ Pd/CuNWs-CNTs. The electrochemical response characteristic of the modified GPE/LFOR toward HQ, CC and RS were investigated by cyclic voltammetry, differential pulse voltammetry (DPV) and Chronoamperometry. Under optimum conditions, the calibrations curves were linear up to 228 µM for each with detection limits of 0.4, 0.6 and 0.8 µM for HQ, CC and RS, respectively. The diffusion coefficient for the oxidation of HQ, CC and RS at the modified electrode was calculated as 6.5×10^{-5} , 1.6×10^{-5} and $8.5 \times 10^{-5} \text{ cm}^2 \text{ s}^{-1}$, respectively. DPV was used for the simultaneous determination of HQ, CC and RS at the modified electrode and the relative standard deviations were 2.1%, 1.9% and 1.7% for HQ, CC and RS, respectively. Moreover, GCE/Pd/CuNWs-CNTs was successfully used for determination of HQ, CC and RS in real samples.

Keywords : dihydroxybenzene isomers, galvanized copper nanowires, electrochemical sensor, Palladium, speciation

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