A Nonenzymatic Sensor Based on {PEI/[P₂W₁₇V-CNTs/PEI-CuO]₁₀/P₂W₁₇V-CNTs} Nanocomposite Film for the Sensitive Determination of Iodate

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doi: 10.20964/2018.09.72

Received: 6 May 2018 / Accepted: 11 July 2018 / Published: 5 August 2018

In this work, a new composite film electrode based on Dawson-type polyoxometalate α_2 -K₇P₂VW₁₇O₆₂·18H₂O (P₂W₁₇V) and accessory copper oxide nanoparticles (CuO NPs) with a composite of carbon nanotubes (CNTs) was successfully proposed and employed for iodate (IO₃⁻) analysis. Highly stable determination of IO₃⁻ was achieved by a combination of cyclic voltammetric and chronoamperometric methods performed on this layer-by-layer (LbL) self-assembly composite film electrode. For the tricomponent composite film, the amperometric response time of iodate (defined as the time to achieve 95% steady-state current) was estimated to be 2 s, confirming the faster electron transfer rate in the tricomponent composite film. This iodate sensor with 10 bilayers has a linear range of 1.25×10^{-7} to 1.63×10^{-4} M, a low detection limit of 1.5×10^{-8} M (S/N = 3), a high sensitivity of 4.82 mA mM⁻¹ IO₃⁻ and an excellent anti-interference performance. In addition, the composite film could also be applied to detect iodate in table salt. The as-prepared sensor can be used for detecting iodate with a good average recovery of 100.1%, indicating the well reliability of the present sensor for iodate determination in table salts. This approach may open a new path for the rational design of high-performance tricomponent composite film electrochemical sensors.

Keywords: polyoxometalate; modified electrode; composite film; iodate sensor

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