One-pot Synthesis of Fe₂O₃/PEDOT/rGO Nanocomposite for Sensitive Determination of Caffeine

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doi: 10.20964/2018.07.66

Received: 26 August 2017 / Accepted: 26 September 2017 / Published: 5 June 2018

In this research, a ternary nanocomposite, based on iron oxide (Fe₂O₃), reduced graphene oxide (rGO) and PEDOT had been successfully synthesized via one-pot method for the electrochemical detection of caffeine. The obtained nanocomposite Fe₂O₃/PEDOT/rGO was characterized by SEM, EDS, XRD, XPS and Raman spectroscopy to confirm the morphology, structure and composition. In addition, the electrochemical behaviors of caffeine on the nanocomposite modified electrode were investigated by cyclic voltammetry and differential pulse voltammetry. The results demonstrated that the Fe₂O₃/PEDOT/rGO nanocomposite exhibited excellent electrocatalytic activity to caffeine. Under the optimized conditions, the Fe₂O₃/PEDOT/rGO modified glassy carbon electrode showed a wide linear range of 1.0×10^{-6} to 8.0×10^{-4} M with the correlation coefficient of 0.992 and a detection limit of 3.3×10^{-7} M for the determination of caffeine. Furthermore, the modified electrode displayed high sensitivity and selectivity, good reproducibility and long-term stability in subsequent experiments. It was also successfully used to determine caffeine in beverage samples.

Keywords: Iron(III) oxide; Poly(3,4-ethylene-dioxythiophene); Graphene; Caffeine; Electrochemical sensor.

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