

Voltammetric determination of dopamine mediated by nanoparticle WO₃ /MWCNT modified glassy carbon electrode

ABSTRACT

Chemically-modified electrode fabricated by mechanical attachment of multi-walled carbon nanotubes/tungsten oxide (MWCNTs/WO₃) in the electrocatalytic study of dopamine was investigated. The MWCNTs/WO₃ nanocomposite has been characterized using voltammetric techniques of cyclic voltammetry, chronoamperometry and chronocoulometry. The CNT/WO₃/GCE induces a 2.9 enhancement oxidative peak with peak separation of approximately 200 mV, shifting towards a lower potential in the electrochemical oxidation of 0.4 mM dopamine at pH 7.0, in comparison with the WO₃/GCE, MWCNTs/GCE and bare GCE. The lowering positive potential and enhancement current are evident of electrocatalysis process. From the calibration plot, the high sensitivity response of 57.00 $\mu\text{A}/\mu\text{M}$ for the anodic peak with the detection limit of 0.018 μM (100 mV/s scan rate) of dopamine at the CNT/WO₃/GCE were obtained. Based on the chronocoulometric study on 0.4 mM dopamine in 0.1 M KCl, the diffusion coefficient was found to be $5.43 \times 10^{-8} \text{ cm}^2/\text{s}$ with the surface charge of $6.86 \times 10^{-4} \text{ C}/\text{cm}^2$. The easily prepared nanocomposite-modified electrode showed to have high sensitivity, selectivity and good reproducibility.

Keyword: Tungsten oxide (WO₃), Dopamine; Multi-walled carbon nanotubes (MWCNTs); Cyclic voltammetry