

Electron transport and electrocatalytic properties of MWCNT/nickel nanocomposites: Hydrazine and diethylaminoethanethiol as analytical probes

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ABSTRACT

This work describes the electron transport and electrocatalytic properties of chemically-synthesized nickel (Ni) and nickel oxide (NiO) nanoparticles supported on multi-walled carbon nanotubes (MWCNT) platforms. Successful modification of the electrodes with the Ni and NiO nanoparticles was confirmed by techniques such as FTIR, FESEM, HRSEM, TEM, XRD, EDX and cyclic voltammetry (CV). The electrocatalytic oxidation of DEAET and hydrazine on the modified electrodes was investigated using CV and electrochemical impedance spectroscopy (EIS) and discussed. Results showed that EPPGE–MWCNT–Ni electrode gave the best electro-oxidation response towards DEAET and hydrazine. The catalytic rate constant and the limit of detection of the electrode to DEAET and hydrazine were $5.93 \times 10^9 \text{ cm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ (0.87 μM) and $7.67 \times 10^8 \text{ cm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ (0.29 μM), respectively. The electrochemical Gibbs free energy change due to adsorption (DG₀) for the EPPGE–MWCNT–Ni in DEAET and hydrazine were estimated as -18.14 and -17.21 kJ mol^{-1} , respectively. The electrode has proven to be a potential electrochemical sensor for DEAET and hydrazine.