Enhanced Electrochemical Sensing of Neurotransmitter in Serum and Injection Samples at Nickel (II) Hexacyanoferrate Deposited on Nanotubular Clay as Facile Electron Transfer Mediator

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Abstract

Surface modification of natural clay halloysite with nickel hexacyanoferrate (NiHCF@HNT) have been obtained by chemical deposition of NiHCF at polydimethyldiallyamine pretreated HNT (PDDA/HNT) using positively charged polymer electrolyte as glue as well as nucleation site to grow metal hexacyanoferrate. The deposition of NiHCF on PDDA/HNT was confirmed using FT-IR and FE-SEM images. Cyclic voltammetry and electrochemical impedance spectroscopy techniques were used to study the electrochemical properties of NiHCF modified halloysite nanotubes. The modified sensor showed better electrocatalytic activity in dopamine (DA) oxidation and was used as a DPV sensor. The DA sensor revealed a linear response ranging from 8 to 152 μM (R^2 = 0.9982) with a sensitivity of 134.4 μA μM^{-1} cm^{-2} and LOD of 0.9 nM. This developed sensor also reveals an excellent catalytic activity, good stability, repeatability, reproducibility, and high sensitivity. Also, the designed sensor exhibited no overlapping signal from other co-existing electroactive species and studied real sample applications like DA injection and serum samples.

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