

Title: Metal-polymer-clay nanocomposites based electrochemical sensor for detecting hydrazine in water sources

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Abstract: AgNPs embedded polymer-clay (AgNPs@PEI-HNT) nanocomposites were successfully employed to sensitively detect hydrazine in water samples using differential pulse voltammetry (DPV) and amperometry methods. In-situ polymerization was utilized for assembling the polymer-clay composites, which were subsequently coated with AgNPs. PEI improves conductivity and absorbs AgNPs on the surface of HNTs, as evidenced with the help of UV-Visible, IR spectroscopy, XRD, XPS and morphological studies (FE-SEM and TEM). Nanocomposites were coated with GCE, which improved their electrocatalytic performance during hydrazine oxidation. The Tafel plot, Galus and Cottrell equations were used to compute the electron transfer coefficient (0.64), catalytic reaction rate constant ($4.81 \times 10^4 \text{ M}^{-1}\text{s}^{-1}$) and diffusion coefficient ($2.56 \times 10^{-5} \text{ cm}^2/\text{s}$) of hydrazine at AgNPs@PEI-HNT/GCE. Amperometry technique was used to determine the LOD along with sensitivity of hydrazine, which were 0.22 nm and $116.76 \mu\text{A } \mu\text{M}^{-1} \text{ cm}^{-2}$. Modified electrode offers enhanced properties for example strong anti-interference capability, good reproducibility, long-term stability, sensitivity, and so on. The designed sensor successfully detects hydrazine in water samples with high recovery rates (R.S.D. < 5 %).

Keywords: Silver nanoparticles (AgNPs), Polymer-clay nanocomposites, Halloysite nanotubes (HNTs), Polyethyleneimine (PEI), Hydrazine detection, Amperometry

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