Journal Article – Volume 702, Colloids and Surfaces A: Physicochemical and Engineering Aspects 2020, Pages 1 - 12

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

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 (4.81×10^{4} $M^{-1}s^{-1}$) and diffusion coefficient (2.56×10^{-5} cm^{2}/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 $\mu A\ \mu M^{-1}\ cm^{-2}$. 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

Halloysite; Hydrazine oxidation; Polymer-clay composites; Silver nanoparticles; Water samples