

Determination of Nanomolar Mercury (II) by Using Multi-Walled Carbon Nanotubes Modified Carbon Zinc/Aluminum Layered Double Hydroxide - 3 (4-Methoxyphenyl) Propionate Nanocomposite Paste Electrode

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Abstract : A mercury(II) sensor was developed by using multi-walled carbon nanotubes (MWCNTs) paste electrode modified with Zn/Al layered double hydroxide-3(4-methoxyphenyl)propionate nanocomposite (Zn/Al-HMPP). The optimum conditions by cyclic voltammetry were observed at electrode composition 2.5% (w/w) of Zn/Al-HMPP/MWCNTs, 0.4 M potassium chloride, pH 4.0, and scan rate of 100 mVs⁻¹. The sensor exhibited wide linear range from 1x10⁻³ M to 1x10⁻⁷ M Hg²⁺ and 1x10⁻⁷ M to 1x10⁻⁹ M Hg²⁺, with a detection limit of 1x10⁻¹⁰ M Hg²⁺. The high sensitivity of the proposed electrode towards Hg(II) was confirmed by double potential-step chronocoulometry which indicated these values; diffusion coefficient 1.5445 x 10⁻⁹ cm² s⁻¹, surface charge 524.5 μC s^{-1/2} and surface coverage 4.41 x 10⁻² mol cm⁻². The presence of 25-fold concentration of most metal ions had no influence on the anodic peak current. With characteristics such as high sensitivity, selectivity and repeatability the electrode was then proposed as the appropriate alternative for the determination of mercury(II).

Keywords : cyclic voltammetry, mercury(II), modified carbon paste electrode, nanocomposite

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