Bismuth Nano-Flower Modified CPE for Anodic Stripping Voltammetry Detection of Cd(II)

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Bismuth (Bi) nano-needle, nano-rod, nano-sheet, and nano-flower were synthesized using a facile one-step solvothermal method by adjusting the volume of ethylenediamine (EDA). The prepared Bi nanoparticles were characterized by scanning electron microscope (SEM) and X-ray diffraction (XRD) analysis and their formation mechanism was discussed. Bi nano-particle modified carbon paste electrode (CPE) combined with differential pulse anodic stripping voltammetry (DPASV) was developed for the determination of Cd (II). It was shown that Bi nano-flower modified electrode displayed the highest detection sensitivity on account of its particular three-dimensional structures. The stripping peak currents of Cd (II) at “bulk” and “drop coating” Bi nano-flower modified CPEs were compared with those of Bi film modified CPEs using “in-situ” and “out-situ” plating methods. The optimized detection conditions were 5% Bi nano-flower bulk modified CPE at pH 4.4, deposition potential of -1.2 V (vs. AgCl/Ag) and deposition time of 200 s. The linear range, sensitivity and detection limit were 0.05 - 1 μM , 27.5 $\mu\text{A}/\mu\text{M}$, and 2.4 nM, respectively. The proposed Bi nano-flower bulk modified CPE was conveniently usable in the trace Cd (II) analysis for environmental water samples with the recovery range of 91.1%-105.6%.

Keywords: Bi nano-flower particles, CPE, Differential pulse anodic stripping voltammetry, Cd (II) trace detection

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