Simultaneous Determination of Cd(II) and Pb(II) Based on Bismuth Film/Carboxylic Acid Functionalized Multi-Walled Carbon Nanotubes- β -cyclodextrin-Nafion Nanocomposite Modified Electrode

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A bismuth film/carboxylic acid functionalized multi-walled carbon nanotubes- β -cyclodextrin-Nafion nanocomposite modified glassy carbon electrode (Bi/CMWCNTs- β -CD-Nafion/GCE) was fabricated and characterized for the sensitive detection of cadmium and lead using square wave anodic stripping voltammetry (SWASV). Cyclic voltammetry (CV), SWASV and chronoamperometry were utilized to study the electrochemical behavior of cadmium and lead detection. The electrode surface morphology has been characterized by scanning electron microscopy. Compared with β -CD and CMWCNTs, the enhanced stripping peak currents for both Cd(II) and Pb(II) were observed on Bi/CMWCNTs- β -CD-Nafion/GCE. Due to the synergistic effect, the resulting surface provided a favorable surface morphology for improving the efficiency of electrodeposition and accelerating electron transfer rate for the determination of trace amounts of heavy metal ions (HMs). The experimental results show that the CMWCNTs- β -CD-Nafion nanocomposite modified electrode can act as a kind of practical sensor for the simultaneous determination of Pb(II) and Cd(II) by SWASV. The optimized linear working range (S/N = 3) were 1 to 100 μ g/L for Cd(II) and Pb(II), and the limits of detection were 0.21 μ g/L for Pb(II) and 0.13 μ g/L for Cd(II), respectively. Moreover, the sensor was further used for the trace HMs detection in soil samples with satisfactory results.

Keywords: Multi-walled carbon nanotubes, β -cyclodextrin, Nafion, Cd(II) and Pb(II), Soil

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