A Novel Indium Doped Bismuth Nanofilm for Simultaneous Stripping Determination of Zn(II), Cd(II) and Pb(II) in River Water

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A novel indium doped bismuth hybrid nanofilm was prepared on a glassy carbon electrode (Bi@In/GCE) and successfully used for the simultaneous measurements of aqueous zinc (Zn(II)), cadmium (Cd(II)) and lead (Pb(II)). The Bi@In hybrid nanofilm was greatly improved in the ability of electron transfer, surface morphology as well as hydrophilicity over single Bi or In film, and exhibited well-defined and separate peaks for Zn(II), Cd(II) and Pb(II) by square wave stripping voltammetry. Analytical characteristics of the developed Bi@In/GCE were explored by comparing with single Bi and In film modified electrodes with calibration curves, which exhibited the most preferable electrochemical behaviors toward three metals as predicted. The synergistic effect of Bi and In mainly contributed to the enhanced electrochemical activity of the new electrode. In the concentration range of 0-120 $\mu\text{g L}^{-1}$, a good linear relationship was achieved between the peak current and the metal concentration with correlation coefficient higher than 0.995. The detection limits were calculated to be 0.52, 0.15 and 0.67 $\mu\text{g L}^{-1}$ for Zn(II), Cd(II) and Pb(II) (S/N=3), respectively. The analysis of river sample with Bi@In/GCE was performed with satisfactory recoveries higher than 98%, suggesting that the new method is promising as a simple, sensitive and efficient approach to detect the heavy metals in water samples.

Keywords: Bi@In nanohybrid, Anodic stripping voltammetry, Cadmium, Zinc, Lead

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