

ABSTRACT

The voltammetry method is an alternative solution to heavy metal detection because it is affordable, simple, quick to respond and can be applied directly in the field. The performance of the voltammetry method is influenced by the material of the working electrode. Carbon Paste Electrode (CPE) is widely used in the sensor field because the manufacturing process is simple, non-toxic, can provide a very stable electrochemical response, the sensitivity and selectivity of this electrode can be improved with the addition of modifiers. Bi_2O_3 is one of the modifiers that can be used to modify the surface of CPE because it has a narrow band gap (2 to 3.96 eV), high refractive index, good optical conductivity, non-toxic properties, and high photocatalytic activity. In this study, CPE modification with Bi_2O_3 was carried out for Pb and Cd heavy metal sensors using the Square Wave Anodic Stripping Voltammetry (SWASV) technique. This modification aims to improve sensor performance which includes sensitivity and selectivity, repeatability, reproducibility, linearity, detection limit, and analysis ability on real samples.

The results obtained from this study are that CPE is successfully synthesized with electrochemical characteristics in the form of a reversible redox reaction. The synthesis of Bi_2O_3 produces a product in the form of a yellow powder with a crystallinity index of 39,65%. The addition of Bi_2O_3 modifiers to CPE surfaces can improve the sensitivity and selectivity of Pb and Cd heavy metal testing. CPE/ Bi_2O_3 has good repeatability for Pb and Cd heavy metal testing with %RSD of 4,40% and 3,91%, respectively. CPE/ Bi_2O_3 also has good reproducibility for heavy metal testing of Pb and Cd with %RSD of 5,55% and 3,47%, respectively. The linear range of heavy metal testing Pb and Cd is at concentrations of 10-70 ppb with detection limits of 4,81 ppb and 4,88 ppb, respectively. CPE/ Bi_2O_3 can be used to detect heavy metals Cd in real samples of the agricultural sector with %recovery of 88,10%.

Keyword : carbon paste electrode, Bi_2O_3 , lead (Pb), cadmium (Cd), voltammetry, square wave anodic stripping voltammetry.