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Abstract

2D Layered Pnictogens: Promising Materials for the Development of Voltammetric Sensors for Metal Ion Determination †

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Following the great success of graphene, 2D layered materials based on the elements of group VA (also known as pnictogens) open up many possibilities in the field of sensors. This group of materials include phosphorene, bismuthene, antimonene, and arsenene and offer many desirable features for electrochemical sensors such as high surface area, excellent mobility, morphology tunability, and the possibility to modify their surface properties [1].

In this work, the modification of screen-printed electrodes with 2D layered pnictogens was explored for the enhanced anodic stripping voltammetric determination of metal ions. Particular emphasis was placed on bismuthene and antimonene given both their lower toxicity and the ability of bismuth and antimony films to mirror the analytical performance of mercury electrodes for metal ion determination. Thus, bismuthene and antimonene, as well as some of their derivatives, were tested and compared looking for an improved analytical performance (i.e, low limit of detection, LOD, high sensitivity), which was evaluated for the simultaneous determination of Pb(II) and Cd(II). Out of all the tested materials, bismuthene demonstrated the best analytical performance, providing, for a 120 s preconcentration time, a linear response from 0.2 to 25.0 μg L^{-1} for both Pb(II) and Cd(II) and LODs of 0.06 and 0.07 μg L^{-1} for Pb(II) and Cd(II), respectively [2]. The achieved LODs also represent an improvement over other bismuth-based electrochemical sensors such as those based on bismuth nanoparticles or commercially available sputtered screen-printed electrodes.

Reference:

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