

ABSTRACT

Electrochemical sensors are well-established devices to detect the presence of different analytes in a wide range of fields such as environmental, healthcare diagnostics, and biological applications. Screen-printing technology has offered a low-cost, facile, and highly reproducible approach in the fabrication of disposable electrochemical sensors. The current market of disposable sensors has expensive and non-biodegradable products that are used in the fabrication process such as conductive inks and dielectric materials. Therefore, this study aims to develop a low-cost screen-printed electrochemical electrode sensor for the detection of heavy metal ions in wastewater. Modification of the working electrode with nanomaterials/nanostructures either during or post the fabrication process, has been known to promote the sensors structural and electronic properties and thus improving the electro-catalytic activity. The modified Hummer's method was used to synthesize both the graphene oxide (GO) as well as the conductive ink as it offers strong electrochemical properties and a high conductivity.

Additionally, the synthesized GO ink was used to manufacture a screen-printed electrochemical sensor to detect the traces of Cd^{2+} and Pb^{2+} ions in wastewater by stripping anodic square-wave voltammetry. To improve the stability and selectivity of the electrochemical sensors, g- C_3N_4 was used. By using cyclic voltammetry and square wave voltammetry Cd (II) and Pb (II) were detected at a potential close to 0.5 V observing a linear range from 10 mg/l to 110mg/l. Cyclic voltammetry (CV) presented the redox behaviour of the g- C_3N_4 nanoparticles on SPEs with sodium acetate buffer solution as a supporting electrolyte with a pH of 4,5. As the scan rate increases, a shift and an increase in the oxidation and reduction peaks potential were observed.

In conclusion, the GO ink with 30 wt% of the CMC binder exhibited good stability and screen-printing properties. The paper-based screen-printed electrode modified with g- C_3N_4 showed good selectivity in the detection of Cd^{2+} and Pb^{2+} ions over a linear range of 10 to 110 mg/l with LOD=0,16 mg/l, and Cd^{2+} ions over a linear range between 10 to 110 mg/l with LOD=0,79 mg/l, for Pb^{2+} ions.