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(57) Abstract :
Water being an essential natural resource for sustaining life, yet it is not always readily available. In the current scenario, rapid urbanization and exponential industrial growth has resulted in a significant increase in both surface and groundwater contamination. Due to environmental destruction, industrialization, population explosion, and drastic climatic change, there is an apparent increase in the loss of healthy water reserves and there is an unprecedented need for potable water. The discharge of toxic chemicals and complicated effluents into watersheds has caused major problem not only to the environment but also effected human life across the globe. The Emerging contaminants comprise of modern chemical solvents, plasticizers, surfactants, pesticides, fire retardants, personal care products (PCPs) and pharmaceuticals (PhACs) . Electrochemical sensor analysis, particularly stripping voltammetry, has proved to be very attractive for on-site monitoring of heavy metal ions in the water bodies as well as for addressing other environmental needs . These sensors are inherently sensitive and selective towards electroactive species, they are fast, accurate, portable, and can be made inexpensive . Generally, carbon materials (graphite or glassy carbon) are widely used as electrode materials in analytical and industrial electrochemistry due to their low cost, chemical stability, wide potential window, relatively inert electrochemistry, and electrocatalytic activity for a variety of redox reactions. Furthermore, electrochemical sensors can be easily packed into a compact system. Bulk electrodes have been developed in anodic stripping voltammetry (ASV) analysis of heavy metals , but the sensitivity is very low . An effective way to solve these problems is to use micro- or nanoelectrodes. Compared with bulk electrodes, nanoelectrodes have several advantages, such as a higher surface area, which can improve the electron transfer rate, the increased mass-transport rate, the lower solution resistance, and the higher signal-to-noise ratio. Particularly, graphene has tremendous potential for electrochemical applications as a novel electrode material . Considering the excellent properties of graphene, such as large surface-to volume ratio, high conductivity and electron mobility at room temperature, robust mechanical properties, and flexibility, graphene-based electrochemical sensors have been developed for environmental analysis and the detection of heavy-metal ions . The electrochemical responses of graphene electrodes have more favorable electron-transfer kinetics than graphite and glassy carbon electrodes. Li et al. reported that Nafion–graphene (Nafion-G) composite film-based electrochemical sensors not only exhibited improved sensitivity for metal ion (Pb^{2+} and Cd^{2+}) detection, but also alleviated interference due to the synergistic effect of graphene nanosheets. Willemse et al. also reported a Nafion-G nanocomposite solution in combination with an in situ plated mercury film electrode as a highly sensitive electrochemical platform for the determination of Zn^{2+}, Cd^{2+}, Pb^{2+}, and Cu^{2+} by square-wave anodic stripping voltammetry. Recently, graphene-based nanosensors were fabricated with the aim of employing them in electrochemical heavy-metal ion sensors, such as graphene decorated with metal or metal oxide. Gong et al. distributed monodispersed Au NPs onto the graphene nanosheet matrix, which could greatly facilitate electron-transfer processes between Hg^{2+} and the electrode; this exhibited a good performance for the detection of Hg^{2+} in practical water samples. Graphene-based electrochemical sensors also show good performance in real water sensing, which is critical for practical applications. Recently, Liu et al. reported reduced GO composite films for the selective detection of Ag^{+} in natural waters, which showed a high sensitivity and a low detection limit (1nM) . The proposed graphene-based water sensor devices combined with a nanomaterials will be attractive to detect an individual ion as well as simultaneously monitor multiple metal ions with a low detection limit bridging the technological gap between signal transduction, processing.

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