

Utilization of reduced graphene oxide/cadmium sulfide-modified carbon cloth for visible-light-prompt photoelectrochemical sensor for copper (II) ions

ABSTRACT

A newly developed CdS/rGO/CC electrode was prepared based on a flexible carbon cloth (CC) substrate with cadmium sulfide (CdS) nanoparticles and reduced graphene oxide (rGO). The CdS was synthesized using an aerosol-assisted chemical vapor deposition (AACVD) method, and the graphene oxide was thermally reduced on the modified electrode surface. The existence of rGO in the CdS-modified electrode increased the photocurrent intensity of the CdS/rGO/CC-modified electrode by three orders of magnitude, compared to that of the CdS/ITO electrode and two orders of magnitude higher than the CdS/CC electrode. A new visible-light-prompt photoelectrochemical sensor was developed based on the competitive binding reaction of Cu²⁺ and CdS on the electrode surface. The results showed that the effect of the Cu²⁺ on the photocurrent response was concentration-dependent over the linear ranges of 0.16–1.0 M and 1.06–40.0 M with a detection limit of 0.05 M. The results of a selectivity test showed that this modified electrode has a high response toward Cu²⁺ compared to other heavy metal ions. The proposed CdS/rGO/CC electrode provided a significantly high potential current compared to other reported values, and could be a practical tool for the fast, sensitive, and selective determination of Cu²⁺.

Keyword: Graphene; Cadmium sulfide; Carbon cloth; Photoelectrochemical sensor; Copper (II) detection