A Cost-Effective Hierarchical Bimodal Nanoporous Gold Sensor for the Electrochemical Detection of Bisphenol F

Vasireddy, Ayush (School: Marquette High School)

Environmental contaminants, particularly bisphenols, have become increasingly widespread. As a result, global water pollution has become of greater concern. Water pollution has a profound effect on global health, contributing to many illnesses such as cancer and skin diseases. Although it is increasingly used, Bisphenol F (BPF) is almost unregulated. BPF is equally active as or, in certain comparisons, more active than BPA and demonstrates signs of reproductive toxicity and oxidative stress induction. This study examined the effect of hb-NPG on altering the detection ability of BPF when drop-cast onto the surface of a screen-printed carbon electrode (SPCE). This study was the first to fabricate a hierarchical bimodal nanoporous structure of gold and analyze its electrochemical detection performance. Scanning electron microscopy (SEM) and electron-dispersive X-ray spectroscopy (EDS) were used to characterize the hb-NPG structure. Cyclic voltammetry (CV) was used to examine the redox behavior of the electrochemical sensor before and after hb-NPG surface modification. SEM and EDS confirmed that hb-NPG primarily contained gold with trace amounts of silver. Moreover, the analysis of pore size confirmed the hierarchical bimodal structure. The hb-NPG demonstrated a greater surface area than NPG. The CV analysis revealed a 2.30-fold (130.4%) increase in oxidation rates for 100 μM BPF when the bare SPCE surface was modified with hb-NPG. The results obtained from this study indicate a cost-effective detection ability of environmental contaminants through hb-NPG modification.

Awards Won:
Second Award of $2,400
Arizona State University: Arizona State University ISEF Scholarship (valued at up to $32,000 each)
YM American Academy: Third Award of $500.00
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