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Ultra-sensitive phenol sensor based on overcoming surface fouling of Reduced Graphene Oxide-Zinc Oxide composite electrode

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Abstract

A major drawback of non-enzymatic approach for phenol detection is surface fouling which results from the electrochemical oxidation of phenol to polymeric products, thereby restraining the electrode process to low concentrations and limited to single time use. In this work, we report a novel approach for stable, non-enzymatic phenol detection using reduced Graphene Oxide (rGO)-Zinc Oxide (ZnO) composite modified Glassy Carbon Electrode (GCE) which eliminates the surface fouling effect by allowing precise selection of the sensing peak. Here, the rGO-ZnO composite was synthesized using a wet chemical method wherein rGO and ZnO were formed in-situ from GO and Zinc Acetate, respectively. The phenol sensing was investigated by differential pulse voltammetry (DPV) which yielded two peaks at 0.35 V and 0.94 V. Phenol detection was performed at a lower potential (0.35 V) as it eliminates the need for surface renewal of the electrode prior to each scan caused due to surface fouling thus facilitating stable and reproducible detection. The as-fabricated sensor responded linearly to phenol over two ranges, one in the range 2-15µM with a ultrahigh sensitivity of 1.79µA/µM cm^2 and the other in the range 15-40µM with a sensitivity of 0.389µA/µM cm^2 with good reproducibility, stability,