

Electrochemical sensor based on single-walled carbon nanotube/ ZnO photocatalyst nanocomposite modified electrode for the determination of paracetamol

ABSTRACT

Electrodes modified with single-walled carbon nanotube/zinc oxide were prepared for electrochemical characterization and sensing of paracetamol. The modified electrodes were characterized using cyclic voltammetry, field emission scanning electron microscopy and energy dispersive X-ray spectroscopy. The single-walled carbon nanotube/zinc oxide-modified glassy carbon electrode allowed an increased oxidative peak current of paracetamol with an enhancement factor of 4, in comparison to the bare electrode. Linear calibration plots of oxidative peak currents against paracetamol concentrations were obtained with a correlation coefficient as high as 0.994. The scan rate study suggested that the electrocatalytic processes were affected by both diffusion and adsorption processes. The effect of pH study indicated that the modified electrodes performed well under acidic conditions. The field emission scanning electron microscopy images showed the surface porosity of the composite with particle size increased after the electroanalysis. The energy dispersive X-ray analysis revealed the presence of carbon, zinc, and oxygen in the composite prior to electroanalysis, and additional phosphorus and potassium elements after electroanalysis. The analytic performance of this modified electrode was evaluated for the detection of paracetamol in commercial drugs with satisfactory results. Ultraviolet-visible spectrophotometry measurements were used to determine the band gap of single-walled carbon nanotube/zinc oxide nanocomposite. An unprecedented band gap of 3.11 eV was estimated. The proposed modified electrode exhibited better electrocatalytic activity in the determination of paracetamol. Potentially, the developed single-walled carbon nanotube/zinc oxide-modified glassy carbon electrode could be used for analytical applications.

Keyword: Carbon nanotubes; Cyclic voltammetry; Glassy carbon; Paracetamol; Zinc oxide