Desempenho Fotoeletroquímico de Nanocompósitos de Óxido de Grafeno Reduzido Decorados com Pontos Quânticos de CdTe de Diferentes Tamanhos na Oxidação de Dopamina e Ácido Úrico

Photoelectrochemical Performance of CdTe Quantum Dots of Different Sizes Decorated on Reduced Graphene Oxide Towards Dopamine and Uric Acid Oxidation

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Abstract: Photoelectrochemical (PEC) approach has emerged as a promising low-cost electroanalytical technique. PEC sensing has received increasing attention due to its potential to detect biomolecules and pollutants towards the charge transfer mechanism between a photoactive material and electrode surface upon light irradiation. In order to obtain an effective and reliable PEC sensor, it is important to fully understand the mechanism and properties of photocatalytic materials in addition to the design of the photoelectrode systems to capture and transport electrons. Herein, we investigated the photoelectrochemical performance of CdTe quantum dots (QDs) decorated on reduced graphene oxide (RGO) towards dopamine and uric acid oxidation. Thereby, we obtained three different size CdTe QDs using RGO as template for QD growth in solution medium based on the methodology described by Kaniyankandy et al. (2012) [1]. The nanocomposites were characterized by Transmission Electron Microscopy (TEM), UV-vis and Raman spectroscopies, and photoluminescence. The size of CdTe QDs in the nanocomposite was found to be ~3.0, 4.0 and 4.5 nm, those are associated with the emission wavelength of 570 nm (yellow), 670 (orange) and 710 nm (red), respectively. To evaluate the size effect on the photoelectrochemical performance of the nanocomposites, we chose dopamine and uric acid as electrochemical probes. Firstly, we immobilized the nanocomposites on screen printed electrodes (SPE), followed by dropping Nafion® 0.5%. The SPEs were composed by carbon ink as working and counter electrodes and silver/silver chloride ink as the reference one. The electrochemical behavior of different modified electrodes with each nanocomposite was investigated in 0.1 M Britton-Robinson buffer pH 7.0 in the absence of light trough differential pulse voltammetry. Remarkably, the dopamine was oxidized at -0.11 V in the SPE/CdTeQD@RGO exhibiting a significant potential shift in comparison to bare SPE and SPE/RGO (~0.15V) and several reported dopamine sensors [2]. Uric acid was simultaneously detected at +0.03 V. Additionally, a superior increase in the current peak was observed for the SPE/CdTeQD@RGO modified with CdTe QD emitting at 570 nm. Finally, we have achieved interesting outcomes regarding CdTeQD@RGO composites and further studies under irradiation need to be performed.

Acknowledgments:
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