New miniaturized electrode based on platinum black and poly-eugenol for NO sensing

Leonardo M. A. Ribeiro[1,2*], Jie Sun[2], Mauro Bertotti[1], Fethi Bedioui[2], Sophie Griveau[2]

[1] Instituto de Química – USP, [2] Chimie ParisTech – PSL

**e-mail: leonardo.ma.ribeiro@usp.br*

Nitric oxide (NO) is a fundamental mediator in regulating the dilation and contraction of blood vessels and being involved in many biological functions [1]. The direct detection of NO presents significant analytical challenges due to its low concentrations (pico to nanomolar range) and the presence of electroactive interferents in the cellular environment, such as dopamine, ascorbic acid, uric acid, and H_2O_2 [2]. Electrochemistry combined with microelectrodes and electrode surface modification can meet the requirements for real-time NO detection without the addition of any tag or label in the medium, minimizing the perturbation of the microenvironment of the measurement. In this work, we present the development of a new miniaturized electrode for the detection of NO in media containing H_2O_2. The sensor was fabricated by modifying a platinum disc ultramicroelectrode (25 µm diameter) in two steps: (1) deposition of Platinum Black (PtB) and (2) electrodeposition of a poly-eugenol. Scanning electron microscopy (SEM) analysis confirmed the morphological changes, including increased surface roughness after PtB deposition and membrane formation due to the poly-eugenol layer. Electrochemical characterization demonstrated that the PtB/poly-eugenol modification enhanced the current response for nitric oxide oxidation by 3-fold compared to a platinum/poly-eugenol electrode. The modified sensor showed reduced interference from nitrite, ascorbic acid, and uric acid. Calibration plots for NO were obtained in the range of 0.48 to 9 µmol L^{-1} in the presence of three different concentrations of H_2O_2. The sensor also demonstrated good reproducibility, repeatability, and stability over one week when stored in phosphate-buffered saline (PBS).

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