

Paracetamol: Quantification of an Emerging Pollutant Using a Nanoporous Gold Microelectrode

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Emerging pollutants are chemical compounds detected in different environmental matrices, which can occur naturally or because of anthropogenic actions. The main characteristic of these compounds is that they are not periodically monitored and are not included in specific legislation, even though they present a risk to the ecosystem in which they exist. Thus, paracetamol (acetaminophen), one of the most consumed medications in the world, can be classified as an emerging pollutant due to its presence in effluents and surface waters, resulting from inadequate disposal [1]. In this context, developing methods for detecting and quantifying this pollutant is becoming increasingly important for its control. Hence, the main goal of this work is to fabricate a gold-modified microelectrode as an alternative to increasing the selectivity and sensitivity in paracetamol quantification. Modifying the microelectrode surface involves the electrodeposition of nanoporous by an anodization process in a 0.5 M H₂SO₄ solution [2]. The formation of a nanoporous gold (NPG) layer generates catalytic sites due to the presence of surface and/or edge defects, and a potential shift of 154 mV was obtained comparing CVs recorded in paracetamol solution using bare and NPG microelectrodes. Calibration plots were obtained by amperometry ($E = 0.80$ V) within the 16.8 to 133.5 μ M concentration range (Figure 1). The calibration plot obtained with the NPG

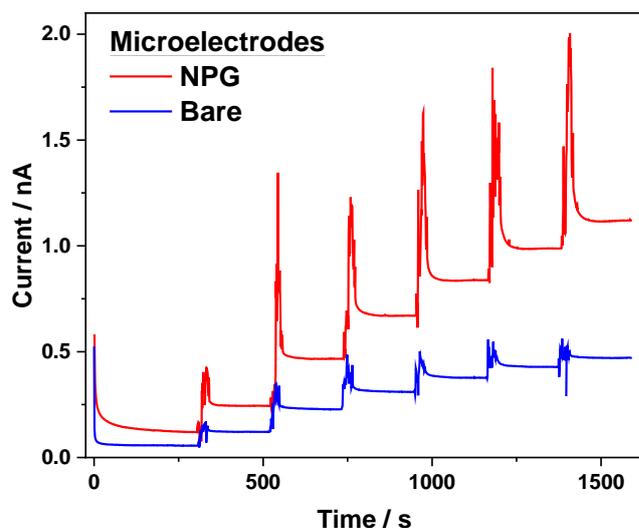


Figure 1- Amperograms recorded with **NPG** and **bare** microelectrodes within the 16.8 to 133.5 μ M paracetamol concentration range. $E = 0.80$ V.

microelectrode has a high linearity, with an $R^2 = 0.9999$ and a sensitivity 2.5-fold higher than the bare one because the catalytic sites facilitated the anodic oxidation of paracetamol. The limit of detection (LoD) and the limit of quantification (LoQ) were calculated as 1.9 μ M and 5.8 μ M, respectively. The quantification of paracetamol in a medication (200 mg/mL) was performed in triplicate, resulting in a concentration value ((185 \pm 7) mg/mL) close (-7.5%) to that specified by the manufacturer. Future investigations will focus on optimizing the modification parameters to obtain more stable NPG microelectrodes and an even lower LoD, as well as expanding the analysis to real environmental matrices, ensuring a robust and reliable approach for monitoring this emerging pollutant.

[1] Júnior GJS, Selva JSJ, Sukeri A, Gonçalves JM, Regiart M, Bertotti M, Talanta, 226, 2021, 122130

[2] Pereira PAR, Campos AM, Mendonça CD, Calegari ML, Machado SAS, Oliveira Jr ON, Sensors and Actuators B:Chemical, 252, 2017, 165.

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