

## II Fronteiras em eletroquímica e eletroanalítica: avanços realizados por jovens Mulheres cientistas

### Screen printed electrode modified with reduced graphene oxide obtained by $\gamma$ radiation for levonorgestrel detection

Raynara M. S. Jacovone<sup>a</sup>, Juliana M. S. de Jesus<sup>b</sup>, Antonio C. S. C. Teixeira<sup>b</sup>, Solange K. Sakata<sup>a</sup>  
[raynara.silva@usp.br](mailto:raynara.silva@usp.br)

<sup>a</sup>Radiation Technology Center, Nuclear and Energy Research Institute (IPEN/ CNEN – SP) Av. Professor Lineu Prestes, 2242, São Paulo, Brazil

<sup>b</sup>Research Group in Advanced Oxidation Processes (AdOx), Department of Chemical Engineering, Escola Politécnica, University of São Paulo, Avenida Prof. Luciano Gualberto, tr. 3, 380, São Paulo, Brazil

**INTRODUCTION** Screen printed electrodes (SPE) have attracted attention due to their fast and accurate response, high sensibility, specificity, and portable platforms. To increase their electrical carrier mobility and sensibility, the working electrode surface has been modified using reduced graphene oxide (rGO) [1]. In the present work, gamma radiation reduced Graphene Oxide (GO) to produce rGO in a sustainable method that avoids toxic reagents and the production of hazardous chemical residues [2]. Levonorgestrel (LNG) is a synthetic contraceptive hormone of worldwide concern, being harmful to aquatic organisms, even at low concentrations, e.g., 0.024 nmmol L<sup>-1</sup> [3].

**METHODOLOGY** Reduced graphene oxide was obtained using GO (10 mg mL<sup>-1</sup>) dispersed in a water/isopropanol. The sample was irradiated in the Multipurpose Gamma Irradiation Facility at CETER/IPEN/CNEN-SP, at a dose rate of 10 kGy h<sup>-1</sup> and 80.0 kGy in inert conditions. The SPE was modified by drop casting 10  $\mu$ L of the rGO solution and dried at room temperature. The rGO-SPE was characterized by Raman spectroscopy and the electrochemical behavior of LNG was investigated using cyclic voltammetry (CV) in phosphate buffered saline (PBS) medium (pH 7.0) within the oxidation window 0.0-1.0 V and 25 mV s<sup>-1</sup> (Fig. 1).

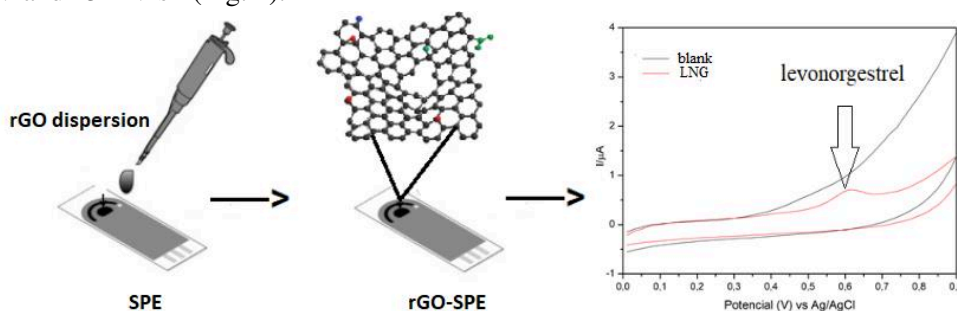
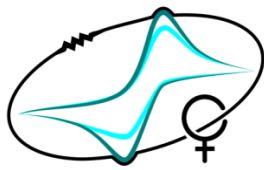


Fig. 1 – Schematic representation of SPE preparation and electrochemical behavior of LNG

**RESULTS** The Raman spectrum showed D (1.347 cm<sup>-1</sup>) e G (1.594 cm<sup>-1</sup>) bands for both rGO-SPE and SPE. The I<sub>D</sub>/I<sub>G</sub> ratio was 0.85 and 1.40 for SPE and rGO-SPE, respectively. For rGO-SPE, cyclic voltammograms showed a reversible behavior in K<sub>4</sub>Fe(CN)<sub>6</sub> [2 mmol L<sup>-1</sup>] and in the presence of LNG [64 × 10<sup>-9</sup> mol L<sup>-1</sup>], anode inflection was observed at 0.6 V, associated with the non-reversible oxidation reaction of LNG.

**CONCLUSIONS** The surface of the rGO-SPE was uniform, being the I<sub>D</sub>/I<sub>G</sub> ratio for the covered electrode higher than that exhibited by the uncovered one. This electrode presented electrochemical response to LNG, even at low concentrations, thus proving its application as an electrochemical sensor for the LNG hormone.



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