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Glass-based biosensing device for monitoring CA15-3 cancer biomarker

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Cancer is a leading cause of death worldwide, being breast cancer amongst the most common forms of the disease. Advances in health-related practices have anticipated the detection of breast cancer and allowed establishing appropriate follow-up procedures. Monitoring circulating biomarkers as CA15-3 is amongst the several tools used to this end. Thus, there is great interest in developing new biosensors for CA15-3 that are suitable for a point-of-care (POC) use.

This work describes the application of an eco-friendly substrate to assembly a new sensor for CA15-3 detection in POC. It consists in the development of an artificial antibody based on molecularly imprinted polymer (MIP) technology and electropolymerization of *o*-phenylenediamine (*o*-PD). The polymer was tailored on a glass microscope slide hand-coated with a commercial conductive carbon inks based on screen-printed electrodes technique (C-glass SPEs). Afterwards, the surface was modified with platinum nanoparticles (Pt NPs), followed by a bottom-up assembly of the artificial antibody for CA15-3 detection.

The analytical performance of the resulting devices was performed through square wave voltammetry (SWV) and electrochemical impedance spectroscopy (EIS), showing sensitive readings for CA15-3 concentrations ranging between 1.0 mU/mL and 100.0 U/mL in phosphate buffer (PB) pH7.50, with limit of detection (LOD) below 1.4 mU/mL. Chemical modifications of the surface were characterized using a confocal Raman-AFM spectroscopy and Scanning Electronic Microscopy (SEM). In general, the CA15-3 artificial antibody was successfully applied in spiked fetal bovine serum (FBS) samples, demonstrating linear responses below to the normal physiological levels (30.0 U/mL). Therefore, the developed sensing material may be a simple, selective and a promising tool to monitor this cancer biomarker in a clinical context.

***Keywords*:** Cancer, CA15-3 biomarker, Protein surface imprinting, Glass substrate, Homemade screen-printed electrodes (C-glass SPEs).

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