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The potential of molecular imprinting as a biosensing devices for monitoring the CEA cancer biomarker

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Colorectal cancer is the third most common type of cancer and the major cause of the death throughout the world. Widely known, carcinoembryonic antigen (CEA) is an important tumour marker responsible for clinical diagnosis of 95% of all colon tumors[1]. The discovery of novel non-invasive biomarkers, as CEA, and its fast determination at low cost is presently required, to enable its use over wide screening programs and applications in point-of-care context, and, thus, its monitoring quite early.

As a novel approach, this work proposes a novel support with molecular imprinted polymer (MIP) for CEA cancer biomarker based on carbon ink matrix linked by sol-gel chemistry on top of conductive glass covered by fluorine-doped tin oxide (FTO glass). In brief, the electrical biosensor was tailored on top of a disposable conductive glass electrode, following a bottom-up approach. The several stages of this process included the chemical modification of a homemade carbon ink layer and the assembly of a MIP or non-imprinted polymer (NIP) layer.

The analytical performance of the obtained devices was followed by electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV). Chemical modifications of the surface were characterized using Fourier Transform Infrared (FTIR), and Raman spectroscopy with confocal microscopy. Overall, the MIP/FTO glass-based device displayed linear responses to CEA in EIS assays from 2.5×10^{-3} µg.mL^{-1} to 1.25 µg.mL^{-1} in PBS buffer, with detection limits of 2.5×10^{-3} µg.mL^{-1}. Successful detection of CEA was, also, achieved in spiked samples of fetal bovine serum.

In conclusion, the devices developed are a promising tool for the monitoring of CEA in a point-of-care applications, due to its detection capability below the normal physiological levels expected for this cancer biomarker, simplicity of manufacture, low-cost and good sensitivity and selectivity.

[1] Kemmegne-Mbouguen, J.C.; Ngameni, E.; Baker, P.G.; Waryo, T.T.; Kgarebe, B.; Iwuoha, E.I. *Int. J. Electrochem. Sc.* **2014**, 9, 478-492.

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