Carbon Black modification towards electrochemical biosensors

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Abstract

The development of innovative electrical biosensors for early detection of cancer powered by a passive direct methanol fuel cell (DMFC) is the core of the work presented. In fact, the current state of the art of electrical detection methodologies underpin the progressive drive towards miniaturised, sensitive and portable biomarker detection protocols [1], which in our case was synergistically associated with the molecular imprinting strategy of the biomarkers [2].

Having as target a protein biomarker of the rectal colon cancer, carcinoembryonic antigen (CEA) will be recognized by a proper molecularly imprinted polymer (MIPs) matrix, assembled inside the DMFC. The process of molecular imprinting involves the formation of recognition cavities by connecting different polymeric building blocks under the guidance of a molecular template (or print molecule) (**Figure 1**).

Besides the optimization of the polymer/protein matrix, the proper modification of electrocatalysts within the DMFC is also considered. For this purpose, Carbon Black is being modified with pyrenes, namely 1-Pyrenemethyl methacrylate (PyMMA) or 1-Pyrenebutyric acid (PyBA) (**Figure 2**), and the resulting modification followed by thermogravimetric analysis and different spectroscopic techniques, like FTIR, Raman and UV-Vis.

This approach has been applied with success to the dispersion of carbon nanotubes [3], showing that non-covalent interactions (π - π stacking) is attractive in terms of the stability and homogeneity of the functionalization. This surface functionalization is expected to anchor the MIP formation and compared in terms of the effectiveness of polymer binding and performance of the DMFC.

In a first approach, the MIP material is prepared by free radical co-polymerization of vinyl based monomers and crosslinkers in a buffered aqueous medium. Morphological observations and detailed experimental characterization reveals that CB surface modifications occurred.

Acknowledgments

The authors acknowledge funding from European Union's Horizon 2020 research and innovation program through H2020-FET-Open-Symbiotic, GA 665046.

References

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Figures

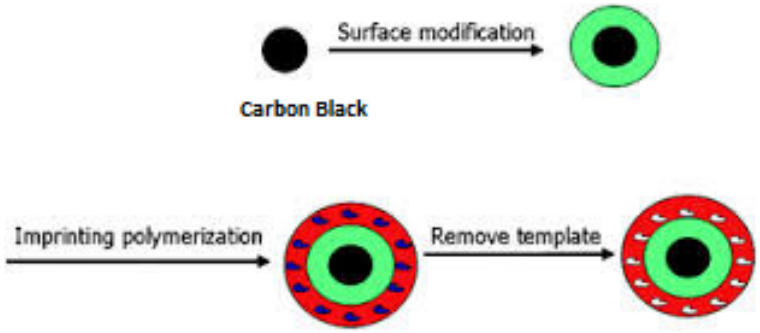
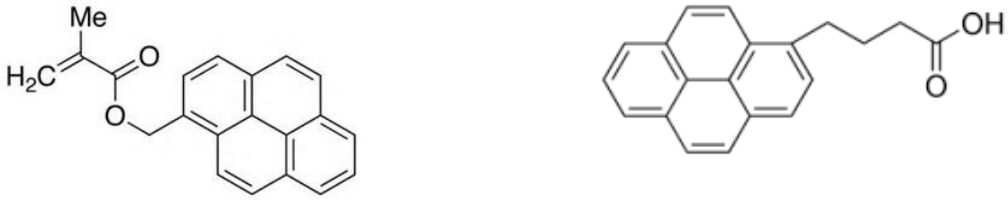


Figure 1. Schematic presentation of the molecular imprinting approach at the carbon black surface.



a) **b)**

Figure 2. Molecular structure of **a)** 1-Pyrenemethyl methacrylate (PyMMA) and **b)** 1-Pyrenebutyric acid (PyBA).