

A New Approach in Electrochemical Biosensing Technology Using 3D Printed Carbon Electrodes

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Abstract

3-dimensional printing (3DP) technology is gaining importance every day because it allows for diversity in design and portable production. 3DP can realize production in a shorter time compared to traditional methods. The fact that it provides the possibility of production in different geometric shapes allows the advantages of various geometries to be used in different bioanalytical applications [1,2]. With the 3D printed working electrodes being produced in our laboratory, it is aimed to pave the way for the development of nucleic acid-based biosensors (genosensors) that can be used in routine analyses for the determination of different biomarkers/molecules in the clinical field. In this study, a FDM 3D printer working with carbon black and PLA-based filament was used to produce sensor surfaces, which we produce as an alternative to the working electrodes of the triple electrode system in electrochemical sensors. In this direction, fish sperm dsDNA and ssDNA oligonucleotide representing Escherichia coli bacteria are biomodified to 3DcbE's (for label-free voltametric detection). Differential pulse voltammetry technique is used for label-free detection of hybridization. The nanostructure of the sensor surface was observed by SEM method. And then an electrochemical aptasensor design was carried out for the rapid, specific and reliable determination of the Myelin Basic Protein (MBP) molecule, which is a biomarker of multiple sclerosis (MS) disease [3]. In addition, the Drug-DNA Interaction with 3DcbE's has also been analyzed using doxorubusin, and it has been shown that the guanine oxidation signal decreases after the interaction of DNA and DOX. It is envisaged that the functionalization and modulation of the structural properties of CB/PLA electrodes will provide new possibilities for the immobilization of materials with electrocatalytic properties, thereby allowing the detection of a wide range of analytes.

References

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Figures

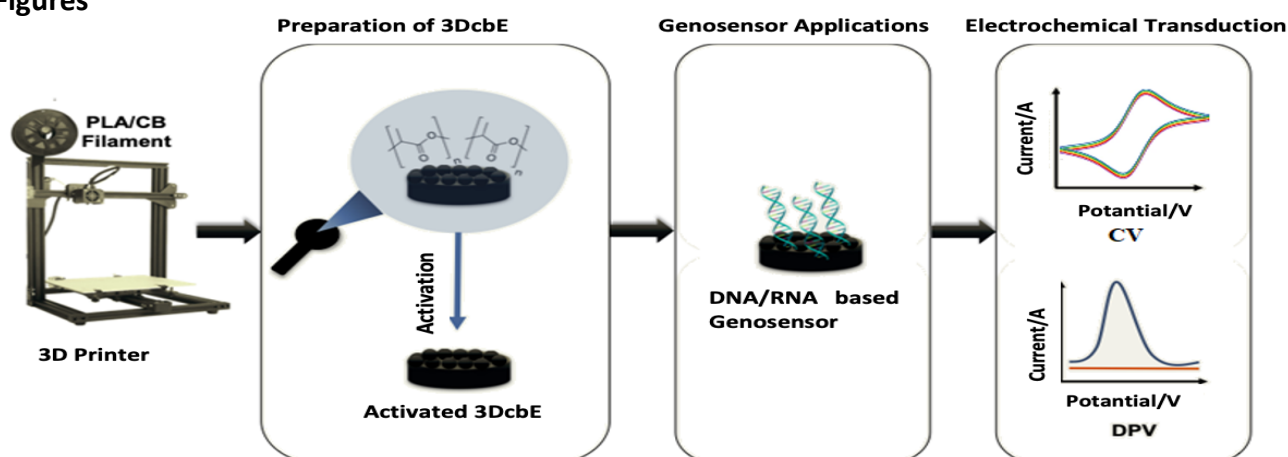


Figure 1: Schematical presentation of the study procedure