

7th EURO BIOSENSORS AND BIOELECTRONICS CONFERENCE

July 10-11, 2017 Berlin, Germany

An overview of conducting polymers based biosensors

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In view of their facile automation, wide linear range and low limits of detection, conducting polymers have been extensively employed as biosensors. Furthermore, electrochemical synthesis of conducting polymers can be carried out effortlessly on various electrodes leading to the robust adherence of the polymer films. Among various sensing applications of conducting polymers, enzymatic and non-enzymatic sensing of glucose, urea, dopamine, etc., deserves their biological importance. Conducting polymers extensively investigated in this context encompass polyaniline and polypyrrole. The enzymatic sensing of glucose using polyaniline nanofibers has been demonstrated using cyclic voltammetric, amperometric and impedimetric analysis with impressive detection limits and calibration range. The potentiodynamic polymerization of pyrrole on Pt is shown to yield non-enzymatic sensors of urea with satisfactory linear range of calibration. The electrochemical sensing of other compounds such as levodopa, dopamine, etc., will be highlighted.

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Point-of-care nanosensor applied to diagnosis of high morbimortality diseases

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Statement of the Problem: Wide-scale point-of-care diagnostic systems hold great promise for economic, rapid and practical diagnosis of several diseases, benefiting those with high morbimortality rates. Electrochemical biosensors using amperometric transduction have several advantages as compared to optical and acoustical transductions due to their ease scale up, fast response and low cost connection with compact (hand-held) analyzers. However, several drawbacks on performance have limited their large use in clinical diagnostic. The purpose of this study is to describe some strategies of sensor platforms using conducting polymer integrating carbon allotropes including carbon nanotubes, graphene and fullerene, in order to overcome challenges required as a low limit of detection and a good reproducibility.

Methodology & Theoretical Orientation: Different nanocomposites were electro-synthesized by using a mixture of the respective carbon allotrope and monomers of conductive polymer (pyrrole, thiophene, ethylenediamine, etc.). Afterwards, antigen or antibodies were covalently immobilized on the sensor surface, followed by blocking of non-specific bindings.

Findings: It was observed that the synergism between these materials (conductive polymer and carbon allotrope) has increased the electron transfer charge, electrode surface area, amount of immobilized biomolecules, faradaic current and conductivity; besides, the functionalized nanomaterials have also promoted covalent immobilization and exposure of reactive sites to analytes. Cardiac troponin T, dengue, hepatitis and degenerative disease were the analytes detected in these immuno-sensors.

Conclusion & Significance: Label-free and redox probe-free responses using amperometric electrochemical technique for detecting analytes in serum and whole blood was obtained. The analytes were found at clinical range of relevance for diagnosis of corresponding diseases. These prospective sensors are potentials for point-of-care testing with ease scale-up and greater performance.

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