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Eletrodetection of oligonucleotide hybridization on poly(4-aminophenol)

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Abstract – Biosensors based on DNA are largely studied by their importance in diagnosis of diseases. In this work, we investigated the incorporation and detection of 16 mer-synthetic oligonucleotide, in graphite electrodes modified with poly(4-aminophenol), using ethidium bromide as hybridization indicator. The dsDNA formation was monitored by means of the increase in the current signal, caused by accumulation of the intercalator on the surface of the electrode. These results indicate that it is possible to immobilize and to detect oligonucleotides on the modified electrode surface.

The chemical modification of the electrodes surface offers a great potential to increase the efficiency and applicability of electrochemical biosensors. The use of polymer films offers several advantages in the construction of biosensors since provide biocompatibility and plays an important role in the sensitivity and stability of biosensor [1].

Electrochemical DNA sensing is a promising technique of nucleic acid analysis because of its speed, high sensitivity and low cost. This technique employs immobilized DNA sequences on the sensor surface as the recognition element and the sequence-specific hybridization can be monitored and analyzed [2].

Ethidium bromide (EB) bind to polynucleotides through intercalation, with planar aromatic group stacked, between base pairs [3]. In this work, it was evaluated the voltammetric detection of 16 mer-synthetic oligonucleotide, polyGA (5´-GGGGGGGGAAAAAAAA-3´), before or after hybridization with the complementary target, poly CT (5´-CCCCCCCCTTTTTTTT3`).

Studies carried out by our group shown that poly(4-aminophenol) is efficient to immobilization of nitrogenated bases of DNA, since, the magnitude of the current increase when compared to bare graphite electrodes [4].

In this work, the electrochemical studies were carried using a 6-mm graphite disk working electrode. Platinum and a saturated calomel electrode (SCE) were used as the counter and reference electrode, respectively. A CH Instruments model 420A potentiostat was used for the electrochemical measurements.

The potential dynamic growth of the film on the graphite electrode surface was performed by continuous cycling of potential using a solution consisting of 4-aminophenol in $HClO_4$.

After electropolymerization, the oligonucleotide was immobilized on the modified electrodes surface. The hybridization experiments were carried out in incubated solutions containing the complementary oligonucleotide.

It was observed an increase in the current values after incubation with the complementary oligonycleotide. These increase can be attributed to hybridization reaction, or be it, duplex formation.

It was possible to immobilize and to detect synthetic oligonucleotide on the poly(4-aminophenol). The results obtained are a contribution for development of genosensors.

[1] T.A.R. Silva, L.F. Ferreira, L.M. Souza, L.R. Goulart, J.M. Madurro, A.G. Brito-Madurro . Mater Sci. Eng. C 29 (2009) 539-545.
[2] F.B Silva, S.N. Vieira, L.R. Goulart, J.F.C. Boodts, A.G. Brito-Madurro, J. M. Madurro. Int. J. Mol. Sci. 9 (2008) 1173-1187.
[3] S. Liu, J. Ye, P He, Y. Fang. Anal. Chim. Acta 335 (1996) 239-243
[4] D.L. Franco, A.S. Afonso, L.F. Ferreira, R. A. Gonçalves, J.F.C. Boodts, A.G. Brito-Madurro, J.M. Madurro. Polym. Eng. Sci. 48 (2008) 2043-2050.