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Poster Presentations

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Quantification of a breast cancer-related miRNA using an electrochemical biosensor: Application of a novel graphene/gold/quantum-dot nanocomposite

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Background: Breast cancer is one of the second most common cancer diagnosed in women. Most of the cases are diagnosed at late stages in which treatments are less effective. Therefore, there is a global challenge finding novel ways to early detect all types of cancer including breast cancer. In this way, conventional methods suffer with low selectivity and sensitivity. However, molecular biomarkers such as miRNAs, which are small non-coding RNAs, are emerged in modern medicine as feasible detection method. Their up- and down-regulation in tissue or even blood samples can be a sign of cancer development.

Objective: MiR-155 have been known as one of the biomarkers for breast cancer detection that is up-regulated in early stages of the disease.

Materials and Methods: Here we developed a novel electrochemical nanobiosensor for quantification of miR-155 in patient serum. We have used nanocomposite of graphene oxide and graphene quantum dots that are decorated with gold nanourchines. The nanocomposite was characterized using Fourier-transform infrared spectroscopy (FTIR) method and the modified electrode was characterized using scanning electron microscope (SEM) imaging, cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS) methods. The final readout signal of the electrochemical label was recorded using differential pulse voltammetry (DPV).

Results: In results, the characterization methods showed the fabrication steps efficiency. In addition, the results of selectivity assay showed that the nanobiosensor is able to detect the target miRNA sequence from some non-complementary sequences (including one-base mismatch, three-base mismatch, completely mismatch, and also mixture of non-complementary and complementary sequences. Additionally, the results of real sample assay are similar to the synthetic samples, with no significant difference.

Conclusion: The nanobiosensor showed very high selectivity towards the target miRNA-155 compared to the non-specific targets including one- and three-base mismatched miRNA-155. In addition, the wide linear range of the nanobiosensor with low detection limit is promising results that makes the nanobiosensor a potential choose for future medical applications of breast cancer detection and screening.

Key words: *Biosensing techniques, Electrochemistry, Breast cancer, Nanostructures, MicroRNAs.*