Nanostructured DNA-based sensors for detection of the prostate cancer biomarker miR-21 – a feasibility study

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Prostate cancer (PCa) is a common tumour disease in western countries and a leading cause of cancer-driven mortality in men. The miR-21 is overexpressed in PCa patients when compared with healthy patients. Due to the statistically relevant of these data, it is promising the use of miR-21 for non-invasive and specific detection of PCa [1]
In the present feasibility study, we are investigating the use of electrochemical detection based on screen printed electrodes and DNA-based hybridization recognition of the miRNA strand of interest. The results of the present work will be the basis for an evaluation of the present technology for the development of a non-invasive, simple to use, cost-effective and rapid point of need diagnostic system.
This preliminary study is based on a DNA probe, designed analogously as similar literature reported probes used for the detection of nucleic acids of similar length (e.g. [2]). miR-21 was spiked in buffer solutions of different concentrations of NaCl, mimicking the range found in urine.
The selective binding of miR-21 to the DNA probe induces its conformational change, which displaces the electrochemical marker methylene blue. The signal is detected by square wave voltammetry. At a frequency of 15 Hz the sensors displays signal-on behaviour with a maximum signal gain of 96.0% ± 5.7% and an estimated dissociation constant (K_D) of 137.7 ± 4.4 nM (n=4). The useful dynamic range (defined as the range from 10 to 90% of the maximum signal change) is from 55 nM to 343 nM with a limit of detection (LOD) of 31 nM (n=4).
This preliminary study will be followed by an extensive study aimed at the test and optimization of further parameters related to the target application in view, such as pH sensitivity, shelf life, stability of the biomarker in solution, etc. The analytical optimization will be followed by evaluating performance in real matrix, i.e. urine

References

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