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Abstract

Electrochemical and SERS Based Biosensors for Cancer Biomarkers Detection †

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The discovery of microRNAs (miRNAs) opened up a new area of research for noncoding RNA molecules. miRNAs play an important function for gene expression regulators at the transcriptional and post-transcriptional level. microRNAs are about 22 nucleotides in length and regulate the expression of mRNA targets with perfect or imperfect complementarity, leading to mRNA degradation or repression of translation, respectively.

Enzyme amplified biosensing of microRNA (mir-21, a breast cancer biomarker) from cell lysate of total RNA has been studied electrochemically [1]. In this work, the oxidation signal of enzymatic reaction product, alpha naphtol (a-NAP), which occurs after hybridization, has been detected by Differential Pulse Voltammetry on a disposable Pencil Graphite Electrode (PGE).

Electrochemical oxidation signal of Carnation Italian ringspot virus p19 protein has been used for the detection of mir21 [2]. P19 senses dsDNA as a molecular caliper and sequesters miRNAs in a size-dependent, sequence-independent manner.

Carbon nanotube-based field-effect transistors functionalized with the p19 protein have been used for the detection of miRNA-122a [3]. The probe-miRNA duplex has been determined by measuring the change in resistance of the biosensor resulting from its binding to p19, which takes in dsRNA in a size-dependent manner.

Graphene-modified disposable pencil graphite electrodes have been used for the detection of mir-21 from cell lysates by voltammetric and impedimetric methods [4]. The electrodes were modified via electropolymerized polypyrrole (PPy) [5].

The prostate cancer marker miR-145 has also been detected to levels below 1 fM by both electrochemical capacitance and voltammetric techniques using PNA probes and gold nanoparticles [6].

Surface enhanced Raman spectroscopy (SERS) methods have been used recently for detection of trace amounts of miRNAs. In addition, 5,5′-Dithiobis(2-nitrobenzoic acid) (DTNB) has been used as the SERS active substrate. DTNB-labelled, rod-shaped nanoparticles have been investigated for miR-21 detection. In the work, SERS active substrate has been used to enhance the reproducibility and sensitivity [7].

Conflicts of Interest: The authors declare no conflict of interest.

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