Novel Nanobiosensors for Detection of Methylated DNA for Early Cancer Diagnosis

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Abstract

Nanobiosensors are the biosensors that exploit nanomaterials for improve recognition of biomolecules including DNA, RNA, proteins and etc. Nanomaterials have the potential to improve the biosensors utilities and may result in cheaper, faster and easy to use analytical tools for rapid detection . Among epigenetic Phenomena, DNA methylation of tumor suppressor genes regarded as the most common DNA modification and best known epigenetic marker that almost found on the 5E[1] position of the pyrimidine ring of cytosine base in the CpG dinucleotides . Currently we have conducted and developed different and novel DNA nanobiosensor for detection of methylated DNA. Specific site of CpG islands of adenomatous polyposis coli (APC) , a well studied tumor suppressor gene, was used as the detection target DNA sequence in the current approaches. Distinguished interaction of specific fluorophore with methylated and unmethylated DNA based on Fe@AU nanoparticles showed fluorescence intensity increased in linear range by concentration of unmethylated ssDNA from 1.6A-10-15 to 6.6A- 10-13M with detection limit of 1.2A-10-16 M and on the other hand, fluorescence intensity declined linearly with concentration of 3.2A-10-15 to 8.0A —10-13M methylated DNA and detection limit was 3.1A-10-16 M. We also reported a colorimetric and fluorimetric technique for direct detection of DNA methylation for the first time. So DNA is being used as an effective template for fluorescent silver nanoclusters formation without any chemical modification or DNA labeling. The sensitivity test showed that upon the addition of target methylated DNA, the fluorescence intensity is decreased in a linear range when the concentration of methylated DNA is increased from 2.0A-10-9to 6.30A-10-7 M with the detection limit of 9.4A-10--10 M. These novel methods provide a very simple, rapid and quantitative tool for DNA methylation detection that avoids utilizing of complicated procedures such as bisulfite treatment. Regarding to significant reproducibility of methods in human serum plasma, they could have important medical applications such as cancer early diagnosis and/or prognosis.

Keywords: Nanobiosensor, DNA Methylation , Cancer , Early Diagnosis, Nanomaterial

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