World Academy of Science, Engineering and Technology
International Journal of Biomedical and Biological Engineering
Vol:12, No:07, 2018

Design and Fabrication of Optical Nanobiosensors for Detection of MicroRNAs Involved in Neurodegenerative Diseases

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Abstract : MicroRNAs are a novel class of small RNAs which regulate gene expression by translational repression or degradation of messenger RNAs. To produce sensitive, simple and cost-effective assays for microRNAs, detection is in urgent demand due to important role of these biomolecules in progression of human disease such as Alzheimer's, Multiple sclerosis, and some other neurodegenerative diseases. Herein, we report several novel, sensitive and specific microRNA nanobiosensors which were designed based on colorimetric and fluorescence detection of nanoparticles and hybridization chain reaction amplification as an enzyme-free amplification. These new strategies eliminate the need for enzymatic reactions, chemical changes, separation processes and sophisticated equipment whereas less limit of detection with most specify are acceptable. The important features of these methods are high sensitivity and specificity to differentiate between perfectly matched, mismatched and non-complementary target microRNAs and also decent response in the real sample analysis with blood plasma. These nanobiosensors can clinically be used not only for the early detection of neuro diseases but also for every sickness related to miRNAs by direct detection of the plasma microRNAs in real clinical samples, without a need for sample preparation, RNA extraction and/or amplification.

Keywords : hybridization chain reaction, microRNA, nanobiosensor, neurodegenerative diseases
Conference Title : ICBN 2018 : International Conference on Biosensors and Nanotechnology
Conference Location : Dublin, Ireland
Conference Dates : July 23-24, 2018