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Development of electrochemical aptasensor for diagnostics and monitoring of multiple sclerosis

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Abstract

Neurodegenerative diseases are associated with progressive and irreversible loss of neurons in specific areas of the central nervous system (CNS). Multiple sclerosis (MS) is a recurrent and progressive inflammatory, demyelinating disease of the CNS. Nowadays, the number of MS patients is increasing, but the diagnostic process is still quite difficult and costly and requires combination of various methods and analysis. Myelin is a structure made up of a few proteins located between two lipid layers tightly wrapping the axons of neuro cells, which is necessary for rapid providing of electrical signal between CNS and body. Myelin basic protein (MBP) makes up to 30% of myelin and it is known to be released into the cerebrospinal fluid (CSF) as a bioindicator of MS. In addition, in case of another demyelinating disease or trauma of CNS, MBP is present as a biomarker in human blood serum. Within the scope of the presented project, MBP specific aptamer earlier developed for possible therapeutic purposes [3] in mouse model was applied as a bioreceptor for MBP recognition. A nanobiosensor for MBP detection and monitoring was developed by using graphene oxide (GO) integrated onto the screen printed carbon electrodes (SPCE) with aptamer immobilized to create a bioactive layer on the sensor surface for MBP binding. The measurements were carried out using electrochemical impedance spectrometry (EIS) technique. Using carbon-based nanomaterial with large surface area aggregated with aptamer showed high specificity and affinity to the target molecule and enabled selective and sensitive MBP determination. Selectivity of the designed nanobiosensor was evaluated using mouse serum albumin (MSA). After optimization of parameters, such as, aptamer concentration, interaction time and washing time, the most appropriate conditions were determined and analyzes were carried out in a biological matrix (artificial CSF) containing MBP, and MSA. The aptasensor had LOD in artificial CSF 1,23 ng/mL. The miniature SPE based biosensing system designed in this study can be implemented for development of prototype product for further clinical use in the MBP determination and monitoring in both CSF and blood serum.

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Biography

P. Kara has completed his PhD at the age of 28 years from Ege University and Postdoctoral Studies from Faculty of Pharmacy, Ege University, Turkey. She is the group leader of Bioelectronics & Biosensing group in Analytical Chemistry Department, in same uniersity. She has published more than 40 papers in reputed journals.

