Journal of Biosensors & Bioelectronics

Pohanka, J Biosens Bioelectron 2015, 6:1
DOI: 10.4172/2155-6210.1000161

Opinion Open Access

Next Effort in Cholinesterases Biosensors

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Received Date: October 13, 2014; **Accepted Date:** October 15, 2014; **Published Date:** February 22, 2015

Opinion

Acetyl cholinesterase (AChE) and butyryl cholinesterase (BChE) are two known enzymes in the body with ability to hydrolyze acetylcholine. While AChE plays crucial role in acetylcholine mediated neurotransmission, BChE is secreted from livers to plasma and biological role of the enzyme is not fully understood [1]. The both cholinesterases are very sensitive to inhibition by nerve agents such as sarin, soman, tabun, VX, and some carbamate inhibitors such as pesticide carbofuran or malaoxon. Pharmacologically important compounds such as galantamine, donepezil, rivastigmine, huperzine, pyridostigmine and physostigmine used for e.g. Alzheimer disease, vascular dementia, myasthenia gravis, glaucoma, and delayed gastric emptying are inhibitors of either AChE or the both cholinesterases [2].

The fact that the cholinesterases can be inhibited by the aforementioned compounds has significant importance for analysis and biosensors construction because devices containing cholinesterases can be simply used for the inhibitors assay [3,4]. Disparate protocols based on spectrophotometry, fluorimetry, electrochemistry, non-linear optics etc. were established in the past [5]. When immobilized on a physico-chemical transducer, cholinesterase can serve as a very sensitive bio-recognition element [6].

In the past years, great success in production of new quantum dots, sol-gel particles, carbon, platinum, nickel etc. nanoparticles was made. The new technologies and materials can be easily combined with cholinesterases. In examples, CdTe quantum dots were used for preparation of a biosensor containing enzymatic system composed from AChE and choline oxidase [7]. Good analytical parameters were seen when electrochemical biosensors with AChE immobilized on silicon dioxide nanoparticles [8] or electrochemical flow injection analysis [9] performed. The biosensors are very sensitive and low limits of detection are typical for cholinesterase based biosensors. The low limits of detection can be demonstrated on work by Raghu and coworkers [10]. Voltammetric biosensor with AChE immobilized via sol-gel detected malathion from concentration 0.16 µmol/l. In another work, colorimetric dipstick with AChE bound to polystyrene coated with acrylic tape was proved to be suitable to detect disparate pesticides [11]. Parathion, in an example, was detected with limit of detection 0.96 nmol/l.

Because of good experience with the both cholinesterases in analytical chemistry and availability of new technologies, the enzymes deserve interest from scientific community. Assays based on cholinesterases are readily to be miniaturized and can be simply used in field detections. Protection from nerve agents, control of pesticides manipulation and control in drugs manipulation and synthesis can be exampled as expected spheres of the biosensors application.

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