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Biosensors-Novel devices for point-of-care (POC) testing

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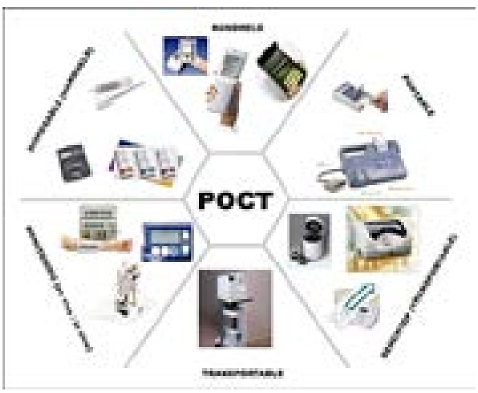
The evolution of biosensors was driven by the need for faster and more versatile analytical methods for application in important areas including clinical, diagnostics, food analysis or environmental monitoring, with minimum sample pretreatment. Rapid and sensitive neurotransmitters detection (i.e. epinephrine, dopamine, norepinephrine) is extremely important in modern medicine. These compounds mainly occur in the brain and central nervous system of mammals. Any changes in the neurotransmitters concentration may lead to many diseases, such as Parkinson's or schizophrenia. However, there is any available device, which will show concentration of these compounds in patient's body. Classical techniques of chemical analysis, despite many advantages, do not permit to obtain immediate results or automatization of measurements. Chemical sensors have displaced the conventional analytical methods-sensors combine precision, sensitivity, fast response and the possibility of continuous-monitoring. Our research is focused to develop optical and electrochemical biosensors or sensors for neurotransmitters detection. In developed optical biosensor for detection of dopamine, we used graphene quantum dots (GQDs) for detection system. In such sensor dopamine molecules coats the GQD surface-in result occurs quenching of fluorescence due to Resonance Energy Transfer (FRET). Changes in fluorescence correspond to specific concentrations of the neurotransmitter in tested sample, so it is possible to accurately determine the concentration of dopamine in the sample. Our research also has proved facile and convenient method for epinephrine, norepinehrine and also dopamine determination based on laccase and tyrosinase-based oxidation of catecholamine derivatives. The resulting sensors (built of electrode modified with graphene quantum dots or semiconducting polymer and laccase) exhibit good performance, strong affinity between enzyme and neurotransmitter, fast response to the substrate and good linear range. Such systems could be used in medical diagnostics for neurotransmitters detection.



Recent Publications

1. Baluta S (2018) Graphene quantum dots-based electrochemical biosensor for catecholamine neurotransmitters detection. Electroanalysis 30:1773-1782.
2. Nawrot W, Drzozga K and Baluta S (2018) A fluorescent biosensors for detection vital body fluid agents. Sensors (Basel) 18:1-21.

3. Baluta S (2017) Neurotransmitters detection using fluoroscence-based sensor with graphene quantum dots. Optica Applicata 47(2):225-231.
4. Baluta S (2017) Dopamine sensing with fluorescence strategy based on low temperature co-fired ceramic technology modified with conducting polymers. Sensors and Actuators B: Chemical 252:803-812

Biography

Sylwia Baluta has completed her Graduation in the field of Biotechnology and Medicinal Chemistry at Wroclaw University of Science and Technology. Since 2015, she is a PhD student at Wroclaw University of Science and Technology, Faculty of Chemistry. Her scientific interests include enzyme-based sensors for neurotransmitters determination, based on electrochemical and optical measurements. In 2018, she received a Minister of Education scholarship for outstanding scientific achievements.

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