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Low-cost platform for determination of NTproBNP in saliva using graphene-based aptasensor

Jarić Stefan, Bobrinetskiy Ivan

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Title (required)

Low-cost platform for determination of NTproBNP in saliva using graphene-based aptasensor

Abstract (required)

Detection of trace concentrations of biomarkers can be essential if non-invasive analysis is employed, such as sampling of saliva, urine, or sweat. A significant early-stage heart failure biomarker N-terminal pro-B-type natriuretic peptide (NT-proBNP) can be found in saliva in concentrations of a thousand times less than in blood plasma suggesting that non-invasive analysis requires an outstanding low detection limit. In this research, we propose a reduced graphene oxide-based FET device to develop a biosensor using specific anti-NT-proBNP aptamers for the detection of NT-proBNP in saliva. To address the need for low-concentration detection in saliva, we included a correlation analysis of two FET parameters: Dirac point shift and transconductance variation, to provide reliable biosensor performance. Namely, depending on the ionic strength of the solution, we found that the correlation is significant (>0.8) for 0.01X PBS, while it is zero for 0.1X PBS. This can be associated with the long aptamer chain, consisting of 72 bases, that has a significant effect on the doping of the rGO channel and such effect is screened by the ions of higher concentrations (>16 mM). The analysis shows that chemical interaction between the target and receptor is transformed into an electrical signal, which is a result of either direct doping effect or charge mobility change. With such an approach, we observed a broad dynamic range of NT-proBNP concentrations in 0.01X PBS of 10^0 – 10^5 fg mL^{-1}. Additionally, femtomolar detection of NT-proBNP is achieved in artificial saliva with a limit of detection of 41 fg mL^{-1}.

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Authors and Affiliations (required)

Stefan Jarić (Presenting) sjaric@biosense.rs

University of Novi Sad, Biosense institute, Novi Sad, Serbia

Ivan Bobrinetskiy bobrinet@biosense.rs

University of Novi Sad, Biosense institute, Novi Sad, Serbia

S sjaric@biosense.rs

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