I-motif aptamer for biosensing by electrolyte-gated organic field-effect transistors

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Electrolyte-gated organic field-effect transistors (EGOFET) are widely used as a platform for biosensors, providing low analyte detection limits and high specificity. Antibodies, enzymes, proteins, and aptamers are used as recognition elements for biosensors based on EGOFET. Compared to antibodies and enzymes, aptamers are resistant to heat, pH changes and chemically aggressive conditions. Therefore, aptamers are more effective substances for practical use. The use of aptamers opens up a method for sensitive, selective and affordable detection of biomolecules. Furthermore, due to their unique structure, aptamers can be used to detect multiple analytes under different conditions. This property of aptamers was investigated in this work to determine the possibility of controlling the properties of biosensors based on EGOFET using an aptamer with i-motif structure.

The previously described approach to manufacturing a biosensor with an active semiconductor layer based on C8-BTBT-C8 in a mixture with polystyrene and a bioreceptor layer based on the siloxane dimer BTBT and the biotin derivative BTBT-biotin was used as the EGOFET platform[1].This platform provides biotin-streptavidin interaction on the surface of the semiconductor layer of the EGOFET. The streptavidin layer was functionalized with the recognition element aptamer BV42, which has an i-motif structure and binds influenza A virus virions at pH 6. The absence of shift in threshold voltage and transfer conductivity of biosensors based on EGOFET at pH 6 and pH 8 was demonstrated. BV42 is able to bind silver cations, forming an organometallic complex cytosine-Ag^+-cytosine, causing a shift in the saturated mode transfer conductivity (g_m) of the EGOFET-based biosensor at pH 8. Aptamer BV42 is pH-dependent in the pH range from 6 to 8, which can be used to determine the pH of the environment in the range significant for biological measurements. The sensitivity of the i-motif aptamer based sensor lies in the same range as for the aptamer RHA0385, published earlier[1].

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[1] Poimanova E.Yu, Shaposhnik P.A, Anisimov D.S, et al. *ACS Appl Mater Interfaces*. 2022, **14**(14), 16462-16476.