Immobilization of protein aptamers on binary SAM for protein sensing applications

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Self-assembled monolayers (SAMs) of alkanethiols, 11-mercapto-undecanoic acid (11-MUA) and 3,6-Dioxa-8-mercaptooctanol, were used to immobilize protein aptamers on a gold surface. It was developed as a biosensor for blood proteins (e.g. hemoglobin and thrombin) detection.

Using binary SAM instead of uni-SAM may improve sensitivity and selectivity of the sensor. Design parameters which affect the sensitivity are surface density of the molecules on a gold electrode and the length of hydrocarbon tails of the molecules. When a binary SAM is used, amine-terminated aptamers bind to longer alkanethiol molecules. The role of shorter alkanethiol molecules is to repel interfering species (e.g. other non-target proteins) in order to prevent non-specific adsorption on the electrode as well as to provide lower resistance for electron transfer. The aim of this study is to optimize the sensor in terms of selectivity and sensitivity.

After formation of SAMs on a gold surface of a screen printed electrode (SPE) electrochemical impedance spectroscopy (EIS) technique was used to confirm the formation of the SAMs. Then protein samples were tested and EIS results (Bode and Nyquist plots) show that impedance will increase by increasing the protein concentration in the samples.