Immobilization of protein aptamers on binary SAM for protein sensing applications

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Self-assembled monolayer (SAM) of alkanethiols like 3-mercaptopropionic acid (3-MPA) and 11-mercapto-undecanoic acid (11-MUA) on gold surface was used to immobilize protein aptamers. It was developed as a biosensor for blood proteins (e.g. thrombin and albumin) detection.

Using binary SAM instead of uni-SAM may improve sensitivity 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 the alkanethiol molecules and shorter alkanethiol molecules provide lower resistance for electron transfer. The aim of this study is to optimize these parameters (length ratio and surface density) in order to get the highest sensitivity. For this purpose several solutions of alkanethiols of different chain length and concentration were used to form SAM on gold surface.

After formation of SAM on a gold surface of a screen printed electrode (SPE) electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV) were used to confirm the formation of the SAM. By comparing the EIS and CV results for different configurations of SAMs the optimum case was also found. EIS results (Bode plots) showed different impedance magnitude and phase shift and in cyclic voltammogram peaks of different height were obtained.