

Antibody-redox active molecule conjugates as platform for simultaneous electrochemical determination of low density lipoprotein (LDL) and oxidized low density lipoprotein (oxLDL).

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The main objective of this project is to develop a platform for the simultaneous electrochemical determination of low density lipoprotein (LDL) and oxidized low density lipoprotein (oxLDL). This platform will be based on antibody-redox active molecule conjugates used as a recognition element. Moreover, another objective of the project is to study the effectiveness of inhibition of LDL oxidation by individual components of spices, black cumin or fenugreek, using the platform developed.

Currently it is estimated that approximately 31% of the all deaths in the world are caused by cardiovascular diseases, CVD. One example of diseases connected to cardiovascular system is atherosclerosis which is associated with endothelial dysfunction (ED). The high concentration of reactive oxygen species promotes the development of inflammatory processes, modification of LDL to oxLDL, platelet aggregation and thrombus formation. Thus, both, LDL and oxLDL may be regarded as biomarkers of oxidation state of the endothelium. Selective and sensitive detection of biomarkers plays a crucial role in the disease diagnosis, treatment and monitoring its progress. Nowadays, there is a trend to perform rapid, specific and inexpensive analyses of clinically relevant substances by point-of-care tests ("bedside" tests). The electrochemical detection system fits perfectly into this trend, mainly because of the possibility of miniaturization as well as analysis of small sample volume (order of microliters). The design of system, which will be capable of simultaneous determination of two or more analytes in a single measurement, for example on a single working electrode in single solution, is a great challenge. Multi-analyte assay has many advantages compared to single analyte test, such as cost per test, labour, throughput and convenience. Therefore, in the course of this project, we are going to test if two monoclonal antibodies, against LDL and oxLDL labelled with redox active molecules, derivatives of ferrocene and ruthenium complex with 2,2'-bipyridine as well as phenothiazine and phenazine, immobilized on the surface of gold electrode can be used for simultaneous electrochemical detection of LDL and oxLDL. Moreover, if their mutual ratio oxLDL/LDL could be determined through this platform. Additionally, we will verify whether it is possible to test the inhibition of LDL oxidation in the presence of selected components of spices: thymoquinone, thymol, nigelline, trigonelline, capsaicin or piperine.

We will focus mainly on the modification of gold electrodes by using self-assembled monolayers (SAMs) to immobilize the antibodies on their surface, by covalent bonding, or via affinity to protein G or A. The research will be carried out mainly on the basis of electrochemical techniques: cyclic voltammetry (CV), square-wave voltammetry (SWV), differential pulse voltammetry (DPV) and electrochemical impedance spectroscopy (EIS). Moreover, the enzyme-linked immunosorbent assay (ELISA) and spectrophotometry UV-VIS will be conducted.

Requirements for the candidate:

1. Professional title of master's degree in biological or related sciences (or graduate studies).
2. Basic knowledge in the field of enzyme-linked immunosorbent tests.
3. Willingness and predisposition to start scientific work.
4. Ability to work independently and in a team.
5. Very good knowledge of English language