Stabilitätspakt für Südosteuropa
Gefördert durch Deutschland
Stability Pact for South Eastern Europe
Sponsored by Germany

Workshop "From Molecules to Functionalised Materials" – Cluj-Napoca, October 2013

PROTEIN-FILM VOLTAMMETRY-ELECTROCHEMICAL SPECTROSCOPY FOR PROBING THE REDOX FEATURES OF BIOCATALYSTS

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As we know, the life on Earth depends significantly on the occurrence of reactions involving an exchange of electrons between two or more systems. Reactions comprising an electron transfer are responsible for the functioning of many proteins in important bio-relevant processes. The photosynthesis and respiration, for example, are fundamental processes where the conversion of the energy occurs through a complex sequence of electron transfer reactions involving different enzymes. Electron transfers also occur in many other biological processes ranging from cell defense to gene control. Since many diseases are mainly associated with malfunctioning redox biochemistry in humans, the understanding of these processes has also a big medical significance.

In the case of proteins, the use of voltammetry as a tool for getting insight into their redox chemistry is quite difficult task. The main problems are seen in the huge protein size and the presence of big "electroinactive" lipophilic tails that hinder the "access" of electrons to the protein's redox-active site(s). Nearly 20 years ago, a promising voltammetric methodology had been developed for studying the redox chemistry of various redox-active proteins. The method had been named "protein-film voltammetry".

In this lecture we focus on the main achievements and experimental challenges of the protein-film voltammetry. A special attention will be paid to the application of PFV for studying various redox reactions of relevant enzymes that are main biocatalysts. We will also focus on relevant theoretical models developed to study various electrode mechanisms under conditions of SWV. Several simple ways to get access to relevant thermodynamic/kinetic data of the redox processes of many enzymes will be discussed.

Key words: Redox Enzymes, voltammetry, theoretical modeling, biosensors.

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