Application of infrared spectroscopy for structural analysis of thin molecular films under electrochemical control

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Abstract

In this work *in situ* spectroscopic studies aiming at the determination of the structure of biomolecules in multicomponent supramolecular assemblies under electrochemical control are described. Biological membranes or extracellular matrix protein films are bioaggregates, which have a complex composition and structure. Therefore, their models are used in biomimetic studies. Methods of the preparation of biomimetic models of biological membranes are reviewed. Structure sensitive techniques applicable for the analysis of models of biological membranes are briefly described. Due to a well-defined orientation of biomolecules in their biological assemblies, high electric fields appear at their surfaces. The deposition of models of biologically relevant assemblies on electrode surfaces ensures their exposition to physiological electric fields. As described in chapter 4 electrochemical methods provide the information concerning the stability, compactness and permeability of model membranes. However, they are not suitable for the analysis of the structure of molecules adsorbed on electrode surfaces. In order to provide the structure of molecules adsorbed on an electrode surface, a surface analyzing technique has to be adapted to probe *in situ* the metal|liquid interface. Infrared spectroscopy techniques applicable for structural analyses of organic molecules in various supramolecular assemblies adsorbed on an electrode surface are described in chapter 5. The adaptation of infrared spectroscopy and electrochemical methods for requirements of biomolecules adsorbed on electrode surfaces is reviewed. In the following sections studies of the potential-driven changes in the structure and orientation of lipid molecules in various models of biological membranes are described. The impact of the lipid-protein interaction on the structure of model membranes under electrochemical control is described. The influence of an interacting protein on the structure of lipid molecules in an entire membrane as a function of changing potential is presented. Concluding remarks concerning a holistic determination of structural changes of individual components in entire supramolecular assemblies at electrified interfaces are presented.

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