Abstract

Protein adsorption at interfaces is of great relevance in industry and medicine. The growth of biofilms at interfaces is strongly influenced by adsorbed proteins. The control of this biofilm formation is necessary for technical and medical applications.

Fundamental mechanisms of protein adsorption at solid/liquid- and liquid/gas-interfaces are investigated by surface-sensitive x-ray scattering methods. The investigated proteins are lysozyme, ribonuclease A, bovine serum albumin, fibronectin and apolipoprotein A1. The temperature-induced adsorption and desorption at the solid/liquid-interface is the main part of this work. The used solid substrates are hydrophilic and hydrophobic silicon wafer. It is possible to distinguish between thermodynamical and kinetical mechanisms by using two different environments, namely buffer and protein solution. Two processes have been observed, desorption in buffer and adsorption in protein solution. The strength of these processes depends on conformational stability and electrostatic interaction. The investigated mechanisms can also be used for more complex proteins, although the protein structure influences the temperature dependent behaviour as well. Protein adsorption at the liquid/gas-interface and at membranes are investigated in an other part of this work. Phospholipids (DPPA), also in a mixture with cholesterol, and stearic acid were used to prepare model-membranes. The adsorption at the liquid/gas-interface is mainly driven by hydrophobic effects, whereas electrostatic interactions are more important for the adsorption at membranes. Furthermore, first indications for a lateral ordering of proteins adsorbed at the free liquid/gas-interface or at membranes are found in this work.

These results increase the comprehension of fundamental mechanisms of protein adsorption at interfaces. They could be used to tailor surfaces to control protein adsorption, and therefore biofilm formation.