INFLUENCE OF BIVALENT METAL IONS ON THE SELF-ASSEMBLY OF S-LAYER PROTEINS FROM LYSINIBACILLUS SPHAERICUS JG-B53


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Many systems in nature are perfectly optimized for their function. Good examples therefore are surface layer (S-layer) proteins. These proteins form two-dimensional lattices acting as interfaces between prokaryotic cells and their environment and as such as selective and protecting barrier. Outstanding properties are their autocatalytic self-assembly, high physicochemical stability, many different and regular arranged functional groups and their nanoscale fine structure. Understanding the dynamic and complex process of self-assembly is not only highly interesting from a scientific point of view but also for the technical application of this group of proteins. Their use is particularly promising for nanotechnology, and here especially for surface modification creating metal selective filter materials, bio-sensors or improved catalytic materials. Especially challenging within an industrial process is controlling the speed of the lattice formation and the formation of large areas of undisturbed lattices. For the examination of the structure-function relationship and the process dynamics of the protein self-assembly of the S-layer from Lysinibacillus sphaericus JG-B53 several complementary analytical techniques and methods have been applied: 1) The secondary structure of the S-layer protein was analyzed by CD spectroscopy. 2) Small-angle X-ray scattering (SAXS) was applied to gain insights into the three dimensional structure in solution. 3) The interaction with bivalent cations was followed by differential scanning calorimetry (DSC). 4) The dynamics and time-dependent assembly of S-layers was also investigated applying dynamic light scattering. 5) The two dimensional structure of the para-crystalline S-layer lattice was additionally examined by atomic force microscopy (AFM). The data obtained provide essential structural insights into the mechanism of the S-layer self-assembly, particularly with respect to the binding of the bivalent cations Mg\(^{2+}\) and Ca\(^{2+}\).

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