Recrystallization of bacterial surface layers: how fast S-proteins self assemble to build 2-D nanobiostructures

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Crystalline monomolecular cell surface layers, S-layers, are one of the most common outermost cell envelope components of the prokaryotic organisms (bacteria and archaea). They are composed of a single protein or glycoprotein and exhibit oblique, square or hexagonal (nano)lattice symmetry. Due to this fact, in the last fifteen years much effort has been focused on two directions in nanobiotechnology [1-2]: i) the recrystallization of (truncated) S- proteins on different substrates [3-8] and ii) genetic modification of S-protein with biomolecules (such as streptavidin or green fluorescence molecule) [9-10]. Both research lines are intimacy interconnected, since good recrystallization conditions assure the necessary know-how to build biosensors composed of a biological matrix made up of S-layers that hosts spatially well oriented molecules.

In this work we are presenting the first results on the kinetics of the recrystallization of the S-protein SbpA on different supports: silicon oxide, silane, polyelectrolyte, and thiol substrates. We will show that adsorption kinetics does not only depend on the protein concentration but also on the substrate chemistry.

Atomic force microscopy (AFM) was used to investigate the 2-D structure of the protein layer. Quartz microbalance (QCM) and surface plasmon resonance (SPR) were used to investigate the adsorption kinetics of the S-proteins.

These results are the first results up to date that monitore the building of robust biomimetic surfaces, either a native bacterial surface or a more advanced nanostructured functional surface that mimics the behaviour of biomolecules at the nanoscale.

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Biomacromolecules 12 (2006) 3298