SPECIFIC AND ORIENTED IMMOBILIZATION OF PROTEINS ON GOLD NANOPARTICLES

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Over the past years, there has been a noticeable interest on the coverage of gold surfaces with monolayers of proteins based on the molecular recognition properties of biological systems[1]T. In this sense, the immobilization of proteins on surfaces retaining their full activity and stability constitutes a challenging goal. Most of the common methods are difficult to control and usually yield randomly bound proteins. On the contrary, an ideal immobilization would produce saturation coverage of specifically bound proteins. The formation of protein layers is induced by anchoring them to gold surfaces functionalized with active molecules, such as transition metal complexes with affinity to repetitive histidine sequences. A feasible method to uniformly cover gold surfaces consists on the self-assembly of thiols by oxidative-chemisorption over the gold[2]. Reversible monolayers of histidine-tagged proteins have been produced using a gold layer covered with a chelator thioalkane monolayer[3]. In order to avoid a highly complex organic synthetic work, step-by-step construction of the functional monolayer over a template of thiocarboxylic acid chemisorbed onto gold has been developed[4].

Because of its simplicity, both, from a conceptual as well as from a practical point of view, the step-by-step synthesis of a functional self assembled monolayer is accessible to most of the laboratories working on enzyme technology in spite of having limited facilities for organic synthesis. This synthetic strategy allows, by a judicious design of the synthetic route, the development of a multiplicity of architectures on SAMs. Different SAM strategies have been developed in our group for controlled and oriented immobilization of enzymes onto gold surfaces, using them as amperometric electrodes in the characterization of the enzymatic catalytic performance[4,5,6].

We present a next step of these SAM strategies towards functionalization of gold nanoparticles' surface for oriented immobilization of model proteins. The SAM provides the ability to discriminate between specific and non-specific proteins attachment[7].

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