

Study of Protein-Gold Nanoparticle Conjugates by Fluorescence and Surface Enhanced Raman Scattering

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It is a universal rule of materials in biology that a material is always covered by proteins immediately upon contact with a physiological environment and this phenomenon will also be key to understanding much of the bionanoscience world. Proteins are the important part of the cell's language, machinery and structure and understanding their functionalities is extremely important for further progress in human well being. The protein-nanoparticle interactions has begun to emerge recently with the development of the idea of the nanoparticle-protein “corona” [1] with applications in nanomedicine and nanotoxicity.

Noble-metal nanoparticles open exciting new ways to create efficient optical probes based on the strongly enhanced spectroscopic signals that can occur from molecules in their surface plasmon resonance fields.

In this study, Surface-Enhanced Raman Scattering (SERS) and fluorescence spectroscopy were used to investigate the interaction of well known proteins bovine serum albumin (BSA) and collagen with gold nanoparticles (GNP). While the modification of fluorescence spectra of tryptophan residue in BSA in the presence of GNP was exploited for determining their binding constant (Fig 1A), the SERS indicates the specific binding sites as well as possible modification of protein structure in contact with gold nanoparticles (Fig 1B).

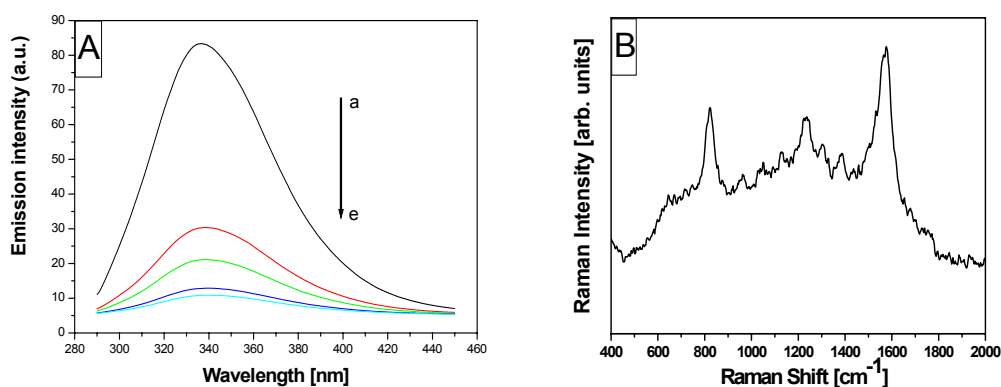


Fig. 1: (A) Fluorescence emission spectra of BSA in the absence (curve a) and presence of GNP (curve b-e); (B) SERS spectrum of bioconjugates gold nanoparticles-BSA;

The protein-conjugated gold nanoparticles could have potential for use for labels for living cells and tissues. While most of the knowledge regarding protein-nanoparticle interactions is from solution and *in vivo* studies, it is clear that future directions will require studies under competitive binding conditions such as occur *in vivo*.

[1] I. Lynch et al., Adv. Colloid Interface Sci. 134-135 (2007) 167.

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