Synthesis of gold nanostructured hybrid materials for biomedical applications

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Nanoscale drug delivery systems have been under investigations for several decades [1]. At present, numerous types of nanoparticles (NPs) are designed as feasible candidates for gene therapy and molecular imaging, but only very few have actually to mature to clinical applications. The syntheses of polymer-, dendrimer-, lipid-, iron oxide-, quantum dots- or other organic- and inorganic-based NPs are well-known. Moreover, the proteins are also widely used for encapsulation and transportation of different drug molecules. The albumin-(BSA or HSA)-based NPs play a determinant role in the development of novel nanocarrier systems because many binding sites are available to several drug molecules. In addition, the albumins have various specific advantages in nano-scale range, such as biodegradability, biocompatibility and non-toxicity [2]. Metallic NPs, especially of gold and silver NPs, are of particularly interest due to their size-, shape-, composition-, aggregation-, and surface roughness-dependent optical properties. The noble metal NPs with diameters larger than *ca.* 2 nm show unique plasmonic properties, while the subnanometer sized NPs (nanoclusters (NCs), $d < 2$ nm) exhibit characteristic size-dependent photoluminescence [3]. These gold NPs and NCs have been used to develop optical probes for bio-sensing, bio-labelling and bio-imaging applications.

In our work, the syntheses and detailed structural characterization of protein-based NPs and plasmonic or fluorescent gold/protein nanohybrid systems were carried out by using small-angle x-ray (SAXS) and dynamic light scattering (DLS) technique. The size of the NPs and NCs was determined by high resolution transmission electron microscopy (HRTEM) images. Moreover, infrared, circular dichroism, fluorescence and x-ray photoelectron spectroscopic measurements have also been performed in order to get deeper information on the structure of the nano-objects.

References

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