Modified Protein Complexes for Non-Invasive Molecular Control

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The possibility of an application of the iron storage protein Ferritin has gained great interest in various biological and medical fields as well as in nanotechnology. Ferritin is an universal intracellular iron storage protein of spherical shape with an outer and inner diameter of 12 and 8 nm, respectively. It possesses an iron core inside the cavity [1]. This cavity acts like a reaction chamber and is well-suited for the natural formation and storage of nano-sized particles through biomimetic mineralization. Furthermore, modified Ferritin called Magnetoferritin with an iron core that is loaded with the magnetic iron oxides magnetite and/or maghemite, would represent a promising substitute of synthesized magnetic nanoparticles for applications *via* magnetic fields. Hence, a non-destructive imaging inside living organism or manipulation of cells via magnetic fields would be possible. The usage of Magnetoferritin may also facilitate various applications of medical diagnostic methods such as hyperthermia or as contrast agents in MRI [2].
However, the knowledge of the exact native structure is not yet established, even though it would be essential for an understanding of the mechanism of the processes inside the iron core. Then, it would be possible either to modify and tailor Ferritin individually, for instance into Magnetoferritin, or to differentiate accurately real cell samples loaded with iron containing nanoparticles.
Raman Microspectroscopy (RM) has become a versatile tool for investigations of proteins and cells in the past decades [3-5] and would be a promising approach for a non-destructive evaluation and monitoring of the structure and chemical composition of the core inside the protein. Based on the inelastic scattering of light, RM provides spectra which are unique to each compound and structure. Since water is a weak Raman scatterer and does not interfere with the measurements, RM is highly suitable for the analysis of biological samples embedded in their natural matrix. Due to this advantage minimal or no sample preparation is required and analyses can be carried out at room temperature. We investigate different iron storage proteins and characterize their iron core by means of RM. Further applications of RMfor the analysis of modified protein complexeshold potential to help in several studies, for instance for an understanding of the origin and progress of neurological diseases (e.g. Alzheimer´s disease).

References

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