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SYNTHESIS OF SINGLE CRYSTAL MAGNETITE NANOPARTICLES ENCAPSULATED IN APOFERRITIN

Hideyuki Yoshimura
Meiji University, Kawasaki, Japan

To get homogeneous nanoparticles (NPs), the protein (apoferritin) cavity has been utilized as a reaction chamber. A protein shell served as a template to restrain particle growth and as a coating to prevent coagulation between NPs. Apoferritin is an iron storage protein found in many biological species, known to mineralize several metal ions *in vitro*. It is a hollow, spherical protein composed of 24 subunits (L-chain and H-chain), with outer and inner diameters of 13 nm and 7.4 nm, respectively. Here, we report synthesis of magnetite crystal (Fe3O4) nanoparticle in the apoferritin cavity. Magnetite containing apoferritin is known as magnetoferritin, and its magnetic properties and applications were reported many times. However, crystallinity of these nanoparticles was not exactly controlled. Native horse spleen ferritin (contains about 15% of H-chain) or recombinant human H-ferritin was used for these experiments. H-chain has Fe (II) oxidation site and thus oxidation occurs very quickly at each oxidation site in the cavity. In this reason, synthesized nanoparticles were amorphous or polycrystalline. We have used recombinant L-chain apoferritin which lacked Fe (II) oxidation site and oxidation proceeds slowly. Utilizing slow oxidation process and magnetic-column chromatography purification process, we succeeded to obtain magnetite NPs with nearly single crystal domain which expected to have high T_2 relaxivity in MRI and high efficiency for hyperthermia therapy. We extended the N-terminus of the apoferritin subunits, which exposed to the external surface of the molecule, with peptide chain having specific binding ability to the cancer cell. Combining high quality magnetite nanoparticles and cancer cell specific apoferritin, this magnetoferritin would show high potential for cancer treatment

Biography

Hideyuki Yoshimura has completed his PhD in 1982 from Nagoya University and Postdoctoral studies in Institute of Physical and Chemical Research (RIKEN). He moved to Biometrology Lab in JEOL Ltd., as a Research staff in 1984. He was also joining JRDC, ERATO NAGAYAMA Protein Array Project from 1990 to 1995, as a Manager of Array Characterization Group. After 1995, he moved to Meiji University, Department of Physics, as an Associate Professor. He was promoted to Professor in 2000 at the same department. His current interests are development of an X-ray microscope for biology and synthesis of nanoparticles utilizing protein function.

hyoshi@meiji.ac.jp