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Functional magnetic nanoparticles following Néel relaxation system for hyperthermia treatment

Yuko Ichiyanagi
Yokohama National University, Japan

Recently, magnetic nanoparticles (MNPs) have attracted attention as they have potential medical applications, such as in MRI contrast agents, drug delivery systems (DDS), and in hyperthermia treatments. Magnetic ferrite nanoparticles encapsulated in amorphous SiO_2 were prepared using our original wet chemical method. In these magnetic nanoparticles, Si ions are located on the surface, and because of this characteristic structure particles were functionalized by amino-silane coupling procedure. We tried to introduce these functional particles into the living cells, and these particles were localized by the external magnetic field. Then cancer cell selective particles were further developed by attaching folic acid. In order to estimate heating effect of magnetic nanoparticles, AC magnetic susceptibility was measured. The imaginary part of the AC magnetic susceptibilities, χ'', depending on the frequency, field, and particle size were analyzed. The most efficient heat dissipation can be predicted for the $MnO.8ZnO.2Fe_2O_4$ sample of particle size 18 nm. It was found that this sample followed Néel relaxation system. Then the temperature of samples was measured upon AC magnetic field of 151 Oe, 15 kHz at 310 K. The rise in temperature was found high enough to destroy the cancer cells. *In vitro* experiment was carried out for the cultured cancer cells. An extensive hyperthermia effect was observed, and thereby concluding that this sample is an effective agent of hyperthermia treatment.

Biography

Yuko Ichiyanagi is an Associate Professor at Yokohama National University since 2009 (Applied Physics). Since 2007 she was concurrently a researcher of Precursor Research Embryonic Science and Technology of Japan Science and Technology Agency, and developed magnetic nanoparticles for biomedical applications. She chaired at several international conference. She got a prize of Industrial Times at 9th Annual Meeting of Society of Nano Science and Technology in 2011. Now she has published more than 50 papers and books. In recent year she focused on the magnetic nanoparticles for biomedical applications and was successful in that.

yuko@ynu.ac.jp

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