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Mesoporous silica nanoparticles for sensitive ¹⁹F magnetic resonance imaging, fluorescence imaging and Doxorubicin drug delivery

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MRI (Magnetic Resonance Imaging) has been clinically used since it yields images of deep regions in living animal bodies. We have focused on ¹⁹F MRI. ¹⁹F MRI is suitable for monitoring particular signals concerning biological phenomena because ¹⁹F MRI shows little endogenous background signals. Thus, ¹⁹F MRI probes that can visualize biological functions have been increasingly reported. We have developed the ¹⁹F MRI probes to detect protease activity and gene expression on the basis of paramagnetic resonance enhancement (PRE) effect. We also have developed a novel ¹⁹F MRI contrast agent, fluorine accumulated silica nanoparticle for MRI contrast enhancement, which is composed of a perfluorocarbon core and a robust silica shell. Multifunctional mesoporous silica nanoparticles (MSNs) are good candidates for multimodal applications like in drug delivery, bio-imaging and cell targeting. A novel drug delivery carrier based on MSNs, which encapsulated highly sensitive ¹⁹F magnetic resonance imaging (MRI) contrast agents inside MSNs, will be introduced. The nanoparticles were labeled with fluorescent dyes and functionalized with small molecule-based ligands for active targeting. This drug delivery system facilitated the monitoring of the bio distribution of the drug carrier by dual modal imaging (NIR/¹⁹F MRI). Furthermore, we demonstrated targeted drug delivery and cellular imaging by the conjugation of nanoparticles with folic acid. An anticancer drug (doxorubicin, DOX) was loaded in the pores of folate-functionalized MSNs for intracellular drug delivery. The release rates of DOX from the nanoparticles increased under acidic conditions, and were favorable for controlled drug release to cancer cells.

Biography

Kazuya Kikuchi has completed his PhD from the University of Tokyo, Japan in 1994 and did his Post-doctoral training at UCSD and the Scripps Research Institute. He was appointed as a Research Associate at the University of Tokyo, Japan and promoted as an Associate Professor. He was appointed as a full Professor at Osaka University in 2005. He is involved in molecular imaging probes development for both fluorescence imaging and magnetic resonance imaging and focused both in *in vivo* imaging and single molecule cellular imaging.

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