Development of controllable release DDS based on temperature-responsive-polymer capped magnetic mesoporous silica

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Abstract

Drug delivery system (DDS) is able to realize the treatment of cancer with lower side effects and higher efficiency comparing to conventional chemotherapy by controlling the *in vivo* dynamics of drugs. In recent years, there are many studies regarding to the release control of anticancer drug loaded in DDS in order to enhancing its performance. However, so far the reported controllable drug release DDSs require external stimulation such as light and cooling as triggers for drug release, which cannot reach the deep part inside the human body. To control the release in the deep part inside the human body, here, we aimed at to develop a new DDS carrier which can control drug release by applying magnetic field. Magnetic mesoporous silica (MMS) and ureido-containing poly (allylamine-co-allylurea) copolymers (PAU) were used in this study. PAU is a kind of polymer having upper critical temperature. By modifying it to the surface of magnetic mesoporous silica, it is possible to realize the control of drug release of the DDS carrier triggered by the core heat generation induced by an alternating magnetic field, thereby realizing the control of drug release in the deep part inside the human body. DDS carrier developed in this research enables highly efficient treatment that combines hyperthermia with core heat generation and drug treatment with drug release at the cancer in the body. To synthesize PAU modified MMS (MMS-PAU), Fe_3O_4 nanoparticles were prepared by thermal decomposition method and MMSs were synthesized by a template method. PAU was prepared by reacting polyallylamine with potassium cyanate. Finally, PAU was grafted on the surface of MMS by introducing amide bonds. We confirmed that PAU was successfully modified to the surface of MMS, and MMS-PAU has the drug release control ability.

Image

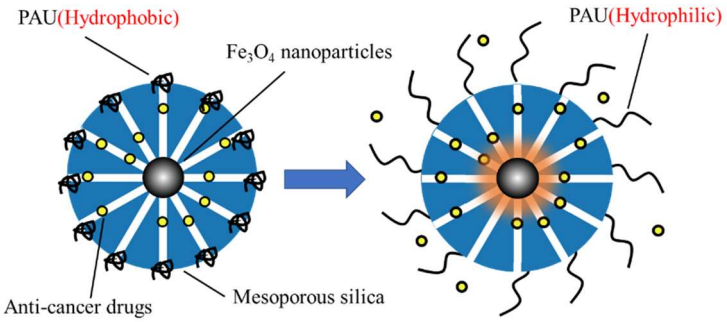

Figure 1. Schematic of MMS-PAU and drug release

Biography

Kodai Kobayashi graduated from school of Mechanical and Aerospace Engineering of Nagoya University, Japan, in 2018. Now he belongs to graduate school of Micro-Nano Mechanical Science and Engeering of Nagoya University. He is working on developing new controllable release DDS.

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